

SURVEY OF BUTTERFLY SPECIES (LEPIDOPTERA: RHOPALOCERA) IN CROCKER RANGE NATIONAL PARK, SABAH, MALAYSIA

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ABSTRACT

A comprehensive checklist of butterflies in Crocker Range Park is presented, documenting 331 species belonging to 158 genera and six families, including 25 species endemic to Borneo. The checklist was compiled based on fieldwork data collected between 2010 and 2019 using baited traps and aerial netting methods. This study provides updated information on the butterfly fauna of Crocker Range Park and highlights the importance of the park as a key biodiversity area in Borneo. The compiled checklist serves as a valuable reference for future biodiversity assessments, monitoring programmes, and conservation management of butterfly diversity in the region.

Keywords: Crocker Range Park; butterflies; checklist; Borneo

ABSTRAK

Satu senarai semak komprehensif kupu-kupu di Taman Banjaran Crocker dibentangkan dalam kajian ini, dengan merekodkan sebanyak 331 spesies yang tergolong dalam 158 genera dan enam famili, termasuk 25 spesies yang endemik kepada Borneo. Senarai semak ini dikompilasi berdasarkan data kerja lapangan yang dikumpulkan antara tahun 2010 hingga 2019 menggunakan kaedah perangkap berumpan dan jaring udara. Kajian ini menyediakan maklumat terkini mengenai fauna kupu-kupu di Taman Banjaran Crocker serta menyerlahkan kepentingan taman ini sebagai kawasan biodiversiti utama di Borneo. Senarai semak yang dikompilasi ini berfungsi sebagai rujukan penting untuk penilaian biodiversiti pada masa hadapan, program pemantauan, dan pengurusan pemuliharaan kepelbagaian kupu-kupu di rantau ini.

Kata kunci: Taman Banjaran Crocker; kupu-kupu; senarai semak; Borneo

INTRODUCTION

Located on Borneo, the third largest island in the world, Crocker Range is a highland area that runs roughly parallel to the west coast of Sabah, a Malaysian state. The elevation ranges from 100 m to 2050 m a.s.l. at the peak of Mount Alab. Crocker Range Park (CRP) (latitude 5°07' to 5°56'N and longitude 115°50' to 116°28'E) was established in 1984 under the management of Sabah Parks. The park was initially designated as a Forest Reserve under the Forest Ordinance in 1969 but was subsequently converted into a State Park in 1984 for the conservation of natural resources and ecosystems under the jurisdiction of the Sabah Parks Trustees (Usui et al. 2006). It is the largest terrestrial state park, covering an area of 139,919 ha, approximately twice the size of Singapore (Sabah Parks 2023), and serves as an important water catchment area. CRP has become more accessible following the establishment of seven substations within the park between 2003 and 2005. In June 2014, Crocker Range was designated as a UNESCO Biosphere Reserve, comprising the entire area of CRP and three forest reserves within the range (Yoh et al. 2020).

Situated approximately 10 km from Kinabalu Park, CRP encompasses a variety of ecosystems ranging from lowland to upper montane forests. The elevation range of 100 m to 2050 m a.s.l. provides diverse environments and resources that support a high diversity of flora and fauna. Several diversity studies and surveys have been conducted on fauna and flora in CRP, including mammals (Tuen et al. 2002), birds (Rahman et al. 2002), anurans (Kueh & Maryati 2005), trees (Repin et al. 2012), mosses (Suleiman et al. 2017), bats (Lok et al. 2021), as well as the discovery of new gecko species (Das et al. 2008).

Approximately 20,000 butterfly species have been described worldwide (New 2014), with about 939 species occurring in Borneo (Abang 2006). Butterflies are characterised as terrestrial, diurnal, and holometabolous insects. Their presence is highly correlated with environmental factors such as temperature, relative humidity, sunlight intensity (Islam et al. 2013), and food resource availability (Hasan et al. 2018). Butterflies can be divided into two feeding guilds, namely fruit-feeding and nectar-feeding guilds (Krenn 2008; Salma et al. 2021). The fruit-feeding guild consists mainly of species from the family Nymphalidae, whereas other families are generally considered part of the nectar-feeding guild (Salma et al. 2021). Butterflies are not only recognised for their aesthetic value due to their attractive appearance but also play important ecological roles as pollinators in various ecosystems. Furthermore, their high sensitivity to subtle environmental changes makes them excellent biological indicators for environmental assessment (Syarina et al. 2024). They have been widely used in monitoring habitat quality and predicting the impacts of climate change. Wan Chik and Mustaffa (2022) reported 187 butterfly species from CRP based on a diversity study conducted in five substations. Their study highlighted the altitudinal pattern of butterfly species distribution across different elevations within the park. This information is important for understanding how tropical butterflies respond to variations in humidity and temperature in tropical forests and provides baseline data for further monitoring of elevational range shifts, which remain understudied in many tropical regions.

This paper presents comprehensive information on butterfly species recorded in CRP based on an extensive dataset compiled over nine years from six out of seven substations. The compiled information can serve as a reference for monitoring population fluctuations of butterfly species and may support appropriate conservation management strategies in the park.

In particular, it provides valuable information on potential bioindicator species that may assist in understanding the impacts of global warming on tropical butterflies and, indirectly, other insect groups.

