





**FANLING GOLF COURSE –  
PROVISION OF ECOLOGICAL CONSULTANCY SERVICES**

**SUMMARY OF KEY ECOLOGICAL FINDINGS**

(Issue 1)

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## 1 Introduction

- 1.1 aec Limited (aec) has been appointed by the Hong Kong Golf Club (HKGC) as ecological consultant to carry out routine ecological monitoring surveys in Fanling Golf Course (FGC) and provide relevant comments and recommendations since April 2018.
- 1.2 After a major public consultation exercise on land supply options in 2018, the Task Force on Land Supply (TFLS) recommended in late 2018 that the Government to accord priority to studying and resuming the 32 ha of land of FGC east of Fan Kam Road for public housing development, among other alternative options. The Government announced in early 2019 that the eight land supply options (including the above-mentioned development of FGC) recommended by the TFLS were fully endorsed.
- 1.3 The Government also announced that the 32 ha of land of FGC east of Fan Kam Road shall be developed for housing uses (with emphasis on public housing). In 2019, the Civil Engineering and Development Department (CEDD) commissioned the technical study titled “Agreement No. CE17/2019 (CE) Technical Study on Partial Development of Fanling Golf Course Site – Feasibility Study” (the Study).
- 1.4 A statutory EIA Process has commenced as part of the Study. The EIA Study Brief (No. ESB-318/2019) was issued in July 2019. The completed EIA Report (No. EIA-282/2022) has been published and exhibited for public to comment from 20<sup>th</sup> May 2022 to 18<sup>th</sup> Jun 2022.
- 1.5 This summary aims to provide key ecological baseline data on bats, moths and night-time sky brightness obtained from recent field surveys commissioned by the HKGC. Where appropriate, results from the surveys commissioned by the HKGC are compared to those presented in the published EIA Report (No. EIA-282/2022). It is hoped that the information provided in this summary could facilitate the ongoing EIA process.

## 2 Bats

### 2.1 Survey Equipment

2.1.1 The equipment used for bat surveys conducted by aec are listed below:

Static Recorders:

- Wildlife Acoustics Song Meter SM4BAT FS Ultrasonic Recorder
- Wildlife Acoustics Song Meter SM4BAT ZC Ultrasonic Recorder

Portable hand-held Recorders:

- Wildlife Acoustics Echo Meter Touch 2 Pro Bat Detector
- Anabat Walkabout Bat Detector

### 2.2 Survey Location

2.2.1 A wide range of habitats are present in Fanling Golf Course (FGC), as different bat species rely on different foraging/roosting habitats. Habitat edges are important for bats, so surveys were conducted at interfaces between woodland/turfgrass, pond/turfgrass, and developed area/turfgrass. Wetland habitats (such as watercourses, ponds and marshes) are also a focus since some bat species (such as the Vulnerable Rickett’s Big-footed Bat) feed on fish and insects associated with waterbodies.

### 2.3 Survey Programme

2.3.1 A summary of bat surveys conducted by aec in Fanling Golf Course focusing on Sub-Areas 1 – 4 and area around the Clubhouse is provided in Table 1 below. These surveys are conducted mainly using static bat recorders and supplemented by portable hand-held recorders. The operating time for static bat recorders was from half an hour before sunset to half an hour after sunrise.

**Table 1.** A summary of bat surveys conducted by aec in Fanling Golf Course

Month	Within EIA Study Period (Nov 19 – Oct 20)	Survey Effort (No. of nights)				
		Sub-Area 1	Sub-Area 2	Sub-Area 3	Sub-Area 4	Clubhouse
July 2018	No		13			
August 2018	No		11	8		
September 2018	No		5			
October 2018	No	9				15
April 2020	Yes		9		8	
May 2020	Yes		29		4	
June 2020	Yes				19	
July 2020	Yes				16	
August 2020	Yes				14	
September 2020	Yes				16	
October 2020	Yes				9	
April 2021	No	8				
May 2021	No	41*				
September 2021	No		23			
October 2021	No	11				
<b>Total number of survey nights</b>		<b>69</b>	<b>90</b>	<b>8</b>	<b>86</b>	<b>15</b>

\* Two recorders were deployed simultaneously in some of the survey nights at different locations within Sub-Area 1

## 2.4 Results

2.4.1 Only data obtained during the wet season (from April to October) are analysed. Data collected in the dry season (between November and March) are not included in any following sections. Summaries of the findings are provided in Tables 2 and 3 below.

**Table 2.** Measurement of bat activities recorded from the surveys carried out by aec

	Sub-Area 1	Sub-Area 2	Sub-Area 3	Sub-Area 4	Clubhouse
<b>Total no. of bat detections</b>	40,745	57,552	1,758	36,681	11,235
<b>Total no. of survey nights</b>	69	90	8	86	15
<b>Average no. of bat detections per night</b>	590.5	639.5	219.7	426.5	749.0
<b>Maximum no. of bat detections per night (Date)</b>	4,827 (6 Oct 21)	1,932 (29 May 20)	422 (27 Aug 18)	3,949 (2 Apr 20)	1,544 (10 Oct 18)

**Table 3.** Species of bats recorded from the surveys carried out by aec

Species	Conservation and Protection Status <sup>1</sup>	Number of bat detections (Total and average per survey night)									
		Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4		Clubhouse	
		Total	Avg.	Total	Avg.	Total	Avg.	Total	Avg.	Total	Avg.
Chinese Horseshoe Bat <i>Rhinolophus sinicus</i>	Cap.170	1	0.01	11	0.12	-	-	146	1.70	-	-
Intermediate Horseshoe Bat <i>Rhinolophus affinis</i>	(LC); Cap.170	179	2.59	75	0.83	172	21.50	6,374	74.12	-	-
Least Horseshoe Bat <i>Rhinolophus pusillus</i>	PRC (RC); Cap.170	19	0.28	23	0.26	-	-	24	0.28	-	-
Himalayan Leaf-nosed Bat <i>Hipposideros armiger</i>	(LC); Cap.170	253	3.67	800	8.89	-	-	-	-	132	8.80
Chinese Myotis <i>Myotis chinensis</i>	(LC); RLCV(NT); Cap.170	-	-	1	0.01	-	-	-	-	-	-
Rickett's Big-footed Myotis <i>Myotis pilosus</i>	(LC); IUCN(VU); RLCV(NT); Cap.170	1	0.01	285	3.17	-	-	-	-	-	-
Chinese Noctule <i>Nyctalus plancyi</i>	PRC (RC); Cap.170	2,324	33.68	12,354	137.27	130	16.25	4,331	50.36	2012	134.13
Japanese Pipistrelle <i>Pipistrellus abramus</i>	Cap.170	14,550	210.87	10,354	115.04	-	-	-	-	-	-
Least Pipistrelle <i>Pipistrellus tenuis</i>	RLCV(NT); Cap.170	14,795	214.42	19,188	213.20	-	-	-	-	-	-
Pipistrelle Group <i>Pipistrellus</i> spp. <sup>2</sup>	-	50	0.72	5,338	59.31	616	77.00	23,003	267.48	7,861	524.07
Chinese Pipistrelle <i>Hypsugo pulveratus</i>	(LC); RLCV(NT); Cap.170	5,343	77.43	885	9.83	-	-	-	-	-	-
<b>Lesser Bamboo Bat <i>Tylonycteris pachypus</i></b>	<b>(LC); Cap.170</b>	<b>1</b>	<b>0.01</b>	<b>904</b>	<b>10.04</b>	-	-	<b>31</b>	<b>0.36</b>	<b>75</b>	<b>5.00</b>
<b>Lesser Yellow Bat <i>Scotophilus kuhlii</i></b>	<b>(LC); Cap.170</b>	<b>1,438</b>	<b>20.84</b>	<b>3,608</b>	<b>40.09</b>	<b>10</b>	<b>1.25</b>	<b>723</b>	<b>8.41</b>	<b>873</b>	<b>58.20</b>
Lesser Bent-winged Bat <i>Miniopterus pusillus</i>	(LC); RLCV(NT); Cap.170	1,791	25.96	3,627	40.30	-	-	-	-	-	-
Wrinkle-lipped Free-tailed Bat <i>Chaerephon plicatus</i>	Cap.170	-	-	99	1.10	-	-	2,049	23.83	111	7.4
<b>Short-nosed Fruit Bat <i>Cyanopterus spinx</i><sup>4</sup></b>	<b>RLCV(NT); Cap.170</b>	<b>Present</b>		-	-	-	-	-	-	<b>Present</b>	
<b>Number of bat species recorded<sup>2</sup></b>		<b>13</b>		<b>14</b>		<b>4</b>		<b>8</b>		<b>7</b>	
<b>Total number of bat species recorded</b>		<b>15</b>									

**Notes:**

- Conservation and Protection Status refers to:
  - IUCN (2022): VU = Vulnerable.
  - Fellowes *et al.* (2002): LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PG = Potential Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
  - Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT= Near Threatened.
  - Cap. 170: All wild bats species are protected under Chapter 170. Wild Animals Protection Ordinance.
- The group is not independently counted in the number of species recorded in Sub-Areas 1 and 2 as *P. abramus* and *P. tenuis* were recorded.
- Species in bold type are mentioned specifically in the EIA Study Brief.
- Not detectable by bat detector, presence or absence noted only from direct sightings and observations.

2.4.2 For easy comparison, the information regarding bat species recorded from the 12-month surveys conducted as part of the EIA Study has been extracted from the main text of the EIA Report and relevant appendices and tabulated into **Table 4** below in the same format as **Table 3**.

2.4.3 According to the EIA Report, Short-nosed Fruit Bat was also recorded, but was not from Sub-areas 1 – 4 nor from the Clubhouse area. Hence, this record is not presented below.

**Table 4. Species of bats recorded from the EIA Report (No. EIA-282/2022)**

Species	Conservation and Protection Status <sup>1</sup>	Number of bat detections (Total and average per survey night)									
		Sub-Area 1		Sub-Area 2		Sub-Area 3		Sub-Area 4		Clubhouse	
		Total	Avg.	Total	Avg.	Total	Avg.	Total	Avg.	Total	Avg.
Chinese Horseshoe Bat <i>Rhinolophus sinicus</i>	Cap.170										
Intermediate Horseshoe Bat <i>Rhinolophus affinis</i>	(LC); Cap.170										
Least Horseshoe Bat <i>Rhinolophus pusillus</i>	PRC (RC); Cap.170										
Himalayan Leaf-nosed Bat <i>Hipposideros armiger</i>	(LC); Cap.170										
Chinese Myotis <i>Myotis chinensis</i>	(LC); RLCV(NT); Cap.170										
Rickett's Big-footed Myotis <i>Myotis pilosus</i>	(LC); IUCN(VU); RLCV(NT); Cap.170										
Chinese Noctule <i>Nyctalus plancyi</i>	PRC (RC); Cap.170										
Japanese Pipistrelle <i>Pipistrellus abramus</i>	Cap.170	'Scarce' recorded at 1 location									
Least Pipistrelle <i>Pipistrellus tenuis</i>	RLCV(NT); Cap.170										
Pipistrelle Group <i>Pipistrellus spp.</i> <sup>2</sup>	-										
Chinese Pipistrelle <i>Hypsugo pulveratus</i>	(LC); RLCV(NT); Cap.170										
<b>Lesser Bamboo Bat</b> <b><i>Tylonycteris pachypus</i></b>	<b>(LC); Cap.170</b>										
<b>Lesser Yellow Bat</b> <b><i>Scotophilus kuhlii</i></b>	<b>(LC); Cap.170</b>										
Lesser Bent-winged Bat <i>Miniopterus pusillus</i>	(LC); RLCV(NT); Cap.170										
Wrinkle-lipped Free-tailed Bat <i>Chaerephon plicatus</i>	Cap.170										
<b>Short-nosed Fruit Bat</b> <b><i>Cyanopterus spinx</i></b> <sup>4</sup>	<b>RLCV(NT); Cap.170</b>										
<b>Number of bat species recorded<sup>2</sup></b>		<b>1</b>		<b>0</b>		<b>0</b>		<b>0</b>		<b>0</b>	
<b>Total number of bat species recorded</b>		<b>1</b>									

**Notes:**

- Conservation and Protection Status refers to:
    - IUCN (2022): VU = Vulnerable.
    - Fellowes *et al.* (2002): LC = Local Concern, RC = Regional Concern, PRC = Potential Regional Concern, PGC = Potential Global Concern. Letters in parentheses indicate that the assessment is on the basis of restrictedness in breeding and/or roosting sites rather than in general occurrence.
    - Red List of China's Vertebrates (RLCV) (Jiang *et al.* 2016): NT= Near Threatened.
    - Cap. 170: All wild bats species are protected under Chapter 170. Wild Animals Protection Ordinance.
  - The group is not independently counted in the number of species recorded in Sub-Areas 1 and 2 as *P. abramus* and *P. tenuis* were recorded.
  - Species in bold type are mentioned specifically in the EIA Study Brief.
- Not detectable by bat detector, presence or absence noted only from direct sightings and observations.

### 3 Moths

#### 3.1 Survey Methodology

- 3.1.1 Each individual moth survey session used 3 light traps, all with 125W mercury vapour light powered from a 2kW generator, in conjunction with either a Robinson type bucket trap or a Skinner type box trap (see Fry & Waring, 2001). A 8W LepiLED maxi light with sheet with 5mm x 5mm grids was also used as a supplement in some locations. Traps deployed were set between 50m and 100m apart from each other. Abiotic data recorded at the start and end of each session included temperature, relative humidity, wind direction, average wind speed and gusts (using Beaufort scale) and cloud cover. Moon phase and ground conditions (how dry or wet) were noted.
- 3.1.2 Each recording duration began from dusk and ended at 23:45, by when all three traps' contents counted and processed. The contents of each trap was documented on a digital voice recorder. Most species recorded were photographed on site, with voucher material retained for some species that were not readily identified in situ. The voucher material retained have been deposited at the fauna collections of Kadoorie Farm & Botanic Garden (KFBG).
- 3.1.3 Species recorded from the surveys were identified with reference to the followings: (1) Moth collections of KFBG (including those obtained during Dr. Roger Kendrