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An annotated check list of Hong Kong dragonflies and assessment of their local conservation significance

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Abstract

Dragonflies were surveyed at 33 sites across the territory of Hong Kong Special Administrative Region over the period 2016-2017. Surveys included identification of larvae, exuviae and adults, and involved 92 separate site visits. The chosen sites covered the whole spectrum of dragonfly habitats in Hong Kong, with the exception of actively managed fish ponds and reservoirs. Twenty-two of the study locations had been identified as key dragonfly sites by Wilson (1997a). An annotated check list of Hong Kong Odonata was compiled, listing 128 taxa. Comparison of local distribution of dragonflies during the present study with that recorded by Wilson (1997a) indicated that only three species had undergone significant decline in the intervening two decades, while several others (including the conservation-significant *Mortonagrion hirosei* Asahina, 1972 and *Orthetrum poecilops* Ris, 1919) had considerably extended local distributions. Twenty-eight species of particular conservation importance for Hong Kong were identified and ranked, using a species conservation value assessment metric.

Key words: Hong Kong, Odonata, distribution status, conservation significance, species assessment metric

Introduction

The Hong Kong Special Administrative Region (HKSAR) is an area of rugged hills and islands lying just south of the Tropic of Cancer on the coast of southern China. It occupies a land area of 1,100 km² and has a subtropical monsoon climate. The Hong Kong Odonata fauna currently stands at around 122 species, rising to 128 when historical species records for which there are no recent confirmations are included. This compares well with the total of approximately 160 species in Taiwan (Lin 2016) and the approximately 170 species in Hainan (Reels & Zhang 2015), both of these nearby islands being more than 30x larger than the territory of Hong Kong (36,200 km² and 33,900 km² respectively); and is roughly half the number (ca 250 species; this figure is likely to have increased in recent years following work by Zhang (e.g., Zhang 2019) and others) known from adjacent Guangdong (Wilson 2014), one of the most species-rich provinces of China, with a land area more than 160x greater than that of Hong Kong. The vast majority of species known from the Hong Kong Special Administrative Region are of Oriental provenance. About thirty Hong Kong species (nearly half of which are in the Gomphidae) are restricted to southern China.

All lentic and lotic freshwater habitats in Hong Kong, from temporary rain pools to big reservoirs and from tiny forest seepages to large lowland streams, are utilised as breeding and larval habitat by different odonate species. Two Hong Kong species, *Mortonagrion hirosei* and *Orthetrum poecilops*, are able to breed in brackish coastal mangroves and reedbeds, and are essentially restricted to these habitats.

Prior to the 1990s, dragonflies had only been studied sporadically in Hong Kong, commencing in the 1850s and culminating in the work of the Japanese odonatologist Syoziro Asahina in the 1960s and 1980s. Several species recorded in Hong Kong during this long period have not subsequently been recorded, but in most cases it is not possible to know whether this is due to errors of identification in the historical record or genuine local extinction. Since the early 1990s, however, there has been continuous and growing study of the local odonate fauna, beginning with the work of Keith Wilson. Two general trends can be surmised; both are related to habitat change. The drastic reduction in lowland wetlands such as active or abandoned fish ponds, rice paddies and wet vegetable fields that has occurred over the last few decades, through rapid changes in human land use, must inevitably have impacted negatively on the many pond and marsh species which breed in these habitats. Similarly, lowland riverine species will have been badly affected by the unfortunate practice of channelising streams and rivers across Hong Kong and the stripping out of riparian vegetation along river banks. The extent of these impacts is not possible to quantify, but it is intuitively obvious that the more habitat that is lost, the worse the impacts will be. The second trend is of an ongoing recolonisation of Hong Kong by forest-associated dragonflies as woodlands in the territory continue to grow back and mature. Wilson (2014) argued that more than 20 large, strong-flying forest anisopterans first recorded in Hong Kong after 1990 were genuine new arrivals (as opposed to having been historically overlooked), recolonising from forested areas of Guangdong due to recent forest recovery in Hong Kong after a thousand years of severe anthropogenic deforestation. Several more forest species – notably in Gomphidae and Cordulegastridae – have recolonised since 2014, along with a number of libellulids.

Habitat loss is the major threat to Hong Kong dragonflies. As noted above, this is a particular problem for species of open lowland wetlands, although many species dependent on these habitats are regionally ubiquitous and of low conservation concern. Ponds and marshes in Hong Kong tend to occur outside of the protected Country Parks, or within Country Park Enclaves, making them particularly vulnerable. Actively farmed fish ponds are still quite abundant, particularly in the northwest New Territories, but are of far less value as dragonfly habitat than disused fish ponds in which rooted, submerged macrophytes and floating vegetation are established. Such ponds, which can support very diverse dragonfly assemblages, are very rare in Hong Kong. Similarly, lowland rivers with natural substrates and riparian zones are increasingly scarce as Hong Kong's Drainage Services Department continues its practice of channelising all natural waterways outside of the protected areas system, leaving them habitable by only the most tolerant and ubiquitous species. The majority of forested hill streams, trickles and seeps, however, are located within Country Parks and in consequence enjoy a degree of protection.

In 1997, Keith Wilson published an important paper on the status and distribution of Hong Kong dragonflies in the Memoirs of the Hong Kong Natural History Society (Wilson 1997a). This paper summarised the key findings of Wilson's studies of the Hong Kong odonate fauna over the period 1991-1997, a period which had seen the publication of the first guide book on Hong Kong dragonflies (Wilson 1995a) and the expansion of the Hong Kong check list by 70%, including several new taxa described by Wilson (Wilson 1993, 1995b, 1996, 1997b, 1997c). In addition to providing an up to date check list of species, Wilson (1997a) also identified 32 species of conservation interest (eight taxa thought to be endemic and 24 internationally or regionally rare species with restricted distributions in Hong Kong).

In April-July 2016 and May-June 2017, the author was employed by the School of Biological Sciences, The University of Hong Kong, to undertake surveys of dragonflies across Hong Kong, one objective of which was to reassess the status of the Hong Kong species of conservation interest (Reels 2018). Larvae, exuviae and adults were surveyed, in a total of 92 field surveys (at 33 sites distributed across the territory of Hong Kong), as described by Reels (2018). Larval sampling was particularly useful for detecting the presence of gomphids, many species of which can be highly elusive as adults. Some of the recorded species are documented in 'Appendix Species'.

Each of the 23 "key dragonfly sites" identified by Wilson (1997a) was visited at least once in the present study (one site, Kau Sai Chau Pond, was not found by the author but was relocated by Keith Wilson in a visit in June 2018). In addition, a further 11 wetland sites were surveyed on at least one occasion. Site details are given in Appendix 1 and Figure 2 in Appendix as well as in 'Appendix Habitats'.

Number of dragonfly species recorded from Hong Kong

An unimprovable summary of the history of dragonfly recording in Hong Kong, from 1854 to 1997 is provided by Wilson (1997a, pp. 1-2), and is not repeated here. Prior to the work of Wilson, who commenced his studies of Hong Kong Odonata in 1991, the most up to date check list of Hong Kong damselflies and dragonflies was that produced in two parts by Asahina in the late 1980s, which listed 25 species of Zygoptera (Asahina 1987) and 38 species of Anisoptera (Asahina 1988) – a total of 63 species. Wilson (1995a) extended this to 105 species (33 species of Zygoptera and 72 species of Anisoptera). This vast expansion was predominantly an outcome of Wilson's own work in the early- to mid-1990s but also included the reinstatement of one species inadvertently omitted by Asahina (1988), the acceptance of several other taxa records made by Lai (1971) that Asahina had apparently regarded as unsafe, and a small number of newer records made by contemporary workers (details in Table 2). Wilson (1997a) dropped three taxa (*Devadatta argyoides* (Selys, 1859), *Gynacantha hyalina* Selys, 1882 and *Orthetrum testaceum* (Burmeister, 1839)) from the check list, and Wilson (2004a) likewise dropped *Asiagomphus septimus* (Needham, 1930). Nevertheless, the total number of accepted species, particularly anisopterans, continued to rise steadily.

In 2017, after field and laboratory work was completed for the present study, the Hong Kong total stood at 124 species (38 zygopterans and 86 anisopterans – almost a

doubling since 1988 (Figure 1). Twenty years earlier, Wilson (1997a) listed 107 species from Hong Kong, one of which was subsequently dropped, so the adjusted total was 106 (35 zygopterans and 71 anisopterans). Hence, in the period 1997 to 2017, the number of known species increased by 16% overall. Number of Anisoptera species increased by 20% and of Zygoptera by 8.6%. A further four species of Anisoptera (*Polycanthagyna ornithocephala* (McLachlan, 1896), *Stylurus clathratus* (Needham, 1930), *Indothemis carnatica* (Fabricius, 1798) and *Orthetrum albistylum* (Selys, 1848) have been recorded in Hong Kong since 2017.

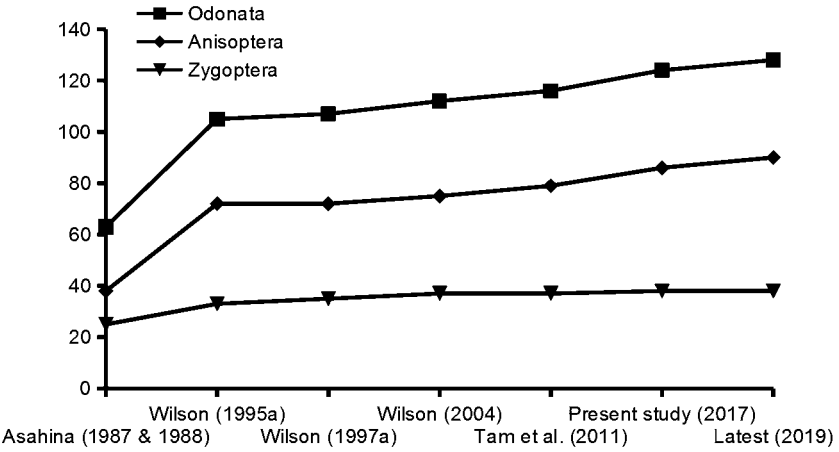

Figure 1. Cumulative number of Odonata species listed from Hong Kong, 1987-2019.

At the higher taxonomic level, in the check list provided by Wilson (1997a) 14 Odonata families were represented (adjusted with reference to Dijkstra et al. (2013, 2014)), while 15 families are currently represented, the family Cordulegastridae having been added to the Hong Kong list in the form of a single taxon, *Anotogaster* sp. cf *klossi* (Table 2). Species additions have been made to five other families, most notably Gomphidae, Libellulidae and Aeshnidae, (of which five species have been added, raising the proportion of the Hong Kong fauna represented by this family from 8.5% to 11.7%). The odonate fauna remains dominated by Coenagrionidae (Zygoptera), Gomphidae and particularly Libellulidae (Anisoptera), the latter accounting for 35.8% of species in 1997 and 34.7% in 2019. Anisopteran species now account for 70.3% of the total, up from 67% in 1997, with a concomitant reduction in the proportion made up by Zygoptera of from 33% to 29.7%. (Table 1).

It should be noted that the calopterygid *Matrona basilaris* Selys, 1853, added to the most up to date check list, is a recently discovered historical record, dating from over a century ago (Seehausen, 2014), rather than a newly recorded species. It would therefore have appeared on earlier check lists had the existence of the record been known.

Table 1. Species composition by suborder and family of Hong Kong dragonflies, 1997 and 2019

Sub-order	Family	1997		2019	
		No. spp.	% of total	No. spp.	% of total
Zygoptera		**35**	**33**	**38**	**29.7**
	Philogangidae	1	0.9	1	0.8
	Calopterygidae	2	1.9	3	2.3
	Chlorocyphidae	1	0.9	1	0.8
	Euphaeidae	2	1.9	2	1.6
	Lestidae	2	1.9	2	1.6
	Megapodagrionidae	2	1.9	2	1.6
	Coenagrionidae	14	13.2	16	12.5
	Platycnemididae	7	6.6	7	5.5
	Platystictidae	4	3.8	4	3.1
Anisoptera		**71**	**67**	**90**	**70.3**
	Aeshnidae	9	8.5	15	11.7
	Gomphidae	16	15.1	21	16.4
	Cordulegastridae	0	0	1	0.8
	Macromiidae	4	3.8	4	3.1
	Corduliidae	4	3.8	4	3.1
	Libellulidae	38	35.8	45	35.1
		106	100	128	100

Status and distribution of dragonfly species recorded from Hong Kong

The species check list provided in Table 2 is based on that given in Tam et al. (2011) and the subsequent additions listed in Leung & Tam (2016). The species name *Aciagrion tillyardi* Laidlaw, 1919 is corrected to *Aciagrion approximans* (Selys, 1876) following Kosterin et al. (2014). Three species of Zygoptera formerly placed in Coenagrionidae and Protoneuridae (*Onychargia atrocyana* Selys, 1865, *Prodasineura autumnalis* (Fraser, 1922) and *P. croconota* (Ris, 1916) are moved into Platycnemididae, in accordance with Dijkstra et al. (2014). *Philoganga vetusta* Ris, 1912, formerly placed in Amphipterygidae by Wilson (1995a, 1997a) and in Diphlebiidae by Wilson (2004a) and Tam et al. (2011), is moved into Philogangidae, following Hämäläinen (2008) and Dijkstra et al. (2013). *Agriomorpha fusca* May, 1933 and *Rhipidolestes janetae* Wilson, 1997, considered incertae sedis by Dijkstra et al. (2014), are provisionally retained in Megapodagrionidae, while species in the genera *Idionyx* and *Macromidia*, considered incertae sedis by Dijkstra et al. (2013), are provisionally retained in Corduliidae. Some 128 taxa in 15 families are listed (126 named species and two taxa identified to genus/species group). Six of these are presumed locally extinct, having not been recorded since the 1970s or earlier, and eight are considered either vagrants or of uncertain status.

