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SUMMARY

The results of sampling of Odonata (dragonflies and damselflies) carried out at the Jelalong East Glenealy Oil Palm Plantations, located west of the Dulit Range and situated in Sebauh District, Bintulu Division in December 2024 are reported. Details of the research permit and dates on which collecting was carried out are listed. Sampling was mainly conducted in the HCVF and riparian buffer, with some sampling within Oil Palm or in open areas around the estates. Seventy-one (71) species of Odonata from 15 families were collected during the surveys, one of these species was recorded from Bintulu Division for the first time and a total of seven were recorded from Sebauh District for the first time (a somewhat surprisingly high total since Sebauh District has been relatively well studied for Odonata). Particularly significant records are Drepanosticta attala and Rhinocypha aurofulgens (both Least Concern species, but the former had not been recorded in Bintulu Divison before and the latter is very rare in Bintulu Division), Heliogomphus borneensis and Macromia corycia (both Near Threatened species) and Phyllothemis raymondi (a Data Deficient species). Forty-one (41; approximately 58%) of the species found during the survey are forest species, e.g. species dependent on forest for their survival and 23 (approximately 32%) of the species recorded are endemic to Borneo; it is species in one or both of these categories that are typically of highest conservation concern. Species found in different categories of land cover are briefly discussed and a brief comparison with the Belaga Estates is made. Recommendations and suggestions for conservation and further work are given. A list of English names for the species collected is provided in an appendix.

CONTENTS

| Introduction | |
|---|----|
| Sampling Locations | |
| Species Recorded | 6 |
| Discussion | 11 |
| Recommendations and Suggestions | |
| Acknowledgements | |
| References | |
| Appendix 1: English Names | |
| Appendix 2: Photographs of selected species | |

List of Tables

| Table 1: Permit number and c | collectin | ng dates | for the | 2024 si | ırvey | • | • | 4 |
|-------------------------------|-----------|----------|----------|-----------|-----------|----------|----------|----------|
| Table 2: Species recorded dur | ring the | 2024 J | elalong | East su | rvey an | d potent | ially of | |
| conservation interest | • | • | | • | • | | • | 12 |
| Table 3: Numbers of families | and sp | ecies co | llected | at each | of the l | ocations | in the . | Jelalong |
| East area sampled in 2024 | • | • | • | • | • | • | • | 13 |
| Table 4: Land cover categorie | es and s | ampled | locatio | ns | • | | • | 14 |
| Table 5: Odonata found in dif | fferent l | and cov | ver cate | gories d | uring th | ne Decer | nber 20 | 24 |
| Jelalong East survey . | • | • | • | • | • | • | • | 16 |
| Table 6: Comparison of result | ts from | Jelalon | g East v | with the | Belaga | Estates | • | 18 |
| Table 7: English names for O | donata | species | collect | ed in the | e Jelaloi | ng East | area sar | npled |
| in 2024 | • | • | • | • | • | • | • | 20 |

List of Figures

| Figure 1: Overview of locations sampled in the Jelalong East area in 2024. | 5 |
|---|---|
| Figure 2: More detail of locations in the Jelalong East 3 area Introduction | 6 |

The report describes the results of sampling of the insect order Odonata (dragonflies and damselflies) carried out at the Glenealy Jelalong East Oil Palm Plantations, located just west of the Dulit Range and situated in Sebauh District, Bintulu Division. Sampling was mostly conducted within riparian buffers and HCVF areas, but also at ponds in Oil Palm and open ponds. The dates on which collecting was carried out and details of the research permit issued by the Sarawak Forestry Corporation, are given in Table 1.

| Year | Research permit | Period of validity of | Dates on which collecting |
|------|----------------------------|---|---|
| | number | permit | was carried out |
| 2024 | SFC.810- 4/6/1(2024)265 | 13 th September 2024– 12 th September 2025 | 9 th -13 th December 2024 |

 Table 1: Permit number and collecting dates for the 2024 survey.

Odonata are insects with aquatic larvae; representatives of the order can be found at almost all freshwater habitats. They are carnivorous as both adults and larvae and are not vectors for any human disease; indeed they play at least some role in keeping mosquito populations under control. Although present on every continent apart from Antarctica, the order is most diverse in the world's tropical regions. In the wet tropics many species are forest dwelling and may be particularly sensitive to environmental disturbance; for this reason they are considered to be good candidates for ecological indicator species. The structure of the report is as follows: The locations where sampling was carried out are listed. The species collected are listed with brief notes. A discussion of the results of the collecting and species of particular conservation interest that were found and the conclusions of the report are given, along with a brief comparison with the Belaga Estates. An appendix lists English names for the species collected.

Sampling Locations

The following codes for groups of samplings sites are used below. All locations are in Sebauh District, Bintulu Division. The list is organised by estate. Coordinates are given to four decimal places. Figure 1 shows an overview of the locations sampled.



Figure 1: Overview of locations sampled in the Jelalong East area in 2024.

Jelalong East 1:

- 1. Ponds near Oil Palm Mill (3.3772N, 113.9963E):
 - a. Large ponds.
 - b. Fish ponds.
 - c. Grassy ditch with water near to 1a.
 - d. Road up hill above ponds, with a trickle of water at side.
- 2. Waterfall stream (Sungai Jugam):
 - a. Mainstream above waterfall (3.3479N, 113.9942E) to 3.3455N, 113.9966E.
 - b. At waterfall (3.3479N, 113.9942E).
 - c. Mainstream for a short distance below the waterfall.
 - d. First sampled tributary.
 - e. Second sampled tributary.