MATERIALS AND METHODS

Study Site

The butterfly checklist presented in this paper was based on field collections conducted at six substations of Crocker Range Park (Figure 1), namely Ulu Senagang, Inobong, Ulu Kimanis, Keningau, Mahua, and Mount Alab substations. These substations are located at elevations ranging from 400 m to 1900 m a.s.l. (Table 1). The samples were collected between 2010 and 2019 during different sampling occasions. Some of the data have been previously published. For example, Takizawa et al. (2012) recorded butterfly species from Ulu Senagang substation, whereas Wan Chik and Mustaffa (2022) documented butterfly species from five substations, namely Inobong, Ulu Kimanis, Keningau, Mahua, and Mount Alab. A significant amount of additional data was contributed by Mr N. Yamada, who participated in several butterfly surveys in CRP, with most of the data remaining unpublished. Therefore, this paper aims to compile all scattered information into a single comprehensive checklist.

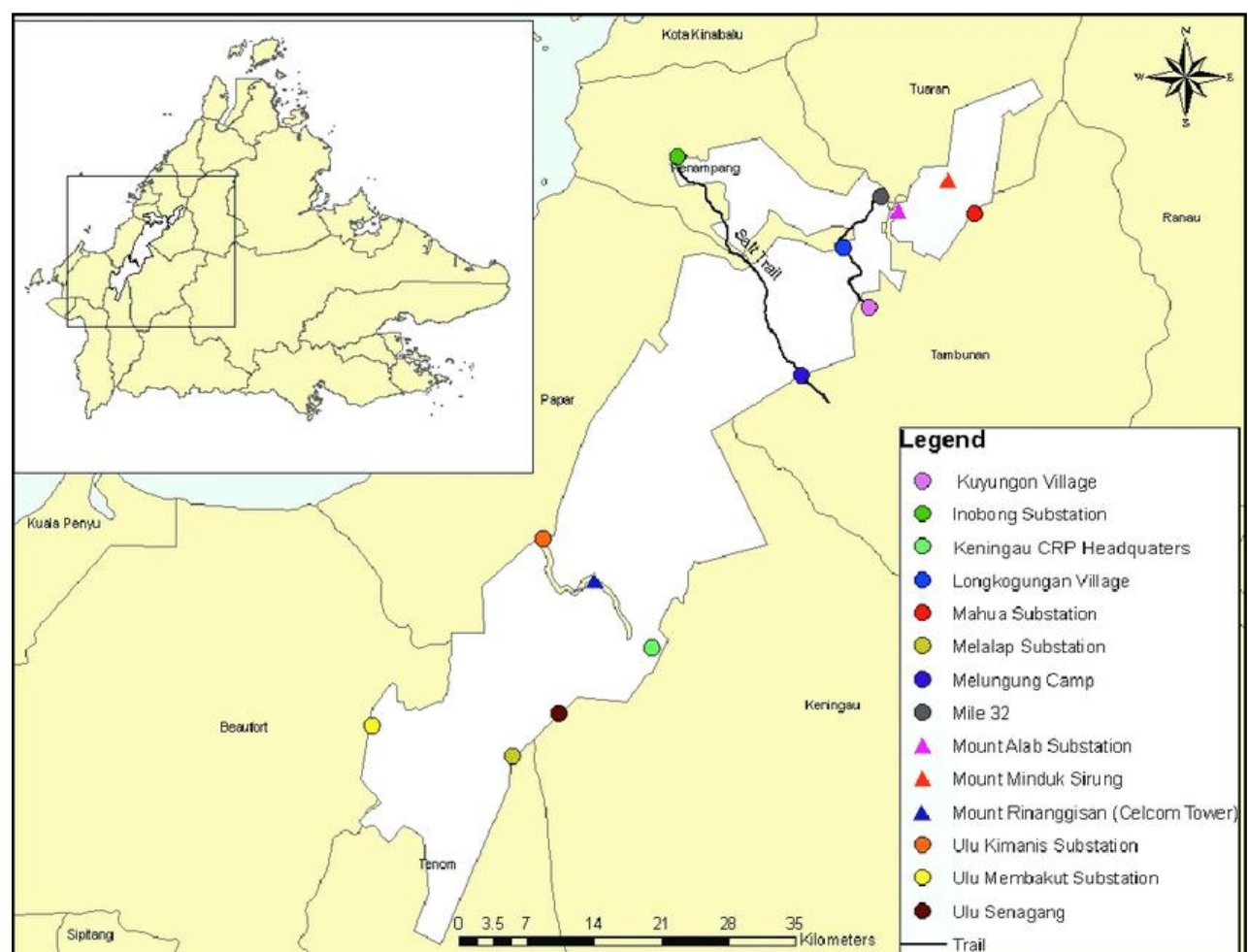


Figure 1. Map of Crocker Range Park and substations

(Source: Suleiman et al. 2017)

Table 1. Elevations of each of the substation

Substation	(Elevation, m a.s.l.)
Inobong	396-533
Ulu Senagang	400-800
Ulu Kimanis	568-713
Keningau	965-1062
Mahua	1060-1249
Mount Alab	1784-1891

Butterfly Sampling

The butterflies were sampled using aerial netting and fruit baited trap techniques. The baited traps were used to collect the fruit-feeding guild, whose members mostly belong to the family Nymphalidae. Twenty traps were baited with ripe bananas and set up along a 1 km transect at approximately 100m interval, and left to operate for overnights. This method was carried out between April to December 2019 and involved 20 trapping days and nights at each substation, except for the Ulu Senagang Substation. Some of the species are considered as crepuscular which they are active at dawn and dusk and can only be sampled by using baited traps. The aerial netting technique was employed for sampling mostly the nectar feeding guild as well as some members of Nymphalidae. The netting activities were conducted from around 8.00am to 2.00pm around the forested area at the substations.