Information on the local status of Hong Kong species during the 1990s was derived from Wilson (1995a, 1997a), who gave undefined indicative statements ("Rare", "Uncommon", "Not common", "Fairly common", "Very common", "Abundant", "Widespread" etc.)

Table 2. Annotated check list of dragonfly species recorded from Hong Kong.

Family	*Species/taxon*	Red List*	Distribution and remarks
PHILO-GAN-GIDAE	*Philoganga vetusta* Ris, 1912	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).]
CALO-PTERY-GIDAE	*Matrona basilaris* Selys, 1853	LC	**Not recorded; presumed locally extinct.** ["Historical" (Leung & Tam, 2016).] The species has not been reported in Hong Kong in modern times but was recently found to have been vouchered in the territory during the period 1878-1907 (Seehausen, 2014).
	Mnais mneme Ris, 1916	LC	**Widespread.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).] A spring species, adults dying out by July.
	Neurobasis chi nensis chinensis (Linnaeus, 1758)	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common, widely distributed" (Wilson, 2004a); "Common, widespread" (Tam et al., 2011).]
CHLORO-CYPH-IDAE	*Rhinocypha per forata perforata* (Percheron, 1835)	LC	**Very widespread.** ["Widespread and common" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]
EUPHAE-IDAE	*Euphaea decorata* Hagen in Selys, 1853	LC	**Very widespread.** ["Very common" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant" (Wilson, 2004a; Tam et al., 2011).]
	Euphaea opaca Selys, 1853	NA	**Not recorded; presumed locally extinct.** ["Rare" (Wilson, 1995a, 1997a, 2004a); "Historical" (Tam et al., 2011).] Not reported from Hong Kong before or since the single record made by Lai (1971).
LESTIDAE	*Lestes nodalis* Selys, 1891	LC	**Sparse.** ["Rare" (Wilson, 1997a, 2004a; Tam et al., 2011); "Local Concern" (Fellowes et al., 2002)]. Wilson (1995; 2004a) recorded the species at only one site (Pat Sin Leng Site 1); Tam et al. (2011) also report-ed the species from Wu Kau Tang. Reels (unpubl.) discovered another breeding site (Sheung Tsat Muk Kiu) in 2006. Recorded at Sheung Tsat Muk Kiu in the present study.
	Lestes praemor-sus praemorsus Hagen in Selys, 1892	LC	**Not recorded; presumed locally extinct.** ["Rare" (Wilson, 1995a, 1997a, 2004a; Tam et al., 2011).] The species has not been reported in Hong Kong since Lai (1971) recorded it at Pat Sin Leng and Hong Lok Yuen; the only previous record, also from the now-developed Hong Lok Yuen, was made in 1964 (Asahina, 1965).

Family	*Species/taxon*	Red List*	Distribution and remarks
MEGAPODAGRIONIDAE	*Agriomorpha fusca* May, 1933	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Abundant" (Wilson, 2004a; Tam et al., 2011).]
	Rhipidolestes janetae Wilson, 1997	LC	**Sparse.** ["Rare, endemic" (Wilson, 1997a); "Rare" (Wilson, 2004a); "Uncommon" (Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] Wilson (1997b) reported this species from 600m asl on the northern slopes of Sunset Peak on Lantau Island and subsequently found a second population at Shing Mun in the Central New Territories (Wilson, 2004a). Tam et al. (2011) added a third locality at Yuen Tun Ha in the Central New Territories. The species was initially considered endemic to Hong Kong but was reported from Guangdong by Wilson & Xu (2007). Recorded at Sunset Peak and Tai Mo Shan South in the present study.
COENAGRIONIDAE	*Aciagrion approximans* (Selys, 1876)	LC	**Sparse.** ["Rare" (Wilson, 2004a; Tam et al., 2011).] The correct taxonomic designation of this species, formerly referred to as *Aciagrion tillyardi*, was established by Kosterin et al. (2014). A small population was discovered at Pat Sin Leng Site 2 in 2000. Recorded at Tsing Tai Stream in the present study.
	Agriocnemis femina oryzae Lieftinck, 1962	LC	**Scattered.** ["Very common and widespread" (Wilson, 1995a, 2004a); "Abundant" (Wilson, 1997a); "Abundant and widespread" (Tam et al., 2011).] Frequently abundant in the appropriate habitat (marshes, pond margins, drainage ditches).
	Agriocnemis lacteola Selys, 1877	LC	**Not recorded.** ["Uncommon" (Wilson, 1997a, 2004a); "Rare" (Tam et al., 2011).] A large breeding population of this species was discovered at Cheung Sheung in Sai Kung in 1996 (Wilson, 1997a). Although this population persists (as verified in a site visit by Reels in 2015), the species has apparently not been reported elsewhere in the past 20 years. Historically it has been recorded at three other sites in the New Territories, however: Tai Po Market in 1965 (Asahina, 1965), Tai Lung Farm in 1970 (Nakao et al., 1976) and Hoi Ha in 1992 (Wilson, 1997a).
	Agriocnemis pygmaea (Rambur, 1842)	LC	**Sparse.** ["Not especially common, fairly widely distributed" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).] Recorded at Ma Tso Lung, Tan Shan River and She Shan in the present study.
	Ceriagrion auranticum ryukyuanum Asahina, 1967	LC	**Very widespread.** ["Common and widespread" (Wilson, 1995a, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]

Family	*Species/taxon*	Red List*	Distribution and remarks
	Ischnura asiatica (Brauer, 1865)	NA	**Not recorded; presumed locally extinct.** ["Rare" (Wilson, 1997a, 2004a); "Historical record" (Tam et al. 2011).] Single historical record by Brauer (1865). Wilson (2004a) alluded to "more recent" records of this species made by Japanese visitors to Hong Kong. Reels (1994) listed *Ischnura asiatica* from Mai Po on the basis of determinations made by Dr S. Asahina. It is now assumed that these were misidentifications of the closely similar *I. senegalensis*.
	Ischnura senegalensis (Rambur, 1842)	LC	**Scattered.** ["Extremely common, widespread" (Wilson, 1995a); "Abundant, widespread" (Wilson, 1997a, 2004a; Tam et al., 2011).] The species is abundant at managed ponds in the northwest New Territories (Reels, pers. data).
	Ischnura sp. (*rufostigma* Selys, 1876 - group)	-	**Not recorded; presumed locally extinct.** ["Rare" (Wilson, 1997a (as *Ischnura mildredae*), 2004a); "Historical record" (Tam et al., 2011).] Not reported from Hong Kong since Lai (1971). Asahina (1965) first reported collecting this taxon (as "*Ischnura rufostigma mildredae*") from Ho Chung in 1964 and 1965.
	Mortonagrion hirosei Asahina, 1972	NT	**Sparse.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] This species was originally considered endemic to Japan and restricted to coastal *Phragmites* reedbed habitats (Asahina, 1972). Since its discovery in reedbeds at Mai Po in 1991 (Asahina, 1992) breeding populations of this species have been found at several brackish coastal reed and/or mangrove habitats in the northern New Territories (Stanton and Allcock, 2011). The IUCN redlisting of this species was downgraded from "Endangered" to "Vulnerable" in 2006 and thence to "Near Threatened" in 2011. Recorded at Kuk Po, Luk Keng and Nam Chung in the present study.
	Paracercion calamorum dyeri (Fraser, 1919)	LC	**Sparse.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011).] Recorded at Lung Tsai Ng pond and Tan Shan River in the present study.
	Paracercion hieroglyphicum (Brauer, 1865)	NA	**Not recorded; presumed locally extinct.** ["Rare" (Wilson, 1997a, 2004a); "Historical record" (Tam et al., 2011).] Not reported in Hong Kong since the species description by Brauer (1865), in which the male was apparently collected in Hong Kong.
	Paracercion melanotum (Selys, 1876)	LC	**Sparse.** ["Rare" (Wilson, 1997a (as *Cercion sexlineatum*)); "Uncommon" (Wilson, 2004a; Tam et al. 2011).] Recorded at Kai Kuk Shue Ha and Tan Shan River in the present study.

Family	*Species/taxon*	Red List*	Distribution and remarks
	Pseudagrion microcephalum (Rambur, 1842)	LC	**Scattered.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011).]
	Pseudagrion pruinosum fraseri Schmidt, 1934	LC	**Scattered.** ["Rare" (Wilson, 2004a); "Common" (Tam et al., 2011).] A large, conspicuous damselfly, first reported from Hong Kong in 2003 (Wilson, 2004a).
	Pseudagrion rubriceps rubriceps Selys, 1876	LC	**Scattered.** ["Uncommon" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common, widespread" (Tam et al., 2011).]
	Pseudagrion spencei Fraser, 1922	LC	**Not recorded.** ["Rare" (Wilson, 1997a, 2004a); "Uncommon" (Tam et al., 2011).] Reported in recent years from Tan Shan River and Tai Tong (Wilson, 1997a) and from Wu Kau Tang (Tam et al., 2011).
PLATYCNEMIDIDAE	*Calicnemia sinensis* Lieftinck, 1984	LC	**Sparse.** ["Uncommon" (Wilson, 1997a, 2004a); "Common" (Tam et al., 2011).] Generally confined to forested hill streams. Recorded at Ng Tung Chai, Sunset Peak and Tai Po Kau in the present study.
	Coeliccia cyanomelas Ris, 1912	LC	**Widespread.** ["Widespread and common" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread and common" (Wilson, 2004a); "Abundant and widespread" Tam et al., 2011).]
	Copera marginipes (Rambur, 1842)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Onychargia atrocyana Selys, 1865	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).] The species was formerly placed in Coenagrionidae, but was moved to Platycnemididae by Dijkstra et al. (2014) on the basis of molecular evidence.
	Prodasineura autumnalis (Fraser, 1922)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Abundant, widespread" (Wilson, 1997a, 2004a; Tam et al., 2011).] The genus *Prodasineura* was previously placed in Protoneuridae, but was moved to Platycnemididae by Dijkstra et al. (2014) on the basis of molecular evidence.
	Prodasineura croconota (Ris, 1916)	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a; Tam et al., 2011).] As noted by Wilson (1995) and Tam et al. (2011), and affirmed in the present study, Hong Kong populations of this species tend to be restricted to the northeast New Territories. The genus *Prodasineura* was previously placed in Protoneuridae, but was moved to Platycnemididae by Dijkstra et al. (2014) on the basis of molecular evidence.

Family	*Species/taxon*	Red List*	Distribution and remarks
	Pseudocopera ciliata (Selys, 1863)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).] The species was formerly placed in the genus *Copera* but was moved to *Pseudocopera* by Dijkstra et al. (2014).
PLATY-STICT-IDAE	*Drepanosticta hongkongensis* Wilson, 1997	LC	**Scattered.** ["Common, endemic" (Wilson, 1997a); "Common, widely distributed/ widespread in well forested areas" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] Treated as *Drepanosticta brownelli* by Asahina (1987) but Wilson (1997c) described the Hong Kong material as a new species, which was briefly known only from the territory but populations were subsequently discovered in Guangdong (Reels, 2001; Wilson & Xu, 2007).
	Protosticta beaumonti Wilson, 1997	LC	**Sparse.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] The male holotype was taken from Keung Shan, Lantau Island (Wilson, 1997c) but the species is also known from Guangdong (Wilson, 1997c; Wilson & Xu, 2007) and Guangxi (Wilson & Reels, 2003). In Hong Kong it appears to be confined to two islands (Hong Kong and Lantau). Recorded at Keung Shan and Sunset Peak in the present study.
	Protosticta taipokauensis Asahina & Dudgeon, 1987	LC	**Sparse.** ["Fairly widely distributed" (Wilson, 1995a); "Uncommon" (Wilson, 1997a); "Common, widely distributed" (Wilson, 2004a); "Common, widespread in well forested areas" (Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] The species was described from Hong Kong (Asahina & Dudgeon, 1987) and was considered endemic to the territory but subsequently recorded in Laos (Sasamoto & Honda, 2003) and Guangdong (Wilson & Xu, 2007). Recorded at Ng Tung Chai, Tai Po Kau and Wu Kau Tang in the present study.
	Sinosticta ogatai (Matsuki & Saito, 1996)	LC	**Sparse.** ["Rare, endemic" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] The species was first described from Hong Kong (as "Platystictidae sp.") in Wilson (1995a). Matsuki & Saito (1996) subsequently described and named it *Drepanosticta ogatai*. Wilson (1997c) established a new genus, *Sinosticta*, for the species. It was briefly known only from Hong Kong but Reels (2001) reported a population at Wutongshan, Guangdong, adjacent to Hong Kong. Recorded at Ng Tung Chai, Tai Mo Shan South and Sunset Peak in the present study.