- 3. Tiny, high gradient stream (3.4044N, 114.0199E) in Conservation Area.
- 4. Sungai Merurong, a large stream with riparian buffer:
 - a. Mainstream and larger tributary, the latter running through Oil Palm and only sampled by field assistants, samples not partitioned between the two habitats. Coordinates at entry point: 3.3838N, 114.0194E.
 - b. Small tributary in Oil Palm, very near 4a entry point.
- 5. Large pond beside road, in Oil Palm (3.3448N, 113.9839E).

Jelalong East 3 (the locations here were within a fairly compact area and are not well visible in Fig. 1, Fig. 2 shows more detail on these locations):

- 6. Sungai Enyang, a large rocky stream near to mess:
 - a. Mainstream, sampled from entry point near 3.2673N, 113.9052E to upstream of 6b.
 - b. Side loop (oxbow) of mainstream, coordinates at point remerges with mainstream: 3.2637N, 113.9098E.
 - c. Old stream bed (or largely underground stream) with many swampy pools, in forest near mainstream (3.2627N, 113.9129E).
 - d. Swampy tributary.
 - e. Muddy pools in Oil Palm near stream.
- 7. Water catchment stream, part of the upstream of Sungai Enyang, sampled during poor weather conditions:
 - a. Mainstream, entered at 3.2562N, 113.9191E, sampled below this point and upstream to 3.2535N, 113.9221E.
 - b. Wet cliff inside forest.
 - c. A pool below 7c.
 - d. Tributary above road crossing, upstream point reached: 3.2529N, 113.9197E.
 - e. Tributary below road crossing.
 - f. Along road.
- 8. Pond in Oil Palm (3.268N, 113.9072E).
- 9. Pond with waterlilies and much emergent vegetation, in Oil Palm (3.2744N, 113.9126E), only sampled briefly because of the onset of rain.
- 10. Grassy margined pond behind mess (3.2625N, 113.9071E).
- 11. Flying over road at 10.

Report on collecting of Odonata in the Glenealy Jelalong East Oil Palm Plantations



Figure 2: More detail of locations in the Jelalong East 3 area.

Species Recorded

Adult Odonata were collected. Collecting was carried out using handheld nets. At each location the aim was to collect at least one specimen of each species present. In cases where species are difficult to distinguish in the field, or of particular interest, an effort was made to take longer series of specimens. However many adult odonates are difficult to capture, hence not every species encountered was successfully collected. Many common species are only represented by one or a few specimens in the material collected; this does not necessarily imply that they are less common at the locations sampled than elsewhere, it merely reflects that after the collection of an initial voucher specimens of such species. The locations listed for each species are those where specimens were collected, unless otherwise noted. An **E** after the locations indicates that the species is endemic to Borneo. IUCN Red List assessments are also indicated for each named species after the locations (**DD** – Data Deficient; **LC** – Least Concern; **NT** – Near Threatened; **NA** – Not Assessed). A * after the species name indicates a first record from Sebauh District, a ** indicates a first record for Bintulu Division.

ZYGOPTERA (DAMSELFLIES)

Lestidae

This family is poorly represented in Borneo. They are medium-sized (e.g. *Lestes* species) to large (*Orolestes*) damselflies, found in a variety of habitats.

1. *Lestes praemorsus decipiens* Kirby, 1894 — Typically a pond species, rather local (i.e. scattered populations confined to small areas) in Sarawak. Location 5. LC

Platystictidae

The Platystictidae is a moderately large family which presents many taxonomic problems. They occur from India across most of Asia, and southwards as far as New Guinea, with species in three subfamilies; a separate subfamily occurs in the neotropics. It is widely recognised that the old world Platystictidae are in need of a major revision. There are many platystictid species in Sarawak, due to difficulties in determining whether some forms are separate, unnamed, species or local variants of known species it is not possible to give an exact figure, but over 30 species are already known to occur in the state. More species will undoubtedly be found.

- 2. Drepanosticta actaeon Laidlaw, 1934 * Originally described from Mount Kinabalu, D. acateon now appears to be common in the mountainous interior parts of Sarawak. Locations 2d, 7d. E, LC
- 3. *Drepanosticta attala* Lieftinck, 1934 ****** A locally occurring forest stream species, more often found on larger streams than most members of the Platystictidae in Borneo. Location 6a. **E**, **LC**
- 4. Drepanosticta rufostigma (Selys, 1886) The most common member of the Platystictidae in Sarawak. Locations 2a, 6d, 7d, 7e. E, LC
- 5. *Drepanosticta versicolor* (Laidlaw, 1913) Another common platystictid, usually found at tiny muddy seeps and trickles. Location 3. **E**, **LC**
- 6. *Telosticta longigaster* Dow & Orr, 2012 This is by far the most common species of *Telosticta* over a large part of Sarawak. Locations 7b, 7d. **E, LC Euphaeidae**

These are medium-sized damselflies of forest streams and rivers. The family, well represented in Sarawak with eight species recorded, is mostly Asian but reaches as far west as extreme south-eastern Europe. Species are mostly darkly coloured, but some have iridescent wing markings.

- Dysphaea dimidiata Selys, 1853 A species of larger forest streams. Locations 4a, 6a. LC
- 8. *Euphaea impar* Selys, 1859 A common species on lowland forest streams. Possibly more tolerant of disturbance than other members of this family in Sarawak. Locations 2a, 2c, 2d, 2e, 4a, 6a, 6b, 6d. **LC**
- 9. *Euphaea subcostalis* Selys, 1873 Another species that is quite common on forest streams in Sarawak, but that may be less tolerant of disturbance than *E. impar*. Locations 2a, 2c, 2e, 4a, 6a, 7a, 7d, 7e. **LC**

Devadattidae

This small family includes only a single genus, *Devadatta*, and was previously included in the Amphipterygidae. Only one species, *Devadatta podolestoides*, was thought to occur in Sarawak until recently, when it was discovered that a number of distinct but very similar species had all been treated as *D. podolestoides*. The true *D. podolestoides* has not been found east of the Lupar River.

10. *Devadatta clavicauda* Dow, Hämäläinen & Stokvis, 2015 — Usually the most common *Devadatta* species in the lowlands of Sarawak and also occurring at higher altitudes. Locations 7d, 7e. E, LC

Philosinidae

A family that was previously included in the Megapodagrionidae, the Philosinidae includes just two genera, of which only the brightly coloured Rhinagrion occurs in Borneo.

11. *Rhinagrion borneense* (Selys, 1886) — Usually a common species on lowland forest streams in Sarawak. Location 2a, 6a. **E**, **LC**

Argiolestidae

Previously included in the Megapodagrionidae (a family now considered confined to the neotropics), the Argiolestidae occur mostly from Australia and New Guinea to China. In Borneo the family is represented by the genus *Podolestes*, many of whose species are peat swamp forest specialists.

12. *Podolestes orientalis* Selys, 1862 — The most common and least specialised *Podolestes* species, found in swamp forest, and at stream pools and ponds in other types of forest. Location 6c. LC

Calopterygidae

A large cosmopolitan family of medium- to large-sized damselflies found on forest streams and rivers. At least eight species occur in Sarawak. In Borneo the family is dominated by the *amoena*-group of the genus *Vestalis*; most of the species in this group are very similar, with metallic green bodies and clear wings, which flash with bright metallic colours when caught by the sun.

- 13. *Neurobasis longipes* Hagen, 1887 This species can be abundant on lowland forest streams. Locations 2a, 2c, 4a, 6a, 7a. LC
- 14. *Vestalis amoena* Hagen in Selys, 1853 A very common species on lowland forest streams. Locations 2a, 4a, 6a. LC
- Vestalis atropha Lieftinck, 1965 * Widely distributed in Sarawak, but more local (i.e. scattered populations confined to small areas) in occurrence than V. amoena. Locations 6a, 7a. E, LC

Chlorocyphidae

The members of this old world family are small and mostly very brightly coloured. At least 15 species occur in Sarawak. They are found on forest streams and are notable for their courtship and agonistic behaviour.

- 16. *Heliocypha biseriata* (Selys, 1859) This species is widely distributed in Sarawak, and is often common on forest streams. Locations 2a, 2c, 2d, 4a, 4b, 6a, 7a. LC
- 17. *Libellago semiopaca* (Selys, 1873) A locally common stream species, favouring open canopy streams and rivers. Location 4a. **LC**
- 18. *Rhinocypha aurofulgens* Laidlaw, 1931 * —This is a species of rocky forest streams. Scarce in Bintulu Division, with only one old record from the Tatau area (made more than 100 years ago) until now. Location 7a. **E**, **LC**

Platycnemididae

The Calicnemiinae and Platycnemidinae are the subfamilies occurring in Borneo that have traditionally been placed in the Platycnemididae. The Calicnemiinae are represented by *Coeliccia* and the Platycnemidinae by *Copera* and *Pseudocopera*. More recently old world species formerly placed in the Protoneuridae, and the enigmatic genus *Onychargia*, have been transferred to the Platycnemididae.

- 19. *Coeliccia borneensis* (Selys, 1886) A locally occurring species of small forest streams. Location 7d. **E**, **LC**
- 20. *Coeliccia cyaneothorax* Kimmins, 1936 A species of local occurrence, it appears to favour small rock pools at the edge of streams on forested hills and mountains. Locations 2a. **E**, **LC**

- 21. Coeliccia nigrohamata Laidlaw, 1918 A common species of small streams and marshy areas in forest. Locations 6c, 6d, 7a, 7d, 7e. E, LC
- 22. *Copera vittata* (Selys, 1863) A common species of lowland forest. Location 6c. LC
- 23. *Prodasineura dorsalis* (Selys, 1860) This species is widespread in Sarawak, but local in occurrence in most areas. Locations 6d, 7e. E, LC
- 24. *Prodasineura hyperythra* (Selys, 1886) This species is widely distributed in lowland forest in Sarawak. Locations 2a, 4b, 6d. **E**, **LC**
- 25. *Prodasineura verticalis* (Selys, 1860) A species that is widely distributed in Sarawak and generally quite common on larger forest streams. Location 2a, 2c, 4a, 4b, 6a. LC

Coenagrionidae

This is a large, cosmopolitan and very diverse family, and includes both forest and nonforest species. Fourteen genera are currently known from Sarawak, with over 40 species.

- 26. Agriocnemis femina (Brauer, 1868) A very common and widespread species of open habitats. Locations 1a, 1b, 1d, 10. LC
- 27. *Ischnura senegalensis* (Rambur, 1842) A very common and widespread species. Location 1b. **LC**
- 28. *Ceriagrion cerinorubellum* (Brauer, 1865) A very common species in disturbed habitats. Locations 8, 9, 10. LC
- 29. *Pseudagrion lalakense* Orr & van Tol, 2001 A locally common species in parts of Sarawak. Location 8. **E**, **LC**
- 30. *Pseudagrion microcephalum* (Rambur, 1842) A common and very widely distributed species of disturbed habitats. Location 1b. LC
- 31. *Pseudagrion perfuscatum* Lieftinck, 1937 A common species of open sections of forest streams. Locations 4a, 4b, 6a. **E**, **LC**
- 32. *Stenagrion dubium* (Laidlaw, 1912) This species is very common on small streams in steep forested terrain in Sarawak. Locations 2a, 2d, 7d, 7e. E. LC
- 33. *Xiphiagrion cyanomelas* Selys, 1876 A *Xiphiagrion cyanomelas* is a common lowland pond species in Sarawak. Locations 5, 8, 19. LC

ANISOPTERA (DRAGONFLIES)

Aeshnidae

A medium-sized family with a worldwide distribution. Many species are large or very large. The majority of species found in Sarawak are crepuscular (dusk and evening flying).

- 34. *Anax guttatus* (Burmeister, 1831) A common species found at standing and slowly flowing waters. Location 11. LC
- 35. *Anax panybeus* Hagen, 1867 Probably common in Sarawak but under-recorded due to difficulty of capture and the fact that it cannot be reliably separated from *Anax guttatus* without capture. Locations 5, 8. LC

Gomphidae

A large family with a worldwide distribution. The Gomphidae have well-separated eyes, which distinguishes them from all other families of Anisoptera found in Borneo. Gomphids are typically very wary and elusive; many species are poorly known.

36. *Heliogomphus borneensis* Lieftinck, 1964 — An uncommon and local species, most often found at small forest streams. At Jelalong East 1 a freshly emerged male was

collected at a larger than typical stream, with a very open canopy. Locations 4a. E, NT

- 37. *Ictinogomphus decoratus melaenops* (Selys, 1858) A very common species on open ponds and open sections of streams. Locations 5, 8. LC
- 38. *Megalogomphus borneensis* (Laidlaw, 1914) * A species of low gradient forest streams, previously treated as *M. icterops* (Martin, 1902). Location 2a. E, LC
- 39. *Microgomphus chelifer* Selys, 1858 A common species of lowland forest streams. A single freshly emerged male was found at the waterfall at location 2. Location 2b. LC

Macromiidae

Formerly included in the Corduliidae, the representatives of this family are fast flying; most species occur on forest streams.

40. *Macromia corycia* Laidlaw, 1922 — A poorly known species, endemic to Borneo as it is currently understood but possibly a junior synonym of the more widespread *M. gerstaeckeri* Krüger, 1899. Location 7a. **E**, **NT**

Synthemistidae

Bornean species included here in the Synthemistidae were previously included in the Corduliidae or treated as *incertae sedis*, their placement is still contentious.

41. *Macromidia fulva* Laidlaw, 1915 — A fairly common forest stream species. Location 6a. **E**, **LC**

Libellulidae

The largest family of the Odonata, with a worldwide distribution. Considerable variety exists in this family of mostly small- to medium-sized species. Males are often brightly coloured.

- 42. *Acisoma panorpoides* Rambur, 1842 A widespread species, less common in Sarawak than in many parts of its range. Location 1b. LC
- 43. *Brachydiplax chalybea* Brauer, 1868 A common species of disturbed habitats. Location 8. LC
- 44. *Camacinia gigantea* (Brauer, 1867) A very large sized species, found at ponds in or at the edge of forest (including second growth and plantation) but local in occurrence. Locations 5, 10, 11. LC
- 45. *Cratilla lineata* (Brauer, 1878) This species is typically found at pools in and at the edges of disturbed forest. Location 6e. **LC**
- 46. *Cratilla metallica* (Brauer, 1878) A widespread forest species, it breeds in forest pools, including in disturbed forest. Locations 4a, 6e, 7c. LC
- 47. *Diplacodes trivialis* (Rambur, 1842) A common and widespread species of open habitats. Location 1d. LC
- 48. *Lyriothemis biappendiculata* (Selys, 1878) A local but widespread species, most often found in small swampy areas and at heads of streams in mixed dipterocarp forest. Location 6d. **LC**
- 49. *Nannophya pygmaea* Rambur, 1842 A very common species of marshy habitats. Location 9. LC
- 50. *Neurothemis fluctuans* (Fabricius, 1793) A very common species of disturbed habitats. Locations 4a, 8, 10. LC
- 51. *Neurothemis ramburii* (Brauer, 1866) A common species of disturbed habitats. Location 1c, 4a. **LC**

- 52. *Onychothemis coccinea* Lieftinck, 1953 * A forest stream species, locally common in Sarawak. Location 6a. LC
- 53. Onychothemis culminicola Förster, 1904 A fairly common stream species. Locations 2a, 4a, 6a. LC
- 54. Orchithemis pulcherrima Brauer, 1878 A common species of swampy forest habitats. Locations 6c, 6d. LC
- 55. Orthetrum chrysis (Selys, 1891) A common species. Locations 6c. LC
- 56. Orthetrum glaucum (Brauer, 1865) A common species. Location 7f. LC
- 57. Orthetrum sabina (Drury, 1773) A very common and extremely widespread species that occurs in a great range of habitat types. Locations 1b, 10. LC
- 58. Orthetrum schneideri Förster, 1903 A common species in many forested areas. Previously treated as a subspecies of Orthetrum pruinosum (Burmeister, 1839). Location 7f. LC
- 59. Orthetrum testaceum (Burmeister, 1839) A very common species of open and disturbed habitats. Locations 1b, 4a, 6e, 10. LC
- 60. *Pantala flavescens* (Fabricius, 1798) * A widely distributed species of open and disturbed habitats. Location 5. LC
- 61. *Phyllothemis raymondi* Lieftinck, 1950 A hyper localised and rarely recorded species. Location 6c. **DD**
- 62. *Rhyothemis obsolescens* Kirby, 1889 A locally common species often found in swamp, also at forest edge ponds. Location 8. LC
- 63. Rhyothemis triangularis Kirby, 1889 A common pond species. Location 10. LC
- 64. *Tholymis tillarga* (Fabricius, 1798) A very common afternoon and dusk flying species. Locations 1a, 1b. LC
- 65. *Tramea* sp. cf *virginia* (Rambur, 1842) This species is known from an increasing number of locations in Sarawak. However its identity remains a puzzle, it differs in small but significant details from the true *T. virginia* and might be a distinct species. Location 5. NA
- 66. *Trithemis aurora* (Burmeister, 1839) A common and widespread open habitat species. Locations 4a, 5, 6a, 8. LC
- 67. *Trithemis festiva* (Rambur, 1842) A common species of open sections of streams. Locations 4a, 6a. LC
- 68. *Tyriobapta laidlawi* Ris, 1919 A locally occurring forest stream species. Location 6d. ?E, LC
- 69. *Tyriobapta torrida* Kirby, 1889 A common species of slow streams, forested pools and swamps. Locations 6c, 6d, 7c. LC
- 70. Urothemis signata insignata (Selys, 1872) A widespread species that occurs in a variety of standing or slowly flowing water habitats. Locations 5, 7a, 8. LC
- 71. Zygonyx ida errans Lieftinck, 1953 A large species usually associated with fast-flowing waters. Location 7a. E, NA

Discussion

Seventy-one (71) species of Odonata from 15 families were recorded in the survey reported on here. One of the species was recorded from Bintulu Division for the first time (*Drepanosticta attala*) and a further six (for a total of seven) were recorded from Sebauh District for the first time. Sebauh District has been relatively well studied for Odonata so only a limited number of new additions at district level were expected; seven new recorded exceeded that expectation. With the additions reported here 187 species of Odonata are known from Bintulu Division and 174 species from Sebauh District.

Five (5) species collected during the December 2024 survey and possibly worthy of special attention from a conservation viewpoint are listed in Table 2 below. Species are included in the table both because of global conservation concern (e.g. species that are or might be globally threatened) and because of local conservation concern (e.g. species that are or might be threatened in Sarawak or in Bintulu Division). All (assessed) species with an IUCN Red List assessment other than Least Concern (LC) are included here.

| Species | Comment |
|-------------------------|---|
| Drepanosticta attala | LC but the site at Jelalong East 3 is the only location |
| | known for the species in Bintulu Division. |
| Rhinocypha aurofulgens | LC but very rare in Bintulu Division, with only one |
| | (very old) record from the division until now. |
| Heliogomphus borneensis | Currently NT on the IUCN Red List. |
| Macromia corycia | Currently NT on the IUCN Red List. |
| Phyllothemis raymondi | Hyper-localised species, DD on the IUCN Red List. |

Table 2: Species recorded during the 2024 Jelalong East survey and potentially ofconservation interest. Red List status: DD – Data Deficient, LC – Least Concern, NT– Near Threatened.

Two of the species listed in Table 2 are included simply because they have Near Threatened Red List assessments. Rhinocypha aurofulgens is a species of rocky forest streams, mostly found in mixed dipterocarp forest, and becomes more common in the deep interior of Sarawak than it is in the coastal districts. The Odonata of Bintulu Division have received a relatively large amount attention, mostly through many surveys within the area of the Sarawak Planted Forest Project, and it is therefore safe to say that Rhinocypha aurofulgens is a scarce species in the division, although it is not globally threatened. The new record for Bintulu Division, Drepanosticta attala, has been included in Table 2 under similar grounds to Rhinocypha aurofulgens, but with more reservations. Unlike the conspicuous Rhinocypha, Drepanosticta attala is an inconspicuous species that exhibits cryptic behaviour, so it is possible that the species is more common in Bintulu Division than the current records suggest. Phyllothemis raymondi is a peculiar species whose habitat requirements are not well understood, it is certainly a forestdependent species and is extremely localised in occurrence but populations occasionally establish themselves at sites within plantations (it has been recorded in both Acacia and Oil Palm where the understorey is not being treated) only to become extinct at such sites at the end of the rotation. It is currently assessed as DD largely because of the uncertainty over its exact habitat requirements but it is not likely to ever be placed in Least Concern simply because of its extremely localised occurrence.

Table 3 summarises the numbers of families and of species so far collected at each of the locations sampled in December 2024. The number of **forest species** (e.g. species dependent on forest for their survival) is also listed along with the numbers of species endemic to Borneo; it is the species in one or both of these categories that are typically most important from a conservation point of view. Additionally the numbers of species listed as of conservation concern in Table 2 are also included for each location. Of the 71 species collected during the December 2024 survey, 41 are forest species (ca. 58%) and 23 (ca. 32%) are endemic to Borneo. All of the species listed in Table 2 are forest species and three of them are endemic (as currently understood) to Borneo.

| Location | Number of species | Number of Forest Species | Number of species endemic to Borneo | Number of species in Table 2 | Number of families |
|----------|----------------------|--------------------------------|--|------------------------------------|-----------------------|
| 1 | 9 | 0 | 0 | 0 | 2 |
| 2 | 15 | 15 | 7 | 0 | 9 |
| 3 | 1 | 1 | 1 | 0 | 1 |
| 4 | 18 | 12 | 3 | 1 | 7 |
| 5 | 9 | 0 | 0 | 0 | 5 |
| 6 | 31 | 26 | 10 | 2 | 10 |
| 7 | 20 | 18 | 12 | 2 | 9 |
| 8 | 10 | 0 | 1 | 0 | 4 |
| 9 | 2 | 0 | 0 | 0 | 2 |
| 10 | 8 | 0 | 0 | 0 | 2 |
| 11 | 2 | 0 | 0 | 0 | 2 |

Table 3: Numbers of families and species collected at each of the locations in theJelalong East area sampled in 2024.

There has been insufficient sampling to draw many conclusions from the numbers in Table 3 but location 6 stands out at first glance because 31 species were recorded there (with 10 families recorded it also has the highest recorded family diversity). However the relatively high numbers from location 6 are largely due to the variety of habitats sampled at that location (large rocky forest stream, small swampy tributary and forest pools as well as some habitat under Oil Palm). Location 7 was sampled during suboptimal conditions (little sunshine, rain throughout most of the morning) but 20 species were still recorded and had the highest number (12) of species endemic to Borneo of any of the locations visited. With more work in better conditions location 7 is likely to equal or surpass locations 6 in species richness and family level diversity. Only one species was recorded at location 3 but this area was only surveyed briefly and too early in the morning for good results.

More generally further sampling would undoubtedly add to the number of species from the area and from each individual location. In particular the forest stream sites will certainly not have a complete inventory yet, since many species that use this habitat, especially from the families Gomphidae and Macromiidae, occur at low densities and exhibit behaviour

that makes it very difficult to record them during a short survey; longer periods of work are needed to obtain anything approaching a full inventory for these groups.

Land cover

It is instructive to consider the results of the survey in terms of land cover. To this end the locations surveyed have been divided into four simple land cover categories, these are listed in Table 4. Note that location 2c is listed as forest edge because the sampled part from just downstream of the waterfall it is open on one bank.

| Land cover category | Locations |
|--------------------------------------|-----------------------------|
| Disturbed old growth forest (OG, 15) | 2a,b,d,e, 3, 4a, 6a-d, 7a-e |
| Forest edge (FE, 1) | 2c |
| Oil Palm (OP, 7) | 4b, 5, 6e, 8, 9, 10 |
| Open (O, 4) | la-d |

Table 4: Land cover categories and sampled locations. The abbreviation used for each category in Table 5 is given in parentheses, followed by the number of sampled locations in the category.

Table 5 shows which species were found in which of the land cover categories during the survey. The highest number of species (47) were recorded from old growth forest, although the survey concentrated on this land cover type this result is expected to hold true with more extensive sampling since it is typically true in South East Asia. Only seven species were recorded at forest edge but since only one site falls into this category the result is not surprising. Twenty-six species were recorded in Oil Palm, this relatively high number is due to the fact that most of the ponds sampled were within Oil Palm. Nine species were recorded in open habitats, a rather low total but only the sites at location 1 are included in the open category here.

Fifteen species were found in more than one category but no species was found in all four categories. Of species only found in one category, old growth forest has the highest number (34) followed by Oil Palm (15), then open habitat (5) with only two species only found at the forest edge. Although old growth forest and Oil Palm had the highest numbers of species recorded, only nine species were found in both of these categories.

| Species | OG | FE | OP | 0 |
|-----------------------------|-----|-----|-----|-----|
| Lestes praemorsus decipiens | | | Yes | |
| Drepanosticta actaeon | Yes | | | |
| Drepanosticta attala | Yes | | | |
| Drepanosticta rufostigma | Yes | | | |
| Drepanosticta versicolor | Yes | | | |
| Telosticta longigaster | Yes | | | |
| Dysphaea dimidiata | Yes | | | |
| Euphaea impar | Yes | Yes | | |
| Euphaea subcostalis | Yes | Yes | | |
| Rhinagrion borneense | Yes | | | |
| Devadatta clavicauda | Yes | | | |
| Podolestes orientalis | Yes | | | |
| Neurobasis longipes | Yes | Yes | | |
| Vestalis amoena | Yes | | | |
| Vestalis atropha | Yes | | | |
| Heliocypha biseriata | Yes | Yes | Yes | |
| Libellago semiopaca | Yes | | | |
| Rhinocypha aurofulgens | Yes | | | |
| Coeliccia borneensis | Yes | | | |
| Coeliccia cyaneothorax | Yes | | | |
| Coeliccia nigrohamata | Yes | | | |
| Copera vittata | Yes | | | |
| Prodasineura dorsalis | Yes | | | |
| Prodasineura hyperythra | Yes | | Yes | |
| Prodasineura verticalis | Yes | Yes | Yes | |
| Agriocnemis femina | | | Yes | Yes |
| Ceriagrion cerinorubellum | | | Yes | |
| Ischnura senegalensis | | | | Yes |
| Pseudagrion lalakense | | | Yes | |
| Pseudagrion microcephalum | | | | Yes |
| Pseudagrion perfuscatum | Yes | | Yes | |
| Stenagrion dubium | Yes | | | |
| Xiphiagrion cyanomelas | | | Yes | |
| Anax guttatus | | | Yes | |
| Anax panybeus | | | Yes | |
| Heliogomphus borneensis | Yes | | | |
| Ictinogomphus decoratus | | | Yes | |
| Megalogomphus borneensis | Yes | | | |
| Microgomphus chelifer | Yes | | | |

| Macromia corycia | Yes | | | |
|--------------------------------------|-----|-----|-----|-----|
| Macromidia fulva | Yes | | | |
| Acisoma panorpoides | | | | Yes |
| Brachydiplax chalybea | | | Yes | |
| Camacinia gigantea | | | Yes | |
| Cratilla lineata | | | Yes | |
| Cratilla metallica | Yes | | Yes | |
| Diplacodes trivialis | | | | Yes |
| Lyriothemis biappendiculata | Yes | | | |
| Nannophya pygmaea | | | Yes | |
| Neurothemis fluctuans | Yes | | Yes | |
| Neurothemis ramburii | Yes | | | Yes |
| Onychothemis coccinea | Yes | | | |
| Onychothemis culminicola | Yes | | | |
| Orchithemis pulcherrima | Yes | | | |
| Orthetrum chrysis | Yes | | | |
| Orthetrum glaucum | | Yes | | |
| Orthetrum sabina | | | Yes | Yes |
| Orthetrum schneideri | | Yes | | |
| Orthetrum testaceum | Yes | | Yes | Yes |
| Pantala flavescens | | | Yes | |
| Phyllothemis raymondi | Yes | | | |
| Rhyothemis obsolescens | | | Yes | |
| Rhyothemis triangularis | | | Yes | |
| Tholymis tillarga | | | | Yes |
| <i>Tramea</i> sp. cf <i>virginia</i> | | | Yes | |
| Trithemis aurora | Yes | | Yes | |
| Trithemis festiva | Yes | | | |
| Tyriobapta laidlawi | Yes | | | |
| Tyriobapta torrida | Yes | | | |
| Urothemis signata insignata | Yes | | Yes | |
| Zygonyx ida errans | Yes | | | |
| Total | 47 | 7 | 26 | 9 |

 Table 5: Odonata found in different land cover categories during the December 2024

 Jelalong East survey. See Table 4 for the abbreviations for land cover categories.

Comparison with the Belaga Estates

It is worthwhile to make a brief comparison with the results from the preliminary Odonata survey made at the Belaga Estates in May 2024. Table 6 shows some key metrics for both areas for ease of comparison. More species were collected at the Jelalong East Estates than at the Belaga Estates (71 compared with 53), from more families (15 compared with 12).

Although more species will be recorded from both areas with more work it is likely that the Jelalong Estates are genuinely more diverse than the Belaga Estates at both species and family level due to a greater variety of habitats being present at the former. The proportion of forest species found in both areas is similar (58% from Jelalong East compared with 55% at Belaga) but a greater proportion of the species found at Jelalong East are endemic to Borneo than at Belaga (32% compared with 17%), this largely reflects the presence of more steep, forested terrain at Jelalong East (endemicity is higher for Odonata in such terrain than in lower gradient landscapes in Borneo). In total 86 species of Odonata have been recorded from the Jelalong East and Belaga Estates, of which 38 (ca. 44%) were found in both areas, 33 (ca. 38%) only at Jelalong East and 15 (ca. 17%) only at Belaga.

| | Species | Families | Forest species | Endemic species | Species of conservation concern |
|------------------|---------|----------|-------------------|--------------------|---------------------------------------|
| Jelalong East | 71 | 15 | 41 (58%) | 23 (32%) | 5 |
| Belaga | 53 | 12 | 29 (55%) | 13 (17%) | 4 |

| Table 6: (| Comparison | of results | from Jelalo | ng East with | the Belaga | Estates. |
|------------|------------|------------|-------------|--------------|--------------|----------|
| Table 0. | Comparison | or results | | ig Dast with | i the Delaga | Locaco. |

In the report on the Belaga Estates it was mentioned that there were some surprising gaps in the odonatan fauna that has already been found in the area, most notably the lack of any member of the Devadattidae and of *Euphaea subcostalis*. These gaps were not found in Jelalong East, where *Euphaea subcostalis* was found to be common and, for the Devadattidae, *Devadatta clavicauda* was found at Jelalong East 3.

Recommendations and Suggestions

In this section some recommendations and suggestions for conservation and further work in the area are given. With 71 species, 58% of which are forest-dependent and 32% of which are endemic to Borneo, the HCVF and riparian buffers already in place at the Jelalong East Estates appear to be doing a good job of maintain odonata diversity in the area, however a caveat should be added here – we have no data from prior to the establishment of the estates so can only guess what the true odonata diversity was prior to clearance of forest and planting of Oil Palm.

- Any expansion of the riparian buffers and HCVF is obviously desirable from a conservation perspective.
- In particular the riparian buffer at location 4 (Sungai Merurong) is relatively adequate but need improvement, with Oil Palm clearly visible from the stream. It is recommended to expand and protect this buffer by or at any cost, at the end of the current rotation, and to simply not clearing the Oil Palm for some distance around the stream, and ceasing treatments of the understorey in this section (native tree species could also be planted). The same is true to some extent for parts of the riparian buffer at location 6 and probably at other locations not yet visited.

- Further surveying is highly desirable to develop a more complete inventory (see the last section). Although the HCVF and riparian buffers are the priorities for such surveys, more work is also needed within the Oil Palm, for comparison purposes. In particular, from locations already visited, the following stand out as in need of further sampling: o Location 2 (Sungai Jugam) above the Jugam Waterfall likely to prove to be species rich with further work.
 - Location 3 and the surrounding HCVF this area was visited too early in the day to find most of the Odonata likely to be present in the habitats there, so this area can hardly be considered to have been surveyed at all.
 - Location 7 (upper Sungai Enyang) and the upper part of location 6 (Sungai Enyang), above the Oil Palm this area has already proved species rich and is likely to prove to be very species rich with more work.

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References

IUCN, 2012. IUCN Red List Categories and Criteria: Version 3.1. Second edition. Gland, Switzerland and Cambridge, UK: IUCN. iv + 32pp.

| Name | English Name |
|-----------------------------|---------------------------|
| Lestes praemorsus decipiens | Scalloped Spreadwing |
| Drepanosticta actaeon | Interior Shadowdamsel |
| Drepanosticta attala | Arboreal Shadowdamsel |
| Drepanosticta rufostigma | Common Shadowdamsel |
| Drepanosticta versicolor | Long-spined Shadowdamsel |
| Telosticta longigaster | Short-winged Shadowdamsel |
| Dysphaea dimidiata | Black Velvetwing |
| Euphaea impar | Dark-tipped Satinwing |
| Euphaea subcostalis | Vexatious Gossamerwing |
| Rhinagrion borneense | Bornean Signaltail |
| Devadatta clavicauda | Club-tipped Grisette |
| Podolestes orientalis | Common Phantom |
| Neurobasis longipes | Long-legged Metalwing |
| Vestalis amoena | Delightful Flashwing |
| Vestalis atropha | Withered-tailed Flashwing |
| Heliocypha biseriata | Window-winged Jewel |
| Libellago semiopaca | Flagged Gem |
| Rhinocypha aurofulgens | Azure Jewel |
| Coeliccia borneensis | Painted Sylvan |
| Coeliccia cyaneothorax | Blue-backed Sylvan |
| Coeliccia nigrohamata | Hook-marked Sylvan |
| Copera vittata | Variable Featherlegs |
| Prodasineura dorsalis | Golden-backed Threadtail |
| Prodasineura hyperythra | White-Lipped Threadtail |
| Prodasineura verticalis | Red-striped Threadtail |
| Agriocnemis femina | White-backed Wisp |
| Ceriagrion cerinorubellum | Painted Coraltail |
| Ischnura senegalensis | Common Bluetail |
| Pseudagrion lalakense | Bornean Sprite |
| Pseudagrion microcephalum | Blue Sprite |
| Pseudagrion perfuscatum | Red-faced Sprite |
| Stenagrion dubium | Bornean Shortleg |
| Xiphiagrion cyanomelas | Cyan Lancet |
| Anax guttatus | Pale-spotted Emperor |
| Anax panybeus | T-spot Emperor |
| Heliogomphus borneensis | Bornean Grappletail |
| Ictinogomphus decoratus | Common Flangetail |
| Megalogomphus borneensis | Bornean Sabretail |

Appendix: English Names

| Microgomphus chelifer | Sunda Scissortail |
|-----------------------------|--------------------------|
| Macromia corycia | Bornean Cruiser |
| Macromidia fulva | Bornean Shadeshifter |
| Acisoma panorpoides | Asian Pintail |
| Brachydiplax chalybea | Blue Lieutenant |
| Camacinia gigantea | Red-winged Sultan |
| Cratilla lineata | Pale-faced Forestskimmer |
| Cratilla metallica | Dark-faced Forestskimmer |
| Diplacodes trivialis | Blue Percher |
| Lyriothemis biappendiculata | Seepage Bombardier |
| Nannophya pygmaea | Scarlet Pygmy |
| Neurothemis fluctuans | Lesser Red Parasol |
| Neurothemis ramburii | Rambur's Parasol |
| Onychothemis coccinea | Orange Riverdarter |
| Onychothemis culminicola | Widespread Riverdarter |
| Orchithemis pulcherrima | Variable Sentinel |
| Orthetrum chrysis | Tufted Skimmer |
| Orthetrum glaucum | Blue Skimmer |
| Orthetrum sabina | Variegated Green Skimmer |
| Orthetrum schneideri | Pink Skimmer |
| Orthetrum testaceum | Fiery Skimmer |
| Pantala flavescens | Wandering Glider |
| Phyllothemis raymondi | Raymond's Junglewatcher |
| Rhyothemis obsolescens | Bronzy Flutterer |
| Rhyothemis triangularis | Blue-based Flutterer |
| Tholymis tillarga | Red Duskskimmer |
| Tramea sp. cf virginia | Enigmatic Glider |
| Trithemis aurora | Pink Dropwing |
| Trithemis festiva | Indigo Dropwing |
| Tyriobapta laidlawi | Stream Treehugger |
| Tyriobapta torrida | Common Treehugger |
| Urothemis signata insignata | Scarlet Basker |
| Zygonyx ida errans | Bornean Cascader |

 Table 7: English names for Odonata species collected in the Jelalong East area in 2024.

Appendix 2: Photographs of selected species

All photographs are by the author.



Photo 1: Lestes praemorsus decipiens male.



Photo 2: Telosticta longigaster male.



Photo 3: Dysphaea dimidiata male.



Photo 4: *Rhinocypha aurofulgens* male.



Photo 5: Coeliccia cyaneothorax male.



Photo 6: Stenagrion dubium male.



Photo 7: Anax guttatus male.



Photo 8: Megalogomphus borneensis male.



Photo 9: Camacinia gigantea male.



Photo 10: *Phyllothemis raymondi* male.



Photo 11: Tramea sp. cf virginia male.

Appendices:









ODONATA (DRAGONFLIES AND DAMSELFLIES) OF THE GPSB, JELALONG EAST OIL PALM PLANTATION AREA, SEBAUH, BINTULU DIVISION, DECEMBER 2024. 25. 26. Agriocnemis femina (Brauer, 1868) Prodasineura verticalis (Selys, 1860) Agriocnemis femina (Brauer, 1868) Prodasineura verticalis (Selys, 1860) 28. 27.

Ischnura senegalensis (Rambur, 1842)

Ischnura senegalensis (Rambur, 1842)



Pseudagrion lalakense (Orr & van Tol, 2001)

Ceriagrion cerinorubellum (Brauer, 1865)

Ceriagrion cerinorubellum (Brauer, 1865)

29.

Pseudagrion microcephalum (Rambur, 1842)