RESULTS AND DISCUSSION

Overall, there were 331 species recorded from Crocker Range Park. Nymphalidae was the dominant family with 141 species (42%) of the total species sampled. It is commonly reported in many butterfly studies that this family is dominant due to their adaptation to a wide variety of habitats (Khyade et al. 2018). Lycaenidae was represented by 87 species, followed by Hesperidae (41 species), Pieridae (31 species), Papilionidae (24 species) and Riodinidae (7 species). CRP also harbours a significant number of butterfly endemic species, with 25 species accounting for 30.9% of the overall 81 endemic species recorded in Borneo (Gohun et al. 2021). The species were mostly found at Mahua and Mount Alab substations.

Butterflies are important pollinators in natural ecosystems, ensuring sustainability of many resources mainly the flora. Major threats to butterflies include habitat fragmentation and habitat loss, due to urban development and agriculture expansion, as well as climate change. Not much is known regarding the conservation status of many species of Bornean butterflies. *Troides andromache*, or commonly known as Kinabalu Birdwing, is endemic to Borneo and occupies a niche in the highlands of Borneo. Kinabalu Park is known to be the habitat of a large population of *T. andromache* (Sutton et al. 2021). This species was recorded from two of the substations at CRP (Keningau and Mahua substations) at elevation ranges from approximately 900 m to 1300m a.s.l. The population of *T. andromache* is declining based on observation and sighting at Kinabalu Park and the IUCN Red List Conservation status of this species is Near Threatened (Collins & Morris 1985; Sutton et al. 2021). It is believed that the populations in Kinabalu Park are facing threats due to habitat loss caused by anthropogenic disturbances, including tourism activities and land conversion (Sutton et al. 2021). IUCN has listed monarch butterflies as Endangered due to habitat loss (IUCN 2022). According to Miuse and Kamlun (2019), the spatial information based on 28 years spatial changes in CRP, the information they obtained is alarming especially with the continuous decline of primary forest that is associated with land conversion and surrounding area associated with natural and anthropogenic activities.

Trogonoptera brookiana, commonly known as the Rajah Brooke's Birdwing, is a large, black, and metallic green butterfly that has become a national icon in Malaysia. This iconic butterfly species is facing heavy commercial exploitation and habitat loss (Phon et al. 2017). The IUCN conservation status of this species is Near Threatened in Peninsular Malaysia, based on the adapted Malaysian IUCN criteria. Between 1987 and 2005, the total reported export trade for this species in Malaysia was 22,091 individuals, with most specimens collected from the wild. However, between 2001 and 2010, the total reported export trade of wild specimens decreased to 5,060 individuals. This species was recorded from four of the substations (Ulu Kimanis, Keningau, Mahua and Ulu Senagang substations). Among other species that were listed as protected species under Wildlife Conservation Act 2010 [Act 716] are *Trogonoptera brookiana*, *Idea stollii*, *Zeuxidia aurelius*, *Agatasa calydonia*, and *Prothoe franckii*. These species are vulnerable to illegal trade because of their great aesthetic appeal, and some had been harvested and exported globally (Collins & Morris 1985; UNEP-WCMC 2012).

CRP can be considered as a highly valuable habitat for many species of butterflies. Ulu Senagang Substation was profoundly high in the number of butterfly species recorded, followed by Mahua Substation (Table 2). Ulu Senagang Substation is identified as Community Use Zone (CUZ), which jointly managed by Sabah Parks and the local communities, with a mixed landscape of old logged-over forest, secondary forest and mixed-crop plantation. High butterfly species richness in the area can be explained by various resources available for many butterfly species. On the other hand, Mahua Substation is solely managed by Sabah Parks, characterised by high vegetation density which consists of secondary to lower montane forests (Zaini et al. 2012). It is also well known as a recreational site with nature attractions including a waterfall and a hiking trail. The butterfly assemblage at the substation composed of many forest dependent species and a significant number of endemic species, which reflects high conservation value of the area. A strategic management plan is important to conserve the biodiversity in the park, which was also proposed as a tourism centre for nature-based healing (Mu 2022). In recent years, ecotourism has been a driving force for conservation efforts for butterflies in some areas. A long-term monitoring program is needed to understand seasonality and long-term population changes. The information gained from such a monitoring program would support conservation efforts of butterfly diversity as well as other fauna of CRP.

Table 2. Butterfly species checklist of CRP: Species present at the substation is marked with the slash (/) and the endemic species is denoted with an asterisk (*)

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
1	Nymphalidae	<i>Agatasa calydonia</i> Fruhstorfer 1913	/					
2		<i>Amathusia ochraceofusca</i> Honrath 1888			/			
3		<i>Amathusia phidippus</i> Linnaeus 1763	/		/			
4		<i>Amathusia schoenbergi</i> Honrath 1888	/					
5		<i>Amathuxidia amythaon</i> Butler 1869	/	/		/		
6		<i>Amnosia decora</i> Fruhstorfer 1908	/		/	/		/
7		<i>Anosia genutia</i> Moore 1883						/
8		<i>Anosia melanippus</i> Hübner 1816						/
9		<i>Athyma assa</i> Tsukada & Kaneko 1985						/
10		<i>Athyma asura</i> Moore 1858	/					
11		<i>Athyma cama</i> Staudinger 1892				/	/	
12		<i>Athyma kanwa</i> Moore 1858		/				
13		<i>Athyma larymna</i> Fruhstorfer 1898				/		
14		<i>Athyma nefie</i> Moore 1858	/		/			
15		<i>Athyma selenophora</i> Druce 1873				/		
16		<i>Bassarona dunya</i> Fruhstorfer 1913			/	/		/
17		<i>Bassarona teuta</i> Distant 1886		/		/		
18		<i>Chethosia biblis</i> Fruhstorfer 1899				/		
19		<i>Cethosia hypsea</i> Doubleday 1847		/		/		
20		<i>Charaxes bernardus</i> Butler 1869	/			/		/
21		<i>Chersonesia peraka</i> Distant 1884	/	/		/		
22		<i>Chersonesia rahria</i> Moore 1857				/		/
23		<i>Chersonesia risa</i> De Nicéville 1893				/		
24		<i>Cirrochroa emalea</i> Guerin Meneville 1843		/				
25		<i>Cirrochroa orissa</i> C. & R. Felder 1860			/		/	
26		<i>Cirrochroa tyche</i> Fruhstorfer 1905			/			
27		<i>Coelites epiminthia</i> Westwood 1851			/			
28		<i>Coelites euptychioides</i> C. & R. Felder 1867		/				
29		<i>Cupha erymanthis</i> Drury 1773		/	/	/		/
30		<i>Cynitia cocytina</i> Horsfield 1829				/		
31		<i>Cyrestis cocles</i> Butler 1865			/			/
32		<i>Cyrestis maenalis</i> Grose Smith 1889				/		
33		<i>Cyrestis nivea</i> Martin 1903				/		/

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
34		<i>Discophora necho</i> C. & R. Felder 1867			/			/
35		<i>Dichorragia nesimachus</i> Fruhstorfer 1903		/				
36		<i>Doleschallia bisaltide</i> Fruhstorfer 1899						/
37		<i>Dophla evelina</i> Fruhstorfer 1913	/		/			/
38		<i>Elymnias nesaea</i> Fruhstorfer 1902	/	/	/			
39		<i>Elymnias panthera</i> Staudinger 1889			/			
40		<i>Elymnias pellucida</i> * Fruhstorfer 1909				/	/	
41		<i>Erites elegans</i> Butler 1868			/			/
42		<i>Euploea algea</i> Druce 1873		/				
43		<i>Euploea camaralzeman</i> Butler 1878		/	/	/	/	
44		<i>Euploea crameri</i> Lucas 1853						/
45		<i>Euploea diocletianus</i> Butler 1878		/			/	
46		<i>Euploea eyndhovii</i> Bryk 1937				/		
47		<i>Euploea mulciber</i> Fruhstorfer 1904		/		/	/	/
48		<i>Euploea phaenareta</i> Moore 1883				/		/
49		<i>Euploea sylvester</i> Moore 1883			/			
50		<i>Euploea tulliolus</i> Moore 1883		/	/			/
51		<i>Euripus nyctelius</i> Distant & Pryer, 1878		/		/		/
52		<i>Euthalia iapis</i> Moore 1858	/		/	/		/
53		<i>Euthalia godarti</i> Butler 1868	/					
54		<i>Euthalia monina</i> Vollenhoeven 1862			/	/		
55		<i>Euthalia tinna</i> Fruhstorfer 1906				/		
56		<i>Faunis canens</i> Fruhstorfer 1905				/		
57		<i>Faunis kirata</i> De Nicéville 1891			/			
58		<i>Faunis gracilis</i> Butler 1867				/		/
59		<i>Faunis stomphax</i> Westwood 1858			/	/		/
60		<i>Herona sumatrana</i> Staudinger 1980		/				
61		<i>Hypolimnas anomala</i> Wallace 1869						/
62		<i>Hypolimnas bolina</i> Butler 1874			/			/
63		<i>Idea stolli</i> Fruhstorfer 1903	/			/		
64		<i>Ideopsis gaura</i> Boisduval 1836						/
65		<i>Ideopsis vulgaris</i> Fruhstorfer 1910	/	/	/	/		/
66		<i>Junonia almana</i> Linnaeus 1758						/
67		<i>Junonia atlites</i> Linnaeus 1763						/
68		<i>Junonia hedonia</i> Cramer 1775						/

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
69		<i>Junonia iphita</i> Staudinger 1889				/		/
70		<i>Junonia orithya</i> Fruhstorfer 1905						/
71		<i>Kallima limborgi</i> Moore 1879			/	/		
72		<i>Kaniska canace</i> Fruhstorfer 1912		/			/	
73		<i>Lebadea martha</i> Moore 1858	/					/
74		<i>Lethe darena</i> Staudinger 1897					/	
75		<i>Lethe dora</i> Staudinger 1897			/			
76		<i>Lethe europa</i> Aoki & Uemura 1982			/	/	/	
77		<i>Lethe perimede</i> * Staudinger 1897					/	
78		<i>Lexias dirtea</i> Fruhstorfer 1913				/		
79		<i>Lexias pardalis</i> Corbet 1941			/	/		
80		<i>Libythea myrrha</i> Fruhstorfer 1914		/		/	/	
81		<i>Melanitis leda</i> Linnaeus 1758	/	/	/			/
82		<i>Melanitis zitenius</i> Fruhstorfer 1908			/			
83		<i>Moduza procis</i> Fruhstorfer 1896				/		/
84		<i>Mycalesis amoena</i> * Druce 1873			/	/		
85		<i>Mycalesis anapita</i> Fruhstorfer 1911		/				/
86		<i>Mycalesis fusca</i> Fruhstorfer 1906	/	/				/
87		<i>Mycalesis horsfieldi</i> Fruhstorfer 1908	/		/			/
88		<i>Mycalesis janardana</i> Fruhstorfer 1908			/	/		/
89		<i>Mycalesis kina</i> * Staudinger 1892		/		/		
90		<i>Mycalesis maianeas</i> Aoki & Uemura 1982	/	/	/			
91		<i>Mycalesis marginata</i> Staudinger 1896		/		/	/	
92		<i>Mycalesis mineus</i> Fruhstorfer 1911						/
93		<i>Mycalesis oroatis</i> Hewitson 1864			/			
94		<i>Mycalesis orseis</i> Fruhstorfer 1906	/	/	/	/		/
95		<i>Neorina lowii</i> Doubleday 1849			/	/		/
96		<i>Neptis clinia</i> Fruhstorfer 1908			/			/
97		<i>Neptis anjana</i> Fruhstorfer 1908				/		
98		<i>Neptis duryodana</i> Moore 1858			/			
99		<i>Neptis hylas</i> Fruhstorfer 1907				/		/
100		<i>Neptis leucoporus</i> Fruhstorfer 1908	/	/				
101		<i>Pantoporia hordonia</i> Eliot 1969	/					
102		<i>Pantoporia paraka</i> Butler 1879	/	/				
103	<i>Parantica aspasia</i> Fabricius 1787	/		/	/		/	

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
104		<i>Parantica crowleyi</i> *Jenner-Weir 1894				/	/	
105		<i>Parantica luzonensis</i> Fruhstorfer 1899		/	/		/	
106		<i>Parthenos sylvia</i> Staudinger 1889	/					/
107		<i>Polyura athamas</i> Rothschild & Jordan 1890						/
108		<i>Polyura moori</i> Preyer & Cator 1894						/
109		<i>Polyura schreiber</i> Rothschild 1899		/				
110		<i>Prothoe franckii</i> Fruhstorfer 1913	/			/		
111		<i>Ptychandra talboti</i> * Hobby 1940		/				
112		<i>Ragadia annulate</i> * Grose-Smith 1887				/		
113		<i>Ragadia makuta</i> Fruhstorfer 1911	/	/	/	/		/
114		<i>Rhinopalpa polynice</i> Fruhstorfer 1912		/				
115		<i>Rohana nakura</i> Moore 1857				/		
116		<i>Rohana parisatis</i> Fruhstorfer 1905			/	/		
117		<i>Stibochiona schoenbergi</i> * Honrath 1889	/		/	/		
118		<i>Sumalia agneya</i> Dohertyi 1891				/		
119		<i>Sumalia daraxa</i> Fruhstorfer 1899		/				
120		<i>Symbrenthia hypselis</i> Staudinger 1896				/		
121		<i>Taenaris horsfieldii</i> Grose-Smith 1889			/	/		/
122		<i>Tanaecia amisa</i> * Grose-Smith 1889					/	
123		<i>Tanaecia munda</i> Fruhstorfer 1899						
124		<i>Tanaecia orphne</i> * Butler 1870		/				
125		<i>Tanaecia pelea</i> Fruhstorfer 1913		/				/
126		<i>Terinos atlita</i> Butler 1869		/				/
127		<i>Terinos clarissa</i> Fruhstorfer 1914		/				
128		<i>Thaumantis klugius</i> Westwood 1851			/	/		/
129		<i>Thaumantis odona</i> Fruhstorfer 1912				/		
130		<i>Thauria aliris</i> Westwood 1858			/			/
131		<i>Tirumala septentrionis</i> Butler 1874		/	/	/		/
132		<i>Vagrans sinha</i> Pryor & Cator 1894		/	/	/		/
133		<i>Vindula erota</i> Fruhstorfer 1889				/		/
134		<i>Xanthotaenia busiris</i> Stichel 1906				/		/
135		<i>Ypthima baldus</i> Fruhstorfer 1911		/	/			/
136		<i>Ypthima fasciata</i> Hewitson 1865	/	/	/	/		/
137		<i>Ypthima huebneri</i> Kirby 1871		/				
138		<i>Ypthima pandocus</i> Fruhstorfer 1911	/	/	/	/		/

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
139	Lycaenidae	<i>Zeuxidia amethystus</i> C. & R. Felder 1867	/	/		/		
140		<i>Zeuxidia aurelius</i> Fruhstorfer 1911	/	/	/	/		
141		<i>Zeuxidia doubledayi</i> C. & R. Felder 1867	/	/	/	/		
142		<i>Acytolepis puspa</i> Fruhstorfer 1917	/					
143		<i>Allotinus bidiensis</i> * Eliot 1986						/
144		<i>Allotinus fabius</i> Distant & Pryer 1887				/		
145		<i>Allotinus horsfieldi</i> Fruhstorfer 1913						/
146		<i>Ancema blanka</i> de Nicéville 1894				/		
147		<i>Araotes lapithis</i> Fruhstorfer 1912	/					
148		<i>Arhopala inornata</i> Corbet 1941	/					
149		<i>Arhopala normani</i> Eliot 1972		/				
150		<i>Arhopala epimuta</i> Moore 1858						/
151		<i>Arhopala fulla</i> Corbet 1941						/
152		<i>Arhopala moorei</i> Bethune-Baker 1896			/			
153		<i>Austrozephyrus borneanus</i> * Pendlebury 1939					/	
154		<i>Britomartis igarashii</i> H. Hayashi 1976		/				
155		<i>Caleta elna</i> Fruhstorfer 1918	/		/	/		
156		<i>Caleta manovus</i> * Fruhstorfer 1918			/			/
157		<i>Catochrysops panormus</i> Distant 1886						/
158		<i>Cebrella pellecebra</i> Chapman 191				/		
159		<i>Celastrina algernoni</i> Barlow, Banks & Holloway 1971				/	/	
160		<i>Celastrina lavendularis</i> Fruhstorfer 1917						/
161		<i>Cheritra freja</i> H.Druce 1873	/					
162		<i>Curetis felderi</i> Distant 1884	/					
163		<i>Curetis santana</i> C. & R. Felder 1865						/
164		<i>Curetis sperthis</i> C. & R. Felder 1865						/
165		<i>Curetis tagalica</i> Fruhstorfer 1908						/
166		<i>Dacalana vidura</i> Fruhstorfer 1914		/				
167		<i>Deudorix epijarbas</i> Moore 1858		/				
168		<i>Discolampa ethion</i> Fruhstorfer 1918				/		
169		<i>Drupadia ravindra</i> H.H. Druce 1895	/	/				/
170		<i>Drupadia theda</i> Fruhstorfer 1912	/		/			
171		<i>Eliotia jalindra</i> Fruhstorfer 1912					/	
172		<i>Eooxylides tharis</i> Fruhstorfer 1904	/	/	/	/		/
173		<i>Euchrysops cnejus</i> Fabricius 1798						/

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
174		<i>Flos fulgida</i> Distant 1885		/				
175		<i>Heliophorus kiana</i> * Grose-Smith 1889		/		/	/	
176		<i>Hypolycaena othona</i> H. H. Druce 1895						/
177		<i>Hypolycaena merguia</i> H. H. Druce 1895		/				
178		<i>Hypolycaena amasa</i> Fruhstorfer 1912	/			/		
179		<i>Ionolyce helicon</i> Moore 1884						/
180		<i>Iraota distanti</i> Fruhstorfer 1904			/			
181		<i>Jamides alecto</i> Fruhstorfer 1916	/		/	/		
182		<i>Jamides aratus</i> H. Druce 1873						/
183		<i>Jamides caeruleus</i> H. Druce 1873			/	/	/	/
184		<i>Jamides callistus</i> H. Hayashi 1976			/			
185		<i>Jamides celeno</i> Moulton 1911						
186		<i>Jamides philatus</i> Staudinger 1889			/			
187		<i>Jamides pura</i> Fruhstorfer 1916	/	/	/	/		/
188		<i>Jamides virgulatus</i> H. H. Druce 1895		/	/			
189		<i>Jamides zebra</i> Fruhstorfer 1916	/			/		
190		<i>Lampides boeticus</i> Linnaeus 1767						/
191		<i>Logania malayica</i> Distant 1884	/	/				
192		<i>Lycaenopsis haraldus</i> H. Druce 1873			/			
193		<i>Manto hypoleuca</i> Hewitson 1869						/
194		<i>Miletus ancon</i> H. H. Druce 1895			/			
195		<i>Miletus cellarius</i> * Fruhstrofer 1913						/
196		<i>Miletus gaetulus</i> H. H. Druce 1895		/				
197		<i>Miletus gopara</i> Fruhstorfer 1913				/		
198		<i>Miletus symethus</i> Distant & Pryer 1887						/
199		<i>Monodontides musina</i> Snellen 1892				/		
200		<i>Nacaduba angusta</i> H. Druce 1873	/					
201		<i>Nacaduba berenice</i> H. Druce 1873						/
202		<i>Nacaduba beroe</i> Fruhstorfer 1916	/					
203		<i>Nacaduba calauria</i> Corbet 1938	/					
204		<i>Nacaduba hermus</i> Corbet 1938	/					/
205		<i>Nacaduba kurava</i> Fruhstorfer 1916				/		
206		<i>Nacaduba ruselli</i> Tite 1963						/
207		<i>Nacaduba sanaya</i> Corbet 1938	/					
208		<i>Nacaduba subperusia</i> Fruhstorfer 1916						/

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
209		<i>Neopithecops zalmora</i> Toxopeus 1930		/				
210		<i>Pithecops corvus</i> Fruhstorfer 1919			/	/		
211		<i>Poritia phama</i> H. H. Druce 1895			/			
212		<i>Poritia plateni</i> Staudinger 1889				/		
213		<i>Prosotas aluta</i> H. Druce 1873						/
214		<i>Prosotas bhutea</i> Barlow, Banks & Holloway 1971				/		
215		<i>Prosotas nora</i> Fruhstorfer 1916						/
216		<i>Prosotas pia</i> Toxopeus 1929					/	
217		<i>Rapala dieneces</i> Hewitson 1878		/				
218		<i>Rapala pheretima</i> Hewitson 1863		/				
219		<i>Sinthus makikoe</i> * H. Hayashi & Otsuka 1985					/	
220		<i>Sithon nedymond</i> Fruhstorfer 1912		/				
221		<i>Spalgis epius</i> Westwood 1851			/			/
222		<i>Taraka hamada</i> Fruhstorfer 1918	/					
223		<i>Ticherra acte</i> H. H. Druce 1895				/		
224		<i>Udara dilecta</i> Fruhstorfer 1917				/	/	
225		<i>Udara placidula</i> H. H. Druce 1895				/	/	
226		<i>Udara selma</i> H. H. Druce 1895				/	/	
227		<i>Zizina otis</i> Fabricius 1787		/				
228		<i>Zizula hylax</i> Fabricius 1775						/
229	Riodinidae	<i>Abisara savitri</i> Fruhstorfer 1904	/					
230		<i>Abisara geza</i> Fruhstorfer 1912	/					
231		<i>Paralaxita damajanti</i> De Nicéville 1894		/	/	/		/
232		<i>Paralaxita orphna</i> Boisduval 1836		/	/	/		
233		<i>Paralaxita telesia</i> Fruhstorfer 1904		/				
234		<i>Zemeros emesoides</i> Fruhstorfer 1904	/		/			/
235		<i>Zemeros flegyas</i> Fruhstorfer 1912			/			
236	Pieridae	<i>Appias cardena</i> Hewitson 1861		/			/	
237		<i>Appias indra</i> Butler 1879				/		
238		<i>Appias lyncida</i> Boisduval 1836	/	/	/			/
239		<i>Appias nero</i> Fruhstorfer 1905						/
240		<i>Appias pandione</i> Grose-Smith 1887				/	/	
241		<i>Appias paulina</i> Fruhstorfer 1902		/				
242		<i>Catopsilia pomona</i> Fabricius 1775					/	/
243		<i>Catopsilia pyranthe</i> Linnaeus 1758						/

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
244	Papilionidae	<i>Catopsilia scylla</i> Fabricius 1787						/
245		<i>Cepora iudith</i> Butler 1899	/			/		/
246		<i>Cepora pactolicus</i> * Butler 1865					/	/
247		<i>Delias cinerascens</i> * Mitis 1893		/			/	
248		<i>Delias heningia</i> Wallace 1867	/	/				
249		<i>Delias hyparete</i> Fruhstorfer 1889			/			
250		<i>Delias ninus</i> Staudinger 1892		/		/		
251		<i>Dercas gobrias</i> Hewitson 1864		/				
252		<i>Eurema ada</i> Distant & Pryer 1887				/		
253		<i>Eurema andersoni</i> Shirôzu & Yata 1982						/
254		<i>Eurema blanda</i> Yata 1981				/		/
255		<i>Eurema hecabe</i> Linnaeus 1758			/			/
256		<i>Eurema lacteola</i> Distant 1886		/		/		
257		<i>Eurema nicevillei</i> Butler 1898						/
258		<i>Eurema sari</i> Moore 1886	/		/			
259		<i>Eurema simulatrix</i> De Nicéville 1895	/					/
260		<i>Gandaca harina</i> Fruhstorfer 1910		/				/
261		<i>Hebomoia glaucippe</i> Wallace 1863						/
262		<i>Leptosia nina</i> Fruhstorfer 1910	/		/			
263		<i>Ixias undatus</i> * Butler 1871						/
264		<i>Pareronia valeria</i> Butler 1879				/		
265		<i>Prioneris cornelia</i> * Vollenhoeven 1865				/		/
266		<i>Saletara panda</i> Butler 1898		/			/	
267		<i>Chilasa slateri</i> Westwood 1895						/
268		<i>Graphium agamemnon</i> Linne 1758				/		/
269		<i>Graphium bathycles</i> Honrath 1884						/
270		<i>Graphium doson</i> Honrath 1884				/		/
271		<i>Graphium empedovana</i> Corbet 1941						/
273		<i>Graphium eurypylus</i> Distant 1885						/
274	<i>Graphium evemon</i> Jordan 1909						/	
275	<i>Graphium macareus</i> Grose-Smith 1887				/			
276	<i>Graphium procles</i> * Grose-Smith 1887		/		/	/		
277	<i>Graphium saperdon</i> Linne 1758				/		/	
278	<i>Graphium stratiotes</i> * Grose-Smith 1887				/	/		
279	<i>Lamproptera curius</i> Fabricius 1787			/	/		/	

No	Family	Species	Substation					
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang
280		<i>Lamproptera meges</i> Zinken 1831				/		/
281		<i>Losaria neptunus</i> Rothschild 1908		/				
282		<i>Papilio acheron</i> * Grose-Smith 1887				/	/	
283		<i>Papilio demolion</i> Cramer 1776	/					/
284		<i>Papilio helenus</i> Doherty 1891		/		/		/
285		<i>Papilio iswara</i> C. & R. Felder 1859					/	
286		<i>Papilio memnon</i> Linne 1758					/	/
287		<i>Papilio nephelus</i> Forbes 1885			/			/
288		<i>Papilio palinurus</i> Fabricius 1787						
289		<i>Papilio polytes</i> Cramer 1779						/
290		<i>Trogonoptera brookiana</i> Wallace 1855		/	/	/		/
291		<i>Troides andromache</i> * Staudinger 1892			/	/		
292	Hesperiidae	<i>Ancistroides armatus</i> H. Druce 1873				/		
293		<i>Ancistroides gemmifer</i> Fruhstorfer 1911				/		
294		<i>Ancistroides nigrita</i> Hewitson 1878						/
295		<i>Baoris oceia</i> Hewitson 1868						/
296		<i>Bibasis sena</i> Elwes & Edwards 1897						/
297		<i>Burara etelka</i> Hewitson 1867		/				
298		<i>Burara gomata</i> Fruhstorfer 1911				/		
299		<i>Celaenorrhinus ficulnea</i> Hewitson 1868				/		
300		<i>Celaenorrhinus ladana</i> Butler 1870			/			
301		<i>Creteus cyrina</i> Evans 1949					/	
302		<i>Halpe ormenes</i> Evans 1937						/
303		<i>Halpe peletronix</i> Fruhstorfer 1910						/
304		<i>Hasora badra</i> Moore 1858		/				
305		<i>Hasora borneensis</i> Elwes & Edwards 1897		/				
306		<i>Hasora mus</i> Elwes & Edwards 1897		/			/	
307		<i>Hasora salanga</i> Plötz 1885		/				
308		<i>Hasora schoenherr</i> Hewitson 1867	/	/	/	/	/	
309		<i>Hasora taminatus</i> C. & R. Felder 1860		/		/		
310		<i>Hasora vitta</i> Butler 1870		/		/	/	
311		<i>Iambrix stellifer</i> Butler 1879						/
312		<i>Isma feralia</i> Elwes & Edwards 1897			/			
313		<i>Iton semamora</i> Hewitson 1866						/
314		<i>Koruthaialos frena</i> Evans 1949				/		

No	Family	Species	Substation						
			Inobong	Ulu Kimanis	Keningau	Mahua	Mount Alab	Ulu Senagang	
315		<i>Koruthaialos rubecula</i> Plötz 1882			/		/		
316		<i>Matapa aria</i> Moore 1866			/				
317		<i>Matapa druna</i> Moore 1866					/		
318		<i>Notocrypta paralysos</i> Plötz 1882				/			
319		<i>Odontoptilum pygela</i> Hewitson 1868				/			
320		<i>Oriens gora/gola</i> Mabilie 1883					/		
321		<i>Pelopidas conjunctus</i> Herrich- Schäffer 1869				/	/		
322		<i>Potanthus ganda</i> Evans 1949					/		
323		<i>Potanthus trachala</i> Elwes & Edwards 1897			/				
324		<i>Quedara monteithi</i> Wood-Mason & de Nicéville 1887			/				
325		<i>Pseudocoladenia dan</i> Fabricius 1787				/	/		
326		<i>Psolos fuligo</i> Mabilie 1876					/		
327		<i>Tagiades gana</i> Moore 1866					/		
328		<i>Tagiades japetus</i> Fruhstorfer 1910					/		
329		<i>Tagiades lavatus</i> Butler 1879				/			
330		<i>Telicota besta</i> Evans 1949		/					
331		<i>Telicota santa</i> * Evans 1934					/		
Total			65	92	91	127	41	140	

CONCLUSIONS

The information presented in this paper provides an important baseline dataset for future monitoring of butterfly fauna in Crocker Range Park. The comprehensive checklist enhances our understanding of butterfly diversity in the park and serves as a valuable reference for biodiversity assessments, conservation planning, and long-term monitoring programmes. Given the ecological importance of Crocker Range Park as a habitat supporting diverse flora and fauna, continued surveys and monitoring are essential to assess changes in butterfly communities and their responses to environmental changes.

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AUTHORS DECLARATIONS

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Conflict of Interest

The authors declared they have no conflict of interest.

Ethics Declarations

No ethical issue required for this study.

Data Availability Statements

Sources of all data have been appropriately cited in the text and reference list. Further details, if required, are available from the corresponding author upon reasonable request.

Author's Contributions

Nazirah Mustaffa (NM) was responsible for the overall project management including the data collection, data compilation and manuscript preparation. Haruo Takizawa (HT) contributed in data collection and reviewed the manuscript. Mahadimenakbar Mohamed Dawood (MMD) and Megan English (ME) contributed to conceptualization, review and editing the manuscript.

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