Family	*Species/taxon*	Red List*	Distribution and remarks
AESHNIDAE	*Anaciaeschna jaspidea* (Burmeister, 1839)	LC	**Sparse.** ["Fairly common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011).] A mainly crepuscular species. Recorded at Ma Tso Lung in the present study.
	Anax guttatus (Burmeister, 1839)	LC	**Scattered.** ["Widespread and common" (Wilson, 1995a, 1997a); "Abundant, widespread" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).]
	Anax immaculifrons Rambur, 1842	LC	**Sparse.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a; Tam et al., 2011).] Recorded at Sheung Tsat Muk Kiu, Tai Tong and Tai Shui Hang in the present study. Also observed in Pat Sin Leng along the trail between Sites 1 and 2.
	Anax indicus Lieftinck, 1942	LC	**Not recorded. Vagrant.** ["Vagrant" (Leung & Tam, 2016).] A male specimen apparently of this species was photographed but not vouchered at Yuen Tun Ha, Tai Po in 2010 (Yam, 2012). The species has not previously been reported from Chinese territory. It is closely similar to *Anax guttatus*.
	Anax nigrofasciatus nigrofasciatus Oguma, 1915	LC	**Not recorded.** ["Rare" (Wilson, 2004a); "Uncommon" (Tam et al., 2011).] First recorded at Ma On Shan in 2003 (Wilson, 2004a); subsequently reported from several locations in the New Territories (Tam et al., 2011).
	Anax parthenope julius (Brauer, 1865)	LC	**Scattered.** ["Common and widespread" (Wilson, 1995a, 1997a, 2004a; Tam et al., 2011).]
	Cephalaeschna klotsae Asahina, 1982	DD	**Sparse.** ["Rare" (Wilson, 2004a; Tam et al., 2011).] First recorded at Ng Tung Chai in 2003 (Wilson, 2004a); not subsequently reported from elsewhere in the territory. Recorded at Ng Tung Chai in the present study.
	Gynacantha japonica Bartenef, 1909	NA	**Sparse.** ["Uncommon" (Wilson, 1997a, 2004a); "Common, widespread in woodlands" (Tam et al., 2011).] Recorded at Luk Keng, Pat Sin Leng Site 2 and Wu Kau Tang in the present study.
	Gynacantha ryukyuensis Asahina, 1962	NA	**Not recorded.** ["Uncommon" (Leung & Tam, 2016).] First recorded in Hong Kong by the AFCD Dragonfly Working Group in Tai Lam Country Park in 2013 and the northeast New Territories in 2014 (Leung et al., 2016).
	Gynacantha saltatrix Martin, 1909	LC	**Not recorded.** ["Uncommon" (Wilson, 1997a, 2004a; Tam et al., 2011).]

Family	*Species/taxon*	Red List*	Distribution and remarks
	Gynacantha subinterrupta Rambur, 1842	LC	**Sparse**. ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011).] Recorded at Keung Shan and Sha Lo Tung in the present study.
	Planaeschna skiaperipola Wilson and Xu, 2008	NA	**Not recorded**. ["Rare" (Tam et al., 2011).] This taxon was first reported from Wu Kau Tang (as "*Planaeschna* sp.") by Wilson (2006). It has not subsequently been reported from elsewhere in Hong Kong.
	Polycanthagyna erythromelas (McLachlan, 1896)	LC	**Scattered.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common, widespread" (Tam et al., 2011).]
	Polycanthagyna ornithocephala (McLachlan, 1896)	LC	**Not recorded. Status uncertain.** To date known only from a good photographic record taken by Ernest Chiu at Tai Po Kau in August 2018. Possibly vagrant.
	Tetracanthagyna waterhousii McLachlan, 1898	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).]
GOMPHIDAE	*Anisogomphus koxingai* Chao, 1954	LC	**Sparse.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al. 2011).] First recorded from Hong Kong at Ping Shan Chai in 1992 (Wilson, 1995b). Most Hong Kong records of this species are from areas upstream of Hok Tau Reservoir and nearby (Wilson, 1995a, 2004a; Tam et al., 2011). Recorded at Hok Tau in the present study.
	Asiagomphus hainanensis (Chao, 1953)	NA	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a, Tam et al., 2011).]
	Burmagomphus vermicularis (Martin, 1904)	LC	**Scattered.** ["Uncommon" (Wilson, 1997a, 2004a); "Common" (Tam et al., 2011).] First recorded from Hong Kong at Tai Tong in 1992 (Wilson, 1995b).
	Fukienogomphus choifongae Wilson and Tam, 2006	LC	**Sparse.** ["Rare" (Wilson, 2004a; Tam et al., 2011).] This species was first discovered at Wu Kau Tang in 2004 (Wilson & Tam, 2006). The Wu Kau Tang site is the only known Hong Kong locality for this species, which was briefly considered endemic to Hong Kong. However, it has now also been reported from Guangdong (Tong, 2013). Recorded at Wu Kau Tang in the present study.

Family	*Species/taxon*	Red List*	Distribution and remarks
	Gomphidia kelloggi Needham, 1930	EN	**Sparse.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] All Hong Kong records of this species are from Sha Lo Tung and areas upstream of Hok Tau Reservoir. Wilson (1995a) noted that, prior to its discovery at Sha Lo Tung in 1992, this species had not been recorded since it was first found in Fujian in 1928. Recorded at Sha Lo Tung and Hok Tau in the present study.
	Heliogomphus retroflexus (Ris,1912)	LC	**Not recorded.** ["Rare" (Tam et al., 2011).] Sha Lo Tung is apparently the only known Hong Kong location for this species recently reported from the territory, with convincing photographic evidence, by Green Power (2009).
	Heliogomphus scorpio (Ris, 1912)	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common, widely distributed/widespread" (Wilson, 2004a; Tam et al., 2011).]
	Ictinogomphus pertinax (Hagen in Selys, 1854)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).]
	Labrogomphus torvus Needham, 1931	LC	**Sparse.** ["Rare" (Wilson, 1997a, 2004a); "Uncommon" (Tam et al., 2011).] First recorded from Hong Kong at She Shan in 1993 (Wilson, 1995b). Recorded at Hok Tau in the present study.
	Lamelligomphus hainanensis (Chao, 1953)	LC	**Scattered.** ["Rare" (Wilson, 1997a, 2004a); "Uncommon" (Tam et al., 2011).] First reported from Hong Kong (as "*Lamelligomphus hongkongensis* sp. n.") at Tai Tong and Sha Lo Tung by Wilson (1995b).
	Leptogomphus hongkongensis Asahina, 1988	NA	**Scattered.** ["Fairly common, endemic" (Wilson, 1997a); "Common, widely distributed/widespread" (Wilson, 1995a, 2004a; Tam et al., 2011).] Formerly *Leptogomphus elegans hongkongensis* Asahina 1988. Raised to full species status by Wilson & Xu (2009). Considered endemic to Hong Kong by Tam et al. (2011) but recorded from Laos by (Yokoi, 2001) and Yokoi & Kano (2002).
	Megalogomphus sommeri (Selys, 1854)	LC	**Scattered.** ["Probably widespread and common in clean fast flowing rivers" (Wilson, 1995a); "Uncommon" (Wilson, 1997a, 2004a); "Common" (Tam et al., 2011).] First recorded from Hong Kong at Sha Lo Tung in 1992 (Wilson, 1995b).
	Melligomphus guangdongensis (Chao, 1994)	NA	**Sparse.** ["Uncommon" (Wilson, 1997a, 2004a); "Common" (Tam et al., 2011).] Recorded at Hok Tau, Tai Po Kau and Ng Tung Chai in the present study.

Family	Species/taxon	Red List*	Distribution and remarks
	Ophiogomphus sinicus (Chao, 1954)	DD	**Sparse.** ["Widely distributed in rapid gravel/cobble streams" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011).] Recorded at Hok Tau, Sha Lo Tung and Sham Tseng in the present study.
	Paragomphus capricornis (Förster, 1914)	LC	**Scattered.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011).] First discovered in Hong Kong (and China) at Tai Tong in 1992 (Wilson, 1995a, 1995b).
	Sieboldius alexanderi Chao, 1955	DD	**Scattered.** ["Rare" (Wilson, 2004a); "Uncommon" (Tam et al., 2011).] First reported from Hong Kong at Sha Lo Tung by Saito & Ogata (1995).
	Sieboldius deflexus (Chao, 1955)	LC	**Not recorded. Status uncertain.** ["Rare" (Tam et al., 2011).] Sha Lo Tung and Wu Kau Tang are apparently the only known Hong Kong locations for this species recently reported from the territory by Green Power (2009) from single exuviae, possibly misidentifications of *S. alexanderi* which is present at both sites.
	Sinictinogomphus clavatus (Fabricius, 1775)	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a; Tam et al., 2011).]
	Stylogomphus chunliuae Chao, 1954	LC	**Sparse.** ["Uncommon" (Wilson, 1997a, 2004a); "Common" (Tam et al., 2011).] First recorded from Hong Kong at Tai Po Kau (Matsuki et al., 1990). Recorded at Ng Tung Chai and Tai Po Kau in the present study.
	Stylurus clathratus (Needham, 1930)	LC	**Not recorded.** First recorded from Hong Kong at Tai O, Lantau, in June 2018 (Wilson, 2019).
	Stylurus kreyenbergi Ris, 1928	NA	**Not recorded.** ["Vagrant" (Leung & Tam, 2016).] The first and to date only Hong Kong record of this species was made by So (2008), with convincing photographic evidence, in the Sai Kung area (Samson So, pers. comm.).
CORDULEGASTERIDAE	*Anotogaster* sp. cf *klossi*	-	**Sparse**. This taxon was first recorded for Hong Kong by the AFCD Dragonfly Working Group in 2015 at an unspecified location (Leung & Tam, 2016) and Kimchi Lo obtained photographs of a species of *Anotogaster* at Lai Chi Wo in June 2016 (pers. comm.). An *Anotogaster* larva was collected at Tai Po Kau in September 2016 (Tommy Hui, pers. comm.), confirming that it has bred at least one site in Hong Kong.
MACROMIIDAE	*Epophthalmia elegans* (Brauer, 1865)	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a; Tam et al., 2011).]

Family	*Species/taxon*	Red List*	Distribution and remarks
	Macromia berlandi Lieftinck, 1941	LC	**Scattered.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011).] First recorded for Hong Kong in 1992 at Sha Lo Tung by Wilson (1993), this record apparently being the first for this species since the type male was collected in Vietnam in the 19th century (Wilson, 1995a). The species was subsequently reported from Guangxi (Zhou et al., 1994) and Hainan (Wilson & Reels, 2001).
	Macromia katae Wilson, 1993	VU	**Sparse.** ["Rare, endemic" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] Described by Wilson (1993) from material collected at Sha Lo Tung. Subsequently discovered in Hainan (Wilson & Reels, 2001) and Laos (Yokoi, 2003). Recorded at Hok Tau and Sha Lo Tung in the present study.
	Macromia urania Ris, 1916	LC	**Scattered.** ["Uncommon" (Wilson, 1997a, 2004a); "Common" (Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] First recorded for Hong Kong in 1992 at Sha Lo Tung, Tai Tong and Ping Yeung by Wilson (1993). The IUCN redlisting of this species was downgraded from "Endangered" to "Least Concern" in 2006.
CORDULIIDAE	*Idionyx claudia* Ris, 1912	LC	**Not recorded.** ["Rare" (Wilson, 1997a, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] First recorded from Hong Kong in 1994 at Ng Tung Chai (Saito & Ogata, 1995), which apparently remains the only known Hong Kong locality for this species (Tam et al., 2011).
	Idionyx victor Hämäläinen, 1991	NA	**Widespread.** ["Fairly common" (Wilson, 1997a); "Common, widely distributed/widespread" (Wilson, 2004a, Tam et al., 2011).] Treated as *Idionyx yolanda* by Asahina (1965) but Hämäläinen (1991) considered the Hong Kong material to represent a new species and described it as *I. victor*. Briefly known only from Hong Kong but subsequently reported from Hainan (Wilson & Reels, 2001), Guangxi (Wilson & Reels, 2003) and Yunnan (Zhang, 2019) in China, and from Vietnam (in Zhang, 2019).
	Macromidia ellenae Wilson, 1996	NA	**Sparse.** ["Rare, endemic" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] First discovered in Hong Kong by Wilson at Sha Lo Tung and Wu Kau Tang (Wilson, 1995a). Subsequently described as a new species (Wilson, 1996) and considered endemic to Hong Kong for several years before its discovery in Guangdong (reported in Tam at. al, 2011). Recorded at Hok Tau and Luk Keng in the present study.
	Macromidia rapida Martin, 1906	LC	**Scattered.** ["Fairly common" (Wilson, 1997a); "Fairly common in the northeast New Territories" (Wilson, 1995a, 2004a); "Common, widespread in woodland streams throughout Hong Kong" (Tam et al., 2011).]

Family	Species/taxon	Red List*	Distribution and remarks
LIBELLULIDAE	*Acisoma panorpoides* Rambur, 1842	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common and widespread" (Wilson, 2004a; Tam et al., 2011).]
	Aethriamanta brevipennis brevipennis (Rambur, 1842)	LC	**Scattered.** ["Uncommon" (Tam et al., 2011).] First reported from Hong Kong at the Wetland Park, Tin Shui Wai, in 2008 (Tam et al., 2008).
	Brachydiplax chalybea flavovittata Ris, 1911	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common and widespread" (Wilson, 2004a; Tam et al., 2011).]
	Brachythemis contaminata (Fabricius, 1793)	LC	**Scattered.** ["Common and widespread" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).] Recorded at nine sites in the present study. The species is abundant at managed ponds in the northwest New Territories (Reels, 2010, 2011).
	Crocothemis servilia servilia (Drury, 1770)	LC	**Scattered.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).] Recorded at nine sites in the present study. The species is abundant at managed ponds in the northwest New Territories (Reels, 2010, 2011).
	Diplacodes nebulosa (Fabricius, 1793)	LC	**Not recorded.** ["Uncommon" (Wilson, 1997a, 2004a; Tam et al., 2011).]
	Diplacodes trivialis (Rambur, 1842)	LC	**Sparse.** ["Widespread and common in late summer" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread especially in late summer" (Wilson, 2004a; Tam et al., 2011").] Recorded at Tsing Tai Stream in the present study. The early summer timing of the field surveys in 2016 and 2017 undoubtedly contributed to under-recording of this species.
	Hydrobasileus croceus (Brauer, 1867)	LC	**Widespread.** ["Not uncommon" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).]
	Indothemis carnatica (Fabricius, 1798)	LC	**Not recorded.** First recorded in Hong Kong in 2018 (AFCD 2019a) and there have now been several sightings, predominantly at eastern coastal locations.
	Lyriothemis elegantissima Selys, 1883	LC	**Widespread.** ["Not common but could occur in woodland areas throughout the territory" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common and widespread" (Wilson, 2004a; Tam et al., 2011).]

Family	*Species/taxon*	Red List*	Distribution and remarks
	Macrodiplax cora (Kaup in Brauer, 1867)	LC	**Sparse.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011).] First recorded in Hong Kong at Lai Chi Wo in 1997 (Wilson, 1997a). Recorded at Kuk Po and She Shan in the present study.
	Nannophya pygmaea Rambur, 1842	LC	**Sparse.** ["Uncommon" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; "Common" (Tam et al., 2011).] Recorded at Sheung Tsat Muk Kiu and Luk Keng in the present study.
	Nannophyopsis clara (Needham, 1930)	LC	**Scattered.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a); "Common" (Tam et al., 2011).] First recorded in Hong Kong at Luk Keng in 1994 (Wilson, 1995a).
	Neurothemis fulvia (Drury, 1773)	LC	**Widespread.** ["Fairly widespread and not uncommon" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).]
	Neurothemis tullia tullia (Drury, 1773)	LC	**Widespread.** ["Locally common and widespread" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a); "Abundant, widespread" (Tam et al., 2011).]
	Onychothemis testacea testacea Laidlaw, 1902	LC	**Sparse.** ["Rare" (Wilson, 1997a); "Rare" (Wilson, 2004a); "Uncommon" (Tam et al., 2011).] First recorded from Hong Kong at She Shan in 1993; previously unknown from Chinese territory (Wilson, 1995a). Recorded at Tan Shan River in the present study.
	Orthetrum albistylum (Selys, 1848)	LC	**Not recorded.** First recorded in Hong Kong in 2018 at the Hong Kong Wetland Park (AFCD 2019b).
	Orthetrum chrysis (Selys, 1891)	LC	**Very widespread.** ["Fairly common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a); "Abundant and widespread" (Tam et al., 2011).]
	Orthetrum glaucum (Brauer, 1865)	LC	**Very widespread.** ["Widespread and common" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]

Family	*Species/taxon*	Red List*	Distribution and remarks
	Orthetrum luzonicum (Brauer, 1868)	LC	**Widespread.** ["Widely distributed and abundant at suitable locations" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Orthetrum melania (Selys, 1883)	LC	**Not recorded.** ["Widespread in small numbers" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Uncommon" Wilson, 2004a; Tam et al., 2011).]
	Orthetrum poecilops poecilops Ris, 1919	VU	**Scattered.** ["Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).] First recorded from Hong Kong at Nam Chung in 1994 (Wilson, 1995a).
	Orthetrum pruinosum neglectum (Rambur, 1842)	LC	**Widespread.** ["Widespread and common" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Orthetrum sabina sabina (Drury, 1770)	LC	**Widespread.** ["Widespread and common" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a); "Abundant, found all over Hong Kong" (Tam et al., 2011).]
	Orthetrum triangulare triangulare (Selys, 1878)	LC	**Widespread.** ["Not often encountered in Hong Kong" (Wilson, 1995a); "Uncommon" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Palpopleura sexmaculata sexmaculata (Fabricius, 1787)	LC	**Sparse.** ["Fairly widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common, fairly widespread" (Wilson, 2004a); "Common and widespread" Tam et al., 2011).] Recorded at Kuk Po, Tan Shan River and Tsing Tai Stream in the present study.
	Pantala flavescens (Fabricius, 1798)	LC	**Widespread.** ["The commonest dragonfly occurring in Hong Kong; adults found everywhere" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Abundant, adults found all over Hong Kong" (Wilson, 2004a; Tam et al., 2011).] Can turn up anywhere and is undoubtedly the only truly ubiquitous species in Hong Kong but recorded in only 14 of the 33 sites in the present study.
	Potamarcha congener (Rambur, 1842)	LC	**Scattered.** ["Widespread but not common" (Wilson, 1995a); "Uncommon" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Pseudothemis zonata (Burmeister, 1839)	LC	**Very widespread.** ["Fairly common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Rhodothemis rufa (Rambur, 1842)	LC	**Scattered.** ["Rare" (Wilson, 1995a, 1997a); "Common" (Wilson, 2004a); "Common and widespread" (Tam et al., 2011).] First recorded in Hong Kong at Sha Lo Tung in 1992 (Wilson, 1995a).

Family	*Species/taxon*	Red List*	Distribution and remarks
	Rhyothemis fuliginosa Selys, 1883	LC	**Not recorded. Status uncertain.** ["Vagrant" (Leung & Tam, 2016).] Photographs of a dragonfly closely resembling this species were taken by Ng (2014a) at a pond in the northeast New Territories in October 2014.
	Rhyothemis triangularis Kirby, 1889	LC	**Scattered.** ["Rare" (Wilson, 1995a); "Uncommon" (Wilson, 1997a); "Common" (Wilson, 2004a); "Common, widespread" (Tam et al., 2011).]
	Rhyothemis variegata aria (Drury, 1773)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Sympetrum darwinianum (Selys, 1883)	LC	**Not recorded. Status uncertain.** ["Vagrant" (Leung & Tam, 2016).] Photographs of a dragonfly closely resembling this species were taken by Ng (2014b) in the northeast New Territories in December 2014.
	Sympetrum fonscolombii (Selys, 1840)	LC	**Not recorded. Vagrant/status uncertain.** Photographs of a male and female dragonfly closely resembling this species were taken by Ernest Chiu (Ken So, pers. comm.) at Po Toi in early October 2017.
	Tholymis tillarga (Fabricius, 1798)	LC	**Scattered.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).] A primarily crepuscular species; likely under-recorded in the present study.
	Tramea transmarina euryale (Selys, 1878)	LC	**Not recorded. Vagrant.** ["Vagrant" (Wilson, 1997a); "Rare" (Wilson, 2004a); "Occasional records" (Tam et al., 2011); "Vagrant" (Leung & Tam, 2016).] Known in Hong Kong from a single individual vouchered at Pui O in 1991 (Wilson, 1995a) and a record from Tai Po Kau more than 20 years later (Tam et al., 2011).
	Tramea virginia (Rambur, 1842)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a); "Abundant, widespread" (Tam et al., 2011).]
	Trithemis aurora (Burmeister, 1839)	LC	**Very widespread.** ["Common and widespread" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Abundant, widespread/found all over Hong Kong" (Wilson, 2004a; Tam et al., 2011).]
	Trithemis festiva (Rambur, 1842)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Abundant" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Trithemis pallidinervis (Kirby, 1889)	LC	**Sparse.** ["Uncommon" (Wilson, 2004a; Tam et al., 2011).] First reported from Hong Kong at Kam Tin in 2003 (Wilson, 2004a), although a photographic record of this species was made by Kwok Hon Kai at Kau Sai Chau in the late 1990s (Kwok, pers. comm.). Recorded at the Wetland Park, Tin Shui Wai, in the present study.

Family	*Species/taxon*	Red List*	Distribution and remarks
	Urothemis signata signata (Rambur, 1842)	LC	**Scattered.** ["Rare" (Wilson, 1997a); "Common, mainly in New Territories" (Wilson, 2004a; Tam et al., 2011).] First recorded in Hong Kong (as *Urothemis signata yiei* (?)) at Tan Shan River ("River Jhelum") in 1995 (Wilson, 1995a).
	Zygonyx asahinai Matsuki & Saito, 1995	LC	**Scattered.** ["Rare" (Wilson, 1995a (as *Zygonyx* sp.)); "Rare" (Wilson, 1997a); "Uncommon" (Wilson, 2004a; Tam et al., 2011); "Global Concern" (Fellowes et al., 2002).]
	Zygonyx iris insignis (Kirby, 1900)	LC	**Widespread.** ["Common and widespread" (Wilson, 1995a); "Common" (Wilson, 1997a); "Abundant, widespread" (Wilson, 2004a; Tam et al., 2011).]
	Zyxomma petiolatum Rambur, 1842	LC	**Scattered.** ["Fairly common and widespread" (Wilson, 1995a); "Fairly common" (Wilson, 1997a); "Common, widespread" (Wilson, 2004a; Tam et al., 2011).] A predominantly crepuscular species; likely under-recorded in the present study.

* IUCN (2019). LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, DD = Data Deficient, NA = Not Assessed.

as to their abundance and distribution. For the 2000s, this approach was formalised in Wilson (2004a) and Tam et al. (2011) as follows: "Rare" = found at one or two sites only, "Uncommon" = found at 3-10 sites, "Common" = found at 11-100 sites and "Abundant" = found at more than 100 sites (out of a total of 207 surveyed sites, 2002-2004) (Tam et al, 2008, 2011). These definitions, whilst undoubtedly precise for rare and uncommon species, are somewhat cruder at the lower resolutions: for example, a species occurring at 11 sites is accorded the same status ("Common") as one occurring at 9x that number of sites (albeit within the same order of magnitude of number of sites).

For the present study, distribution of dragonfly species across the 33 sites surveyed over the period 2016-2017 was characterised as follows: Ubiquitous (recorded in >90% (n = 30+) of sites) (0 species); Very widespread (recorded in 60-90% (n = 20-29) of sites) (7 species); Widespread (recorded in 30-60% (n = 10-19) of sites) (22 species); Scattered (recorded in 10-30% (n = 4-9) of sites) (40 species); Sparse (recorded in <10% (n = 1-3) of sites) (32 species). The data from surveys conducted by Reels (the principal researcher; totally 92 surveys conducted April to July 2016 and May to June 2017) were occasionally augmented with species records made by private individuals during the survey period (taken as the calendar years 2016 and 2017), where those particular species were not observed by the principal researcher. Ne-

vertheless, some 27 taxa on the check list were not recorded during the study, including the 14 that are presumed locally extinct, vagrants, or of uncertain status, and two confirmed species, *Stylurus clathratus* and *Indothemis carnatica*, that were not known from Hong Kong until after 2017 (Wilson, 2019; AFCD, 2019a).

Species of conservation interest recorded from Hong Kong

Twenty-eight species identified here as being of Hong Kong conservation interest are listed in Table 3 and discussed below. They are also evaluated in Table 4. Due mainly to changes in the known distributions of most species, only 19 of the 32 species of Hong Kong conservation interest identified by Wilson (1997a) are retained in Table 3, while 11 other species have been added. As noted by Reels (2018), "The vast majority (23) are forest species, several of which (*Rhipidolestes janetae*, *Calicnemia sinensis*, *Drepanosticta hongkongensis*, *Protosticta beaumonti*, *P. taipokauensis* and *Sinosticta ogatai*) are stenotopic. Two species – *Mortonagrion hirosei* (also stenotopic) and *Orthetrum poecilops* – are associated with mangroves and salt marshes, and four (*Lestes nodalis*, *Aciagrion approximans*, *Agriocnemis lacteola* and *Onychargia atrocyana*) with freshwater marshes. The unusual libellulid *Onychothemis testacea* is a lowland river species. Twenty species on the Hong Kong list are currently known only from southeastern China; four have been placed under threat categories on the IUCN Red List of Endangered Species. Seven species are considered to fall within the "priority species" categories defined by the IUCN Odonata Specialist Group (Moore 1997). Nine species originally described from Hong Kong are considered as being of conservation interest. Three other species are quite widely distributed in East Asia but have highly restricted distributions in Hong Kong."

Species endemic to Hong Kong

Wilson (1997a) recognised seven endemic Hong Kong species (*Rhipidolestes janetae*, *Drepanosticta hongkongensis* Wilson, 1997, *Sinosticta ogatai* (Matsuki & Saito, 1996), "*Lamelligomphus hongkongensis* Wilson, 1995", "*Melligomphus moluami* Wilson, 1995", *Macromia katae* Wilson, 1993 and *Macromidia ellenae* Wilson, 1996) and one endemic subspecies (*Leptogomphus elegans hongkongensis* Lieftinck, 1948) from Hong Kong. "*Lamelligomphus hongkongensis*" was subsequently determined by Wilson & Reels (2001) to be conspecific with *L. hainanensis* (Chao, 1954), known from Hainan and, later, Guangdong (Wilson & Xu 2009). "*Melligomphus moluami*" was subsequently combined with *Ophiogomphus guangdongensis* Chao, 1994, from Guangdong, under *Melligomphus guangdongensis* (Chao, 1994) comb. nov. (Wilson & Xu 2009). The other five species formerly considered endemic to Hong Kong have since been recorded elsewhere in southeastern China (details in Table 2) or further afield. No species is here considered endemic to Hong Kong territory, although *Sinosticta ogatai* may be considered near-endemic as the only known extra-Hong Kong population is at Wutongshan in southern Guangdong, immediately abutting the Hong Kong border (Reels 2001; Wilson 2004a, 2004b).

The subspecies *Leptogomphus elegans hongkongensis* was raised to full species status (*Leptogomphus hongkongensis* Asahina, 1988 stat. nov.) by Wilson & Xu (2009). It

has not been recorded from elsewhere in southeastern China but has twice been reported from Laos (Yokoi 2001; Yokoi & Kano 2002).

Species of "Global Concern" (Fellowes et al., 2002)

Fellowes et al. (2002) listed 15 Hong Kong dragonfly taxa as being of "Global Concern", i.e., species for which further habitat loss or damage in Hong Kong may have implications for their global survival prospects. These included five of the taxa listed as endemic by Wilson (1997a) and ten others thought at the time to have highly restricted global distributions and globally important Hong Kong populations. In most cases the known ranges of these species have been expanded in the past 15 years and the Hong Kong populations, although still important, have accordingly diminished in global significance to some extent. One notable exception is *Sinosticta ogatai*, still known only from scattered populations in Hong Kong and from Wutongshan, just across the border in Guangdong. The "*Sieboldius* sp." of Fellowes et al. (2002) was presumably either *S. alexanderi* Chao, 1955 or *S. deflexus* (Chao, 1955), both of which have subsequently been added to the Hong Kong list (Table 2) and both of which are quite widely distributed in southeastern China (Wilson & Xu 2009).

IUCN Red List species

All but 12 of the 126 named species listed in Table 2 have within the past decade been assessed (or reassessed) for Red Listing by IUCN working groups (e.g. Mitra et al. 2010, Reels et al. 2012). This is in sharp contrast to the situation in 1997, when only two Hong Kong species (*Mortonagrion hirosei* and *Macromia urania*) had been assessed. Of the 114 assessed species, 107 are listed as Least Concern. One species, *Mortonagrion hirosei*, is Near Threatened; two are Vulnerable (*Macromia katae* and *Orthetrum poecilops*), and *Gomphidia kelloggi* is Endangered. *Cephalaeschna klotsae* Asahina, 1982, *Ophiogomphus sinicus* (Chao, 1954) and *Sieboldius alexanderi* are considered Data Deficient.

Among the 14 taxa yet to be formally assessed for Red Listing, four (*Euphaea opaca* Selys, 1853, *Ischnura asiatica* (Brauer, 1865), *Ischnura* sp. (*rufostigma* Selys, 1876 - group) and *Paracercion hieroglyphicum* (Brauer, 1865) are species that have not been recorded in Hong Kong in recent times. The remaining ten are *Planaeschna skiaperipola* Wilson & Xu, 2008, *Melligomphus guangdongensis*, *Idionyx victor* Hämäläinen, 1991, *Macromidia ellenae* (currently thought to be restricted to southeastern China); *Gynacantha japonica* Bartenef, 1909, *G. ryukyuensis* Asahina, 1962, *Asiagomphus hainanensis* (Chao, 1953), *Leptogomphus hongkongensis*, *Stylurus kreyenbergi* Ris, 1928 (known from beyond southeastern China); and *Anotogaster* sp. cf *klossi*, the status of which is unresolved.

IUCN priority species

The IUCN Odonata Specialist Group (Moore 1997) identified three categories (beside Red Listing) of priority species for conservation: taxonomically isolated species, species in monotypic genera confined to a single country, and species with unusual biology.

The taxonomically isolated species identified by Moore (1997) included three species on the Hong Kong list: *Philoganga vetusta*, *Rhipidolestes janetae* and *Onychothemis testacea* Laidlaw, 1902. Two others, *Onychargia atrocyana* Selys, 1865 and *Sinosticta ogatai*, are proposed here. The small Oriental genus *Onychargia* was recently placed, with *Paracnemis* (an endemic monotypic Madagascan genus (Dijkstra & Clausnitzer, 2004)), in a newly erected subfamily, Onychargiinae, within Platycnemididae, based on molecular analyses (Dijkstra et al., 2014). The subfamily Sinostictinae, erected by Wilson (1997c) to receive a single genus, *Sinosticta*, was strongly confirmed as the sister group of all other Platystictidae by Dijkstra et al. (2014). The genus *Sinosticta* now contains four named species, all restricted to southeastern China.

Mortonagrion hirosei was listed by Moore (1997) as a species with unusual biology, on the basis of its ability to breed in salt water. Wilson (2004b) proposed that *Orthetrum poecilops* should be listed for the same reason.

Species globally restricted to southeastern China

Several Hong Kong species thought to be restricted to southeastern China (i.e. Hong Kong, Macau, Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Fujian, Zhejiang, Hainan) at the time of Wilson (1997a) have subsequently been discovered in Indochina. These include *Philoganga vetusta* in Laos (Yokoi 2003) and Vietnam (Do & Dang 2005), *Protosticta taipokauensis* Asahina & Dudgeon, 1987 in Laos (Sasamoto & Honda 2003), *Heliogomphus scorpio* (Ris, 1912) in Laos (Yokoi & Kano 2002) and Vietnam (Do & Dang 2005), *Labrogomphus torvus* Needham, 1931 in Laos (Yokoi 1999), *Leptogomphus hongkongensis* in Laos (Yokoi 2001; Yokoi & Kano 2002, as "*Leptogomphus elegans hongkongensis*"), *Megalogomphus sommeri* (Selys, 1854) in Laos (Yokoi 2001; Yokoi & Kano 2002) and Vietnam (Do 2011), *Stylogomphus chunliuae* Chao, 1954 in Vietnam (Do & Dang 2005), *Macromia katae* in Laos (Yokoi 2003) and *Idionyx victor* in Vietnam (Zhang 2019).

Disregarding species known in Hong Kong only from historical (i.e. pre-1980s) records, there were 10 species globally restricted to southeastern China that were found to be locally rare (either not recorded or sparsely distributed) in Hong Kong in the present study, and a further three that were not locally rare.

Species with distributions extending beyond southeastern China but highly restricted in Hong Kong

Disregarding obvious vagrants and recently recorded species for which it is premature to assess local status, three species on the Hong Kong list are widely distributed across eastern Asia but have highly restricted populations (1-3 sites) in Hong Kong: *Lestes nodalis* Selys, 1891, *Aciagrion approximans* (Selys, 1876) and *Agriocnemis lacteola* Selys, 1877 (three others, *Heliogomphus retroflexus* (Ris, 1912), *Stylurus clathratus* and *S. kreyenbergi* are only known from single records and the existence of breeding populations has yet to be established).

Table 3. Dragonfly species of conservation interest recorded from Hong Kong (revised and updated from Reels (2018) with reference to Zhang (2019).

Species	Remarks
Philoganga vetusta	Priority species (Moore, 1997): taxonomically isolated.
Lestes nodalis	Highly restricted in Hong Kong (three known sites; one unconfirmed in present study).
Rhipidolestes janetae	Priority species (Moore, 1997): taxonomically isolated. Originally described from Hong Kong. Globally restricted to southeastern China. Sparsely distributed in Hong Kong.
Aciagrion approximans	Highly restricted in Hong Kong (two known sites; one unconfirmed in present study).
Agriocnemis lacteola	Highly restricted in Hong Kong (one known site).
Mortonagrion hirosei	Near Threatened (IUCN). Priority species (Moore, 1997): unusual biology.
Calicnemia sinensis	Globally restricted to southeastern China. Sparsely distributed in Hong Kong.
Onychargia atrocyana	Priority species (Moore, 1997): taxonomically isolated.
Drepanosticta hongkongensis	Originally described from Hong Kong. Globally restricted to southeastern China.
Protosticta beaumonti	Male originally described from Hong Kong. Globally restricted to southeastern China. Sparsely distributed in Hong Kong.
Protosticta taipokauensis	Originally described from Hong Kong. Sparsely distributed in Hong Kong.
Sinosticta ogatai	Priority species (Moore, 1997): taxonomically isolated. Originally described from Hong Kong. Globally restricted to southeastern China. Near-endemic to Hong Kong. Sparsely distributed in Hong Kong.
Cephalaeschna klotsae	Data Deficient (IUCN). Highly restricted in Hong Kong (one known site). Globally restricted to southeastern China and Hubei province.
Planaeschna skiaperipola	Globally restricted to southeastern China. Highly restricted in Hong Kong (one known site).
Asiagomphus hainanensis	Globally restricted to southeastern China.
Fukienogomphus choifongae	Originally described from Hong Kong. Globally restricted to southeastern China. Highly restricted in Hong Kong (one known site).
Gomphidia kelloggi	Endangered (IUCN). Globally restricted to southeastern China. Highly restricted in Hong Kong (two known sites, contiguous).
Lamelligomphus hainanensis	Globally restricted to southeastern China.
Leptogomphus hongkongensis	Originally described from Hong Kong. Not recorded from elsewhere in China. Known from one locality in Laos.
Melligomphus guangdongensis	Globally restricted to southeastern China. Sparsely distributed in Hong Kong.
Ophiogomphus sinicus	Data Deficient (IUCN). Globally restricted to southeastern China. Sparsely distributed in Hong Kong.
Sieboldius alexanderi	Data Deficient (IUCN). Globally restricted to southeastern China and Hubei province.

Species	Remarks
Anotogaster sp. cf *klossi*	Breeding confirmed at one site.
Macromia katae	Vulnerable (IUCN). Originally described from Hong Kong.
Idionyx claudia	Globally restricted to southeastern China and Yunnan province. Highly restricted in Hong Kong (one known site).
Macromidia ellenae	Originally described from Hong Kong. Globally restricted to southeastern China. Sparsely distributed in Hong Kong.
Onychothemis testacea	Priority species (Moore, 1997): taxonomically isolated. Sparsely distributed in Hong Kong.
Orthetrum poecilops	Vulnerable (IUCN). Priority species (Moore, 1997): unusual biology.

Changes in local status of Hong Kong species

"Declining" populations

Six species considered "very common" or "abundant" by Wilson (1997a, 2004a) and/or Tam et al. (2011) were found to have scattered distributions in the present study. Similarly, 13 species considered "common" in one or more of the above-cited publications were sparsely recorded in this survey. Are these outcomes strong evidence of a significant change in the overall Hong Kong status of the 19 species involved? Probably not. There is a problem of comparability. The present study data are derived from far fewer field surveys, at far fewer sites, than those upon which Wilson (1997a, 2004a) and Tam et al. (2011) were able to draw when determining species' status, and in many cases this apparent distributional decline can be ascribed to some extent to lower sampling effort in the present study, in which failure to record a species at a site does not necessarily prove that the species is absent. It is also worth noting that under the status criteria adopted by Wilson (2004a) and Tam et al. (2011), a species that occurred in as few as 11 out of 207 surveyed sites would, somewhat counter-intuitively, be described as "common". The 19 apparently "declining" species are discussed below.

In the case of the diminutive damselflies *Agriocnemis femina* Lieftinck, 1962 and *A. pygmaea* (Rambur, 1842), their tiny size makes them quite easily overlooked. For the forest-associated *Agriomorpha fusca*, *Calicnemia sinensis* Lieftinck, 1984, *Protosticta taipokauensis* and *Stylogomphus chunliuae* it is premature to interpret their apparent decline in abundance as indicative of a real one, particularly given the fact that the habitat in which they are found (upland secondary woodland) is maturing and expanding in Hong Kong. On many occasions dragonflies were observed too fleetingly or too far away during field surveys to enable a positive identification owing to possible confusion with similar species. *Anax guttatus* (Burmeister, 1839), *Gynacantha japonica*, *Melligomphus guangdongensis* and *Ophiogomphus sinicus* could all have been under-recorded for this reason. *Ischnura* senegalensis (Rambur, 1842), *Brachythemis contaminata* (Fabricius, 1793) and *Crocothemis servilia* (Drury, 1770) are all abundant at farmed fish ponds in the northwest New Territories

but this habitat was barely examined in the present study. *Anaciaeschna jaspidea* (Burmeister, 1839) is a crepuscular species that might have been encountered more frequently at pond and marsh sites if more late afternoon/early evening surveys had been conducted. *Anax immaculifrons* Rambur, 1842 is one of a number of species that were observed on several occasions at locations on route to or from, but not actually in, a study site, and it is undoubtedly therefore under-recorded in Table 2. *Diplacodes trivialis* (Rambur, 1842) is abundant in late summer and autumn but much less so in April-July when surveys were undertaken in the present study.

It may be argued, therefore that there are just three species in which an apparent decline might possibly be an accurate reflection of the real situation: *Paracercion calamorum* (Fraser, 1919), *Nannophya pygmaea* Rambur, 1842 and *Palpopleura sexmaculata* (Fabricius, 1787). Weedy ponds and marshy abandoned paddies represent important habitats for these three species, particularly *N. pygmaea* and *P. sexmaculata*, and there are fewer sites for these habitats in Hong Kong today than there were 20 years ago.

Expanding populations

It is notable that populations of the two conservation-interest salt-tolerant species, *Mortonagrion hirosei* and *Orthetrum poecilops*, have apparently proliferated in Hong Kong in the past two decades. Wilson (1997a) reported four known localities (Mai Po marshes, Che Ha, Luk Keng and Nam Chung) for *M. hirosei* and two (Shuen Wan and Nam Chung) for *O. poecilops*. Fourteen years later, however, Stanton & Allcock (2011) were able to list 11 coastal sites in Hong Kong at which M. hirosei had been recorded, to which a 12th (Kuk Po) was added in the present study, while *O. poecilops* was recorded at five study sites (and seen at Fung Hang and one other location at Starling Inlet) in this survey.

Five pond/marsh species have been added to the Hong Kong list since 1997, including the damselfly *Aciagrion approximans* in 2000 (now known from two sites), *Anax nigrofasciatus* Oguma, 1915 and *A. indicus* Lieftinck, 1942 (first recorded in 2003 and 2010 respectively), and the migratory libellulid *Trithemis pallidinervis* (Kirby, 1889) in 2003. The pond libellulid *Aethriamanta brevipennis* (Rambur, 1842), first recorded at Hong Kong Wetland Park in 2008 (Tam et al. 2008), has since spread widely in the northern New Territories. It was recorded at seven study sites and at one other location in the present study. Another pond/marsh species that has apparently expanded its range in Hong Kong is *Rhyothemis triangularis* Kirby, 1889, known from only four locations 20 years ago (Wilson 1997a) but recorded at eight sites in the northern New Territories in the present study.

Several forest-associated odonate species have been recorded for the first time in Hong Kong since the publication of Wilson (1997a). These include *Cephalaeschna klotsae*, *Gynacantha ryukyuensis, Planaeschna skiaperipola, Fukienogomphus choifongae* Wilson & Tam, 2006, *Heliogomphus retroflexus* and *Sieboldius alexanderi*. The latter species, in particular, has rapidly expanded its known range in Hong Kong and was recorded at Wu Kau Tang, Sha Lo Tung, Tai Po Kau and Hok Tau in the present study (in addition to being observed in Pat Sin Leng Country Park, near to Pat Sin

Leng Site 1). Wilson (2014) argued that these new arrivals were representative of an ongoing colonisation (or recolonisation) of forested areas in Hong Kong by strong-flying dragonfly species that were probably present before the progressive deforestation of the territory which started with human settlement and probably reached its peak in the mid-20th century. Wilson (2014) cited the recent (post-1990) first Hong Kong records of 16 other forest-associated anisopterans as evidence for this trend, which continues to the present day.

In addition, photographic records have been made of eight other previously unrecorded dragonflies in Hong Kong in the past decade or so. These include *Stylurus kreyenbergi* (photographed in 2008 on a boat near Sai Kung by Samson So (pers. comm.), probable *Rhyothemis fuliginosa* Selys, 1883 and *Sympetrum darwinianum* (Selys, 1883) in the northern New Territories in 2014 (Ng 2014a, 2014b), probable *Sympetrum fonscolombii* (Selys, 1840) at Ha Pak Nai (Au, 2017) and Po Toi (Wong, 2017) in early October 2017 and, most recently, *Stylurus clathratus* at Tai O in June 2018 (Wilson, 2019), *Polycanthagyna ornithocephala*, in Tai Po Kau in August 2018 (Ken So, pers. comm.), *Orthetrum albistylum* (Selys, 1848) at Hong Kong Wetland Park in 2018 (AFCD 2019b) and *Indothemis carnatica* at various locations in 2018-2019 (AFCD, 2019a). *Sympetrum fonscolombii* is particularly interesting as this species, although a strong migrant (Dijkstra & Lewington 2006), was until recently not known from further east than South and Central Asia (Clausnitzer 2013). The species has however been recorded in Japan and Taiwan in recent years (Ozono et al. 2012; Lin 2016).

Species conservation value assessment metric

Wilson & Reels (1999) proposed a metric for using dragonflies in wetland evaluation in tropical southern China. This was subsequently used by Reels (2013) to compare a range of sites across southeastern China. The metric assigns an aggregate value to each dragonfly species on the basis of a number of point-scoring categories (these can then be tallied up species by species to give an aggregate score for a particular site). A modified version of the metric is adopted in the present study, as outlined below, to make it appropriate to the Hong Kong context (Fig. 3).

"Southeast China", for the purpose of the present study, refers to the Hong Kong and Macau Special Administrative Regions and the provinces of Guizhou, Hunan, Jiangxi, Zhejiang, Guangxi, Guangdong, Fujian and Hainan. Species that are presumed extinct, vagrant or of uncertain status in Hong Kong are excluded. Low weighting is given to category (v) because an apparent local population decline may not be real, for two reasons: (1) local population status is not comparably defined (i.e. Wilson 1995a, 1997a, 2004a and Tam et al. 2011 vs present study) and (2) species' status from the present study is based on a much smaller sampling effort than that reflected in Wilson (1995a, 1997a, 2004a) and Tam et al. (2011), so may be an underestimate.

This approach, when applied to the species of conservation interest listed in Table 3, results in the species ranking given in Table 4. [See Appendix 2 for details of all species].

It is notable that, with the exception of *Agriomorpha fusca* (13 points), no other Hong Kong species scores higher than 10 points on the metric (Appendix 2).

Figure 3. Basics of the Metric ranking of Hong Kong dragonfly species by conservation value.

Scoring allocation for each species	
(i) Percentage of world range in southeast China	**Score**
Estimated ≥50% of world range in southeast China	**10**
Endemic to southeast China	**20**
Estimated ≥50% of known world range in Hong Kong	**30**
(ii) IUCN Red Listing	
Data Deficient	**5**
Near Threatened	**5**
Vulnerable	**10**
Endangered	**20**
(iii) Localisation - 3 or fewer Hong Kong sites with known breeding populations	
3 sites	**10**
2 sites	**15**
1 site	**25**
(iv) Priority species (Moore, 1997)	
Taxonomically isolated species	**15**
Species in monotypic genus restricted to one country	**15**
Species with unusual biology	**15**
(v) Apparent population decline trends in Hong Kong, 1997 to 2017	
Abundant/very common (1995-2011) >>> Scattered (present study)	**3**
Common/widespread (1995-2011) >>> Sparse (present study)	**5**
(vi) Species richness	
Any species not falling under (i) to (v)	**1**

Concluding remarks

Dragonfly species in Hong Kong have continued to proliferate since the mid-1990s, when Keith Wilson published the results of the first comprehensive study of the local fauna. Much of the increased species-richness of the territory has been attributed to ongoing recolonisation by strong-flying forest-associated anisopterans as secondary woodland cover has expanded and matured in recent decades. However, several

Table 4. Metric ranking of Hong Kong dragonfly species by conservation value.

Rank	Species	Score
1=	*Rhipidolestes janetae* *Fukienogomphus choifongae* *Gomphidia kelloggi*	55
4=	*Sinosticta ogatai* *Planaeschna skiaperipola*	45
6	*Cephalaeschna klotsae*	40
7=	*Idionyx claudia* *Orthetrum poecilops*	35
9=	*Leptogomphus hongkongensis* *Ophiogomphus sinicus* *Macromia katae*	30
12=	*Philoganga vetusta* *Aciagrion approximans* *Agriocnemis lacteola* *Calicnemia sinensis*	25
16=	*Melligomphus guangdongensis* *Anotogaster sp. cf klossi*	25
18=	*Mortonagrion hirosei* *Drepanosticta hongkongensis* *Protosticta beaumonti* *Asiagomphus hainanensis* *Lamelligomphus hainanensis* *Macromidia ellenae*	20
24=	*Lestes nodalis* *Onychargia atrocyana* *Protosticta taipokauensis* *Sieboldius alexanderi* *Onychothemis testacea*	15

lentic open-water libellulids have also been reported for the first time in the past ten years. Relatively few established Hong Kong species appear to have declined in abundance or distribution in the last two decades; those that have are mainly associated with small, shallow weedy ponds – a habitat that is increasingly scarce in Hong Kong. A large number of Hong Kong species are apparently more widely distributed across the territory now than they were 20 years ago. The number of dragonfly species considered endemic to Hong Kong has however dropped from eight to zero; this due largely to the greatly increased interest in studying dragonflies across southeastern China. Nevertheless, Hong Kong's odonate fauna contains many species of regional and even global conservation significance. The assessment of locally occurring species using a conservation importance metric such as the one adopted for this study can give an objective indication as to which species should be prioritised in conservation efforts. The importance of particular sites can also be objectively assessed by summing the metric scores of all species occurring at a site. This will be the subject of a future paper.

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References

AFCD 2019a. New Dragonfly Record to Hong Kong: *Indothemis carnatica* (Fabricius, 1798). https://www.afcd.gov.hk/english/conservation/hkbiodiversity/news/201804-11.html?fbclid=IwAR1xdQnKFqyt5ZOblncnDjPs-OUn2AmFy546f06Uuo7VxyFoE0-77QzH_ELw

AFCD 2019b. Hong Kong's first *Orthetrum albistylum* (Selys, 1848) recorded by dragonfly working group. https://www.afcd.gov.hk/english/conservation/hkbiodiversity/news/20181008.html. 21/08/2019.

Asahina, S. 1965. The Odonata of Hong Kong. Kontyu Tokyo 33: 493-506.

Asahina, S. 1972. *Mortonagrion hirosei*. The last new dragonfly species from Japan? Kontyu 40(1): 11-16.

Asahina, S. 1987. A revised list of the Odonata of Hong Kong, Part I Zygoptera. Tombo 30(1-4): 7-24.

Asahina, S. 1988. A revised list of the Odonata of Hong Kong, Part II Anisoptera. Kontyu Tokyo 56(4): 689-705.

Asahina, S. 1992. *Mortonagrion hirosei* discovered from Hong Kong. Tombo 35: 10.

Asahina, S. & Dudgeon, D. 1987. A new platystictid damselfly from Hong Kong. Tombo 30(1-4): 2-6.

Au, M. 2017. [*Sympetrum fonscolombii* image]. https://www.facebook.com/photo.-php?fbid=10155961515719653&set=p.10155961515719653&type=3&theater&ifg=1

Brauer, F. 1865. Neuropteren. Ordo Orthoptera. Familia Odonata. Novara-Expedition. Zoologischer Theil. Band II. pp: 52-105, 2 plates.

Clausnitzer, V. 2013. *Sympetrum fonscolombii*. The IUCN Red List of Threatened Species 2013: e.T60038A17538409. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T600-38A17538409.en. Downloaded on 11 October 2017.

Dijkstra, K-D.B., Bechly, G., Bybee, S.M., Dow, R.A., Dumont, H.J., Fleck, G., Garrison, R.W., Hämäläinen, M., Kalkman, V.J., Karube, H., May, M.L., Orr, A.G., Paulson, D.R., Rehn, A.C., Theischinger, G., Trueman, J.W.H., van Tol, J., von Ellenrieder, N. & Ware, J. 2013. The classification and diversity of dragonflies and damselflies (Odonata). Zootaxa 3703(1): 36-45.

Dijkstra, K-D.B. & Clausnitzer, V. 2004. Critical species of Odonata in Madagascar. International Journal of Odonatology 7(2): 219-228.

Dijkstra, K-D.B., Kalkman, V.J., Dow, R.A., Stokvis, F.R. & van Tol, J. 2014. Redefining the damselfly families: a comprehensive molecular phylogeny of Zygoptera (Odonata). Systematic Entomology 39(1): 68-96.

Dijkstra, K-D.B. & Lewington, R. 2006. Field Guide to the Dragonflies of Britain and Europe. British Wildlife Publishing, Gillingham, UK: 320pp.

Do, M.C. 2011. Notes on three species of gomphid dragonflies from Vietnam (Odonata: Gomphidae). International Dragonfly Fund - Report 36: 1-9.

Do, M.C. & Dang, T.T.H. 2005. Checklist of Dragonfly from Vietnam. Vietnam National University Publisher, Hanoi. Vietnam: 181pp.

Fellowes, J.R., Lau, M. W-n., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P-l., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. & Yu, Y.T. 2002. Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. Memoirs of the Hong Kong Natural History Society 25: 123-160.

Green Power (2009). Sha Lo Tung Dragonfly Ecological Survey. http://www.green-power.org.hk/html5/eng/job_dragonfly_01.shtml

Hämäläinen, M. 1991. *Idionyx victor* spec. nov. (Anisoptera: Corduliidae) and some other Odonata from Hongkong. Odonatologica 20: 343-347.

Hämäläinen, M. 2008. Philogangidae versus Diphlebiidae - nomenclatoric note on a family-group name. Notulae Odonatologicae 7(1): 12.

IUCN Red List of Threatened Species (2019). http://www.iucnredlist.org

Kosterin, O.E., Constant, J. & Wilson, K.D.P. 2014. Neotype of *Pseudagrion approximans* Selys, 1876 designated to resolve a nomenclatorial confusion in the genus *Aciagrion* Selys, 1891 (Odonata: Coenagrionidae). International Journal of Odonatology 17(2-3): 161-172.

Lai, Y-L. 1971. An introduction to the Odonata of Hong Kong. New Asian College Academic Annual 13: 1-48.

Leung, K.K.K., Hui, W.L. & Fung, T.H. 2016. New Dragonfly Species for Hong Kong - *Gynacantha* ryukyuensis Asahina, 1962. Hong Kong Biodiversity 24: 14-16.

Leung, K.K.K. & Tam, T.W. 2016. Changes/Updates to the Dragonfly Checklist in Hong Kong. Hong Kong Biodiversity 24: 16-17.

Lin, S. 2016. An Illustrated Identification Guide to the Odonata of Taiwan. Endemic Species Research Institute - Ecology Education Park: 279pp.

Matsuki, K. & Saito, Y. 1996. A new species of *Drepanosticta* from Hong Kong (Odonata: Platystictidae). Nature and Insects 31(3): 39-43.

Matsuki, K., Yamamoto, T. & Ichii, H. 1990. On a small collection of Odonata of Hong Kong. Gekkan-Mushi 235: 12-18.

Mitra, A., Dow, R., Subramanian, K.A. & Sharma, G. 2010. The status and distribution of dragonflies and damselflies (Odonata) of the Eastern Himalaya. In: Allen, D.J., S. Molur & B.A. Daniel (Compilers). The Status and Distribution of Freshwater Biodiversity in the Eastern Himalaya. Cambridge, UK and Gland, Switzerland: IUCN, and Coimbatore, India: Zoo Outreach Organisation: pp. 54-66.

Moore, N.W. 1997. Dragonflies - Status Survey and Conservation Action Plan. Gland, Switzerland and Cambridge, UK, IUCN/SSC Odonata Specialist Group, IUCN: 28 pp.

Nakao, S-i., Asahina, S., Miura, T., Wongsiri, T., Panagga, A., Lee, L.H.Y. & Yano, K. 1976. The Paddyfield Odonata collected in Thailand, the Philippines and Hong Kong. Kurume University Journal 25: 145-158.

Ng, B. 2014a. *Rhyothemis fuliginosa* [photo]. www.flickr.com/photos/m6n66/15-589058555/in/photostream/

Ng, B. 2014b. *Sympetrum darwinianum* [photo]. www.flickr.com/photos/m6n66/-16023552661/in/photostream/

Ozono, A., Kawashima, I., & Futahashi, R. 2012. Dragonflies of Japan. Bunichi-Sogo Syuppan, Tokyo Google Scholar: 532pp.

Reels, G.T. 1994. Management Strategies for the Reed *Phragmites australis* (Cav.) Steud. at Mai Po Marshes Nature Reserve, Hong Kong, with Observations on the Associated Insect Fauna. M. Phil. thesis, Department of Zoology, University of Hong Kong, Hong Kong: 156 pp.

Reels, G.T. 2001. Two Hong Kong "endemics" sunk at Wutongshan. Porcupine! 23: 5.

Reels, G.T. 2010. Seasonal emergence of dragonflies (Odonata: Anisoptera) at ten ponds in Hong Kong. Hong Kong Entomological Bulletin 2(1): 24-31.

Reels, G.T. 2011. Emergence patterns and adult flight season of Anisoptera at a managed wetland site in Hong Kong, southern China. International Journal of Odonatology 14(1): 33-48.

Reels, G.T. 2013. Assessment of Dragonflies (Odonata). In: Biodiversity and Conservation of Hainan Yinggeling Nature Reserve. Kadoorie Conservation China and Hainan Wildlife Conservation Bureau (614 pp): pp. 373-393.

Reels, G. 2018. Hong Kong dragonflies of conservation importance. Agrion 22(2): 72-75.

Reels, G.T., Dow, R., Hämäläinen, M. & Do, M.C. 2012. The status and distribution of dragonflies and damselflies (Odonata) in Indo-Burma. In: Allen, D.J., Smith, K.G. & Darwell, W.R.T. (Compilers). The Status and Distribution of Freshwater Biodiversity in Indo-Burma. Cambridge, UK and Gland, Switzerland: IUCN: pp. 90-101.

Reels, G.T. & Zhang, H. 2015. A Field Guide to the Dragonflies of Hainan. China Forestry Publishing House, Beijing: 465 pp.

Saito, Y. & Ogata, S. 1995. Records of Hong Kong dragonflies, collected from June 1994 to October 1995. Bohso no Konchu 15: 25-47.

Sasamoto, A. & Honda, T. 2003. Collecting records of Odonata in the Laos in the spring of 2002. Aohada 2: 1-21.

Seehausen, M. 2014. New to the fauna of Hong Kong: *Matrona basilaris* Selys, 1853 (Odonata: Calopterygidae). International Dragonfly Fund - Report 65: 3-5.

So, S. 2008. Hong Kong first record *Stylurus kreyenbergi*. www.flickr.com/photos/-35761902@N00/sets/72157606708887373view=sq/with/2759819949

Stanton, D.J. & Allcock, J.A. 2011. Habitat characteristics and odonate communities at selected sites used by *Mortonagrion hirosei* Asahina (Zygoptera: Coenagrionidae) in Hong Kong. Journal of Threatened Taxa 3(12): 2242-2252.

Tam, T-w., Kwan, B.S.P., Wu, K.K.Y., Wong, B.S.F., Tang, S.S.H., Fung, C.H.L., Wong, W.S.Y., Wong, J.K., Fong, S.W.L. & Lei, A.H.C. 2008. Current Status of Dragonflies (Odonata) and their Representation in Protected Areas in Hong Kong. Hong Kong Biodiversity 16: 1-7.

Tam, T-w., Leung, K-k., Kwan, B.S.P., Wu, K.K.Y., Tang, S.S.H., So, I.W.Y., Cheng, J.C.Y., Yuen, E.F.M., Tsang, Y-m. & Hui, W-l. 2011. The Dragonflies of Hong Kong. Friends of the Country Parks, Cosmos Books Ltd: 368 pp.

Tong, X. 2013. *Fukienogomphus choifongae*. The IUCN Red List of Threatened Species 2013: e.T167173A1172025. http://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.-T167173A1172025.en. Downloaded on 22 September 2017.

Wilson, K.D.P. 1993. Notes on *Macromia* from Hong Kong, with a description of *M. katae* spec. nov. (Anisoptera: Corduliidae). Odonatologica 22(2): 233-241.

Wilson, K.D.P. 1995a. Hong Kong Dragonflies. Urban Council, Hong Kong. 211 pp.

Wilson, K.D.P. 1995b. The Gomphid dragonflies of Hong Kong, with descriptions of two new species (Anisoptera: Gomphidae). Odonatologica 24(3): 319-340.

Wilson, K.D.P. 1996. The Idionychinae (Anisoptera: Corduliidae) from Hong Kong with a description of *Macromidia ellenae* spec. nov. Odonatologica 25(4): 355-366.

Wilson, K.D.P. 1997a. An annotated checklist of Hong Kong dragonflies with recommendations for their conservation. Memoirs of the Hong Kong Natural History Society 21: 1-68.

Wilson, K.D.P. 1997b. *Rhipidolestes* from Guangdong and Hong Kong with a description of a new species (Zygoptera: Megapodagrionidae). Odonatologica 26(3): 329-335.

Wilson, K.D.P. 1997c. The Platystictidae of Hong Kong and Guangdong, with descriptions of a new genus and two new species (Zygoptera). Odonatologica 26(1): 53-63.

Wilson, K.D.P. 2004a. Field Guide to the Dragonflies of Hong Kong (2nd Edition). Friends of the Country Parks, Cosmos Books Ltd, Hong Kong: 372 pp.

Wilson, K.D.P. 2004b. Critical species of Odonata in China. International Journal of Odonatology 7(2): 409-422.

Wilson, K.D.P. 2006. New *Planaeschna* record (Odonata: Aeshnidae). Porcupine! 34: 5.

Wilson, K.D.P. 2014. Odonata recolonisation of Hong Kong's forests. Agrion 18(1): 8-20.

Wilson, K.D.P. 2019. The genus *Stylurus* and resolution of *Stylurus annulatus* (Odonata: Gomphidae) and its close allies in Asia. Agrion 23(1): 4-14.

Wilson, K.D.P. & Reels, G.T. 1999. Dragonflies as Indicators of Wetland Biodiversity in Tropical China. Conference presentation, 1999: International Congress of Odonatology and First Symposium of the Worldwide Dragonfly Association, Colgate University, July 11-16, 1999; 18pp. [Proceedings unpublished; paper available from authors]

Wilson, K.D.P. & Reels, G.T. 2001. Odonata of Hainan, China. Odonatologica 30(2): 145-208.

Wilson, K.D.P. & Reels, G.T. 2003. Odonata of Guangxi Zhuang Autonomous Region, China, Part I, Zygoptera. Odonatologica 32(3): 237-279.

Wilson, K.D.P. & Tam, T-w. 2006. *Fukienogomphus choifongae* spec. nov. from Hong Kong and a new record of *Cephalaeschna klotsi* Asahina (Anisoptera: Gomphidae, Aeshnidae). Odonatologica 35(1): 81-87.

Wilson, K.D.P. & Xu, Z. 2007. Odonata of Guangdong, Hong Kong and Macau, South China, part 1: Zygoptera. International Journal of Odonatology 10(1): 87-128.

Wilson, K.D.P. and Xu, Z. 2009. Gomphidae of Guangdong and Hong Kong, China (Odonata: Anisoptera). Zootaxa 2177: 1-62.

Wong, D. 2017. [*Sympetrum fonscolombii* image]. https://www.facebook.com/photo.php?fbid=10214829787761601&set=pcb.10155585255110977&type=3&theater&ifg=1

Yam, L.Y. 2012. *Anax indicus* Lieftinck, 1942 (Odonata: Aeshnidae, Anax) - a new record for Hong Kong. Insect News (Hong Kong Entomological Society) 4: 2-4.

Yokoi, N. 1999. Dragonflies of Central Laos in mid-summer. Malangpo 16: 146-149.

Yokoi, N. 2001. Nine species of dragonflies recorded for the first time in Laos. Tombo 43: 25-28.

Yokoi, N. 2003. A record of Odonata in central Laos. Aeschna 40: 33-35.

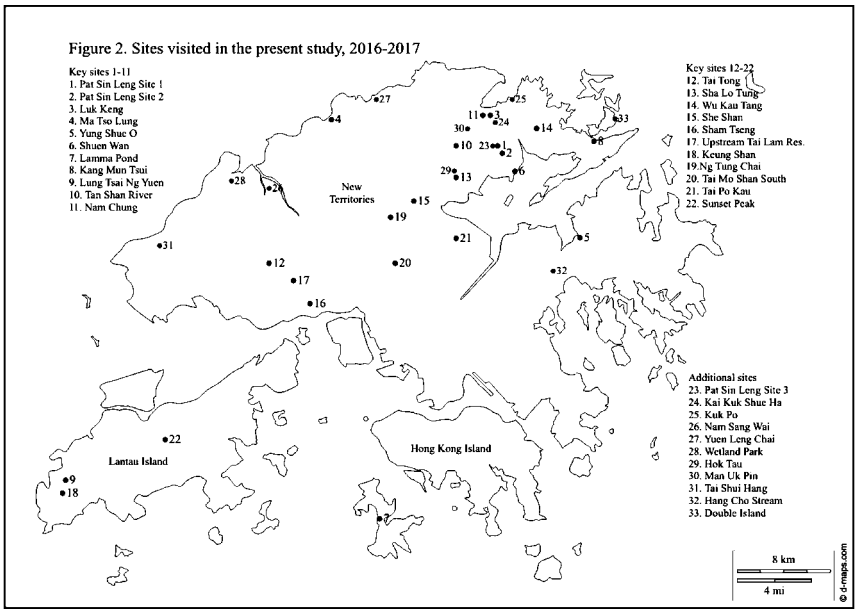
Yokoi, N. & Kano, K. 2002. Odonata collected in Lak Sao and its neighbouring regions, central Laos, in spring. Tombo 45(1/4): 23-26.

Zhang. H. 2019. Dragonflies and Damselflies of China. Chongqing University Press, Chongqing, 1460pp.

Zhou, W-b., Wang, Z-d., Shuai, X-f. & Liu, S-d. 1994. Notes on the Chinese *Macromia* and *Idionyx*, with description of *M. kiautai sp. n., M. maculata* sp. n. and *I. yunnanensis* sp. n. (Anisoptera: Corduliidae). Odonatologica 23(2): 149-157.

Appendices

Appendix: Figure 2: Map of locations studied.



Appendix 1: Sites surveyed in the present study.

Site	Primary habitat(s)	Median location	Date(s) surveyed
1. Pat Sin Leng Site 1	Freshwater marsh	N 22°29.599', E 114°13.514' 220m asl	19-04-16; 16-05-16; 08-05-17
2. Pat Sin Leng Site 2	Freshwater marsh	N 22°30.155', E 114°13.439' 245m asl	19-04-16; 16-05-16; 08-05-17
3. Luk Keng	Freshwater marsh; also salt marsh and small streams	N 22°31.088', E 114°13.098' 2m asl	17-04-16; 21-04-16; 23-05-16; 15-06-17
4. Ma Tso Lung	Freshwater marsh and ponds	N 22°31.156', E 114°05.148' 2m asl	15-06-16; 28-06-16; 22-05-17
5. Yung Shue O	Freshwater marsh; also mangrove and small streams	N 22°25.364', E 114°17.251' 5m asl	18-05-16; 01-06-16; 02-06-17
6. Shuen Wan	Freshwater marsh; ponds, mangrove and small stream	N 22°28.021', E 114°12.206' 0m asl	18-05-16; 21-06-16; 25-05-17
7. Lamma Pond	Pond	N 22°12.535', E 114°07.240' 60m asl	08-06-16
8. Kang Mun Tsui	Pond	N 22°30.066', E 114°17.448' 2m asl	20-06-16
9. Lung Tsai Ng Yuen	Pond; small stream	N 22°14.104', E 113°52.143' 220m asl	05-07-16
10. Tan Shan River ("River Jhelum")	Lowland river	N 22°30.453', E 114°10.403' 20m asl	13-06-16; 14-06-16; 23-05-17
11. Nam Chung	Shallow gradient stream; also ponds and mangrove	N 22°31.171', E 114°12.288' 1m asl	23-05-16; 12-06-17
12. Tai Tong	Shallow gradient stream	N 22°24.266', E 114°01.366' 25m asl	25-04-16; 24-06-16
13. Sha Lo Tung Basin	Shallow gradient stream; also marsh and rice paddy	N 22°28.516', E 114°11.018' 160m asl	20-04-16; 21-04-16; 12-05-16; 23-06-16; 11-05-17; 08-06-17; 26-06-17
14. Wu Kau Tang, Bride's Pool	Shallow gradient streams; also marsh	N 22°30.191', E 114°14.38' 100m asl	26-04-16; 27-04-16; 11-05-16; 26-07-16; 09-05-17; 10-05-17. 11-05-17; 28-06-17
15. She Shan	Shallow gradient stream	N 22°27.120', E 114°08.405' 22m asl	28-04-16; 21-06-16; 23-05-17
16. Sham Tseng (up stream of settlement basin)	Shallow gradient stream; also small reservoir	N 22°22.334', E 114°03.238' 110m asl	02-06-16; 07-07-16; 29-05-17
17. Upstream Tai Lam Reservoir	Rocky hill stream	N 22°23.441', E 114°02.471' 80m asl	09-05-16; 04-07-16; 26-05-17

Site	Primary habitat(s)	Median location	Date(s) surveyed
18. Keung Shan	Forested hill streams	N 22°13.432', E 113°52.062' 300m asl	05-07-16; 21-06-17
19. Ng Tung Chai	Forested hill streams and seepages	N 22°25.411', E 114°07.566' 300m asl	07-06-16; 17-05-17; 18-05-17
20. Tai Mo Shan, South	Forested hill streams and seepages	N 22°23.274', E 114°08.361' 250m asl	31-05-16; 27-06-16; 06-06-17
21. Tai Po Kau	Forested hill streams and seepages	N 22°25.358', E 114°10.457' 200m asl	03-05-16; 04-05-16; 07-06-17; 23-06-17
22. Sunset Peak	Forested hill streams and seepages	N 22°15.610', E 113°57.360' 560m asl	29-06-16; 27-06-17
23. Sheung Tsat Muk Kiu	Freshwater marsh	N 22°30.198', E 114°13.340' 250m asl	19-04-16; 16-05-16; 08-05-17
24. Kai Kuk Shue Ha	Freshwater pond and marsh	N 22°31.438', E 114°13.224' 5m asl	17-04-16; 11-05-16; 24-05-16; 25-05-17
25. Kuk Po	Freshwater marsh; also salt marsh and small streams	N 22°31.634', E 114°14.031' 2m asl	16-06-16; 22-06-17
26. Nam Sang Wai	Freshwater pond and marsh	N 22°27.417', E 114°02.042' 2m asl	01-06-17
27. Yuen Leng Chai	Freshwater pond and marsh	N 22°31.946', E 114°07.109' 5m asl	21-06-16; 29-06-17
28. Hong Kong Wetland Park	Freshwater ponds, marsh and mangrove	N 22°28.108', E 114°00.277' 1m asl	23-06-16
29. Hok Tau	Forested hill streams and seepages, also reservoir	N 22°29.142', E 114°10.967' 130m asl	20-04-16; 12-05-16; 30-05-16; 08-06-17
30. Man Uk Pin	Shallow gradient stream	N 22°31.399', E 114°10.589' 30m asl	06-05-16; 29-06-17
31. Tai Shui Hang	Shallow gradient stream	N 22°24.492', E 113°56.492' 30m asl	02-05-16; 14-05-16
32. Hang Cho Stream	Forested hill stream and seepages	N 22°23.767', E 114°16.055' 130m asl	05-06-17
33. Double Island	Salt marsh and mangrove	N 22°31.045', E 114°19.009' 0m asl	20-06-16

Appendix 2. Hong Kong dragonfly species conservation importance assessment metric*

Species	Points per category					Total score
	(i)	(ii)	(iii)	(iv)	(v)	
Philoganga vetusta	10			15		25
Mnais mneme	10					10
Euphaea decorata	10					10
Lestes nodalis			15			15
Agriomorpha fusca	10				3	13
Rhipidolestes janetae	30		10	15		55
Aciagrion approximans			25			25
Agriocnemis femina					3	3
Agriocnemis lacteola			25			25
Agriocnemis pygmaea					5	5
Ischnura senegalensis					3	3
Mortonagrion hirosei		5		15		20
Paracercion calamorum					5	5
Calicnemia sinensis	20				5	25
Onychargia atrocyana				15		15
Coeliccia cyanomelas	10					10
Prodasineura croconota	10					10
Drepanosticta hongkongensis	20					20
Protosticta beaumonti	20					20
Protosticta taipokauensis	10				5	15
Sinosticta ogatai	30			15		45
Anaciaeschna jaspidea					5	5
Anax guttatus					3	3
Anax immaculifrons					5	5
Cephalaeschna klotsae	10	5	25			40
Gynacantha japonica					5	5
Planaeschna skiaperipola	20		25			45

Species	Points per category					Total score
	(i)	(ii)	(iii)	(iv)	(v)	
Anisogomphus koxingai	10					10
Asiagomphus hainanensis	20					20
Burmagomphus vermicularis	10					10
Fukienogomphus choifongae	30		25			55
Gomphidia kelloggi	20	20	15			55
Heliogomphus retroflexus	10					10
Heliogomphus scorpio	10					10
Labrogomphus torvus	10					10
Lamelligomphus hainanensis	20					20
Leptogomphus hongkongensis	30					30
Megalogomphus sommeri	10					10
Melligomphus guangdongensis	20				5	25
Ophiogomphus sinicus	20	5			5	30
Sieboldius alexanderi	10	5				15
Stylogomphus chunliuae	10				5	15
Stylurus clathratus	10					10
Stylurus kreyenbergi	10					10
Anotogaster sp. cf *klossi*			25			25
Macromia berlandi	10					10
Macromia katae	10	10	10			30
Macromia urania	10					10
Idionyx claudia	10		25			35
Idionyx victor	10					10
Macromidia ellenae	20					20
Brachythemis contaminata					3	3
Crocothemis servilia					3	3
Diplacodes trivialis					5	5
Nannophya pygmaea					5	5
Onychothemis testacea				15		15
Orthetrum poecilops	10	10		15		35
Palpopleura sexmaculata					5	5
Zygonyx asahinai	10					10

*Species that are presumed extinct, vagrant or of uncertain status in Hong Kong are excluded. All other Hong Kong species (as listed in Table 2), come under category (vi) of the metric and score 1 point each.

Appendix: Habitats (Photos taken by G.T. Reels)

Yung Shue O. Coastal mangroves at this site support a thriving population of *Orthetrum poecilops*, which breeds in brackish-saline water.

Luk Keng marsh. The largest unmanaged freshwater marsh in Hong Kong. Supports a large number of lentic species including the tiny libellulid *Nannophyopsis clara*.

Kai Kuk Shue. Ha. A pond and marsh complex adjacent to Luk Keng supporting a very wide range of lentic species including *Aethriamanta brevipennis* and *Rhyothemis triangularis*.

Kang Mun Tsui. A large, remote pond in the northeast of Hong Kong. *Nannophyopsis clara* present at this pond.

Yuen Leng Chai. A disused fish pond adjacent to the border with Shenzhen (mainland China) supporting a good range of pond species.

Tai Shui Hang. A large, gravelly lowland stream in the northwest of Hong Kong, supporting a population of *Paragomphus capricornis*.

Ma Tso Lung. An extensive complex of largely disused fish ponds close to the Shenzhen (mainland China) border.

Lung Tsai lily pond. A good site for the sparsely distributed *Paracercion calamorum*.

She Shan stream. A slow-flowing lowland stream, formerly a good site for *Labrogomphus torvus*, although the species was not recorded in the present study.

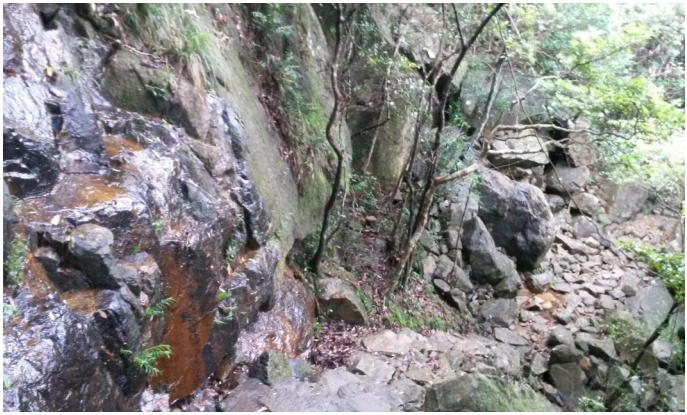
Tai Tong stream. A gravel-bottomed lowland stream with good riparian vegetation supporting a large number of lotic species. Particularly notable for the large population of *Paragomphus capricornis*.

Sham Tseng stream. A cobble-bottomed stream with extensive gravel accumulations providing habitat for several stream gomphids including *Melligomphus guangdongensis*.

Hok Tau upper tributary. A cobble / boulder upland stream in secondary woodland. *Sieboldius alexanderi* breeds here.

Tai Lam stream. Upstream of Tai Lam Reservoir. A fast-flowing boulder stream. Good population of *Megalogomphus sommeri* at this site.

Sha Lo Tung basin. An upland marsh / stream complex supporting more than 70 species of odonates. Long regarded as Hong Kong's richest dragonfly site.



Sunset Peak seepage. One of many seepages at 600-800 m on Sunset Peak, Lantau Island, supporting platystictids such as *Drepanosticta hongkongensis* and *Protosticta beaumonti*.

Appendix: Species (Photos taken by G.T. Reels)

***Philoganga vetusta* at Wu Kau Tang (photographed in 2010). A member of a taxonomically isolated genus.**

***Aciagrion approximans* at Pat Sin Leng Site 2 (photographed in 2010). A sparsely distributed species in Hong Kong.**

***Mortonagrion hirosei* at Luk Keng marsh (photographed in 2010). A species that is confined to brackish water mangroves and reedbeds.**

***Calicnemia sinensis* at Ng Tung Chai, June 2016. Sparsely distributed in Hong Kong and globally restricted to southeastern China.**

***Onychargia atrocyana* at Shuen Wan (photographed in 2011). A member of a taxonomically isolated genus.**

***Sinosticta ogatai* at Ng Tung Chai, June 2016. Originally described from Hong Kong, where it is near-endemic.**

***Idionyx victor* at Ng Tung Chai, June 2016. A widespread species, originally described from Hong Kong.**

***Aethriamanta brevipennis* at Kai Kuk Shue Ha pond /marsh complex, May 2016. This species has spread rapidly across Hong Kong since the first record in 2008.**

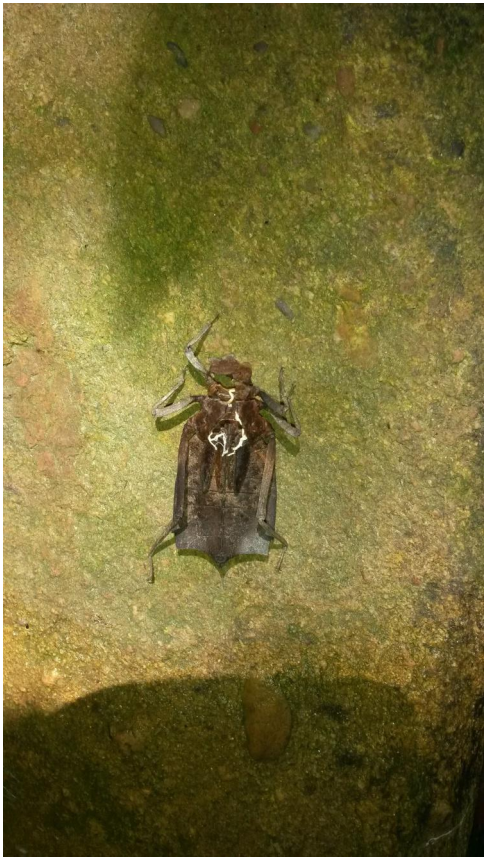
***Nannophyopsis clara* at Luk Keng marsh, May 2016. A tiny libellulid with a scattered distribution in Hong Kong.**

***Orthetrum poecilops* at Yung Shue O, June 2016. This mangrove-associated species has spread quite widely along the eastern coast of Hong Kong since the 1990s.**

***Palpopleura sexmaculata* at Sha Lo Tung (photographed in 2010). A species of small weedy ponds and marshes that appears to have declined in Hong Kong since the 1990s.**

***Rhyothemis triangularis* at Kai Kuk Shue Ha, May 2016. This small attractive species has spread quite widely over Hong Kong since the 1990s.**

***Pseudocopera ciliata* exuviae at Luk Keng marsh, April 2016.**



***Sieboldius alexanderi* exuviae on stream boulder at Wu Kau Tang. This species has become quite widely distributed in Hong Kong since it was first recorded in 1995.**

***Sinictinogomphus clavatus* exuviae at Kai Kuk Shue Ha (photographed in 2010). A large pond species.**

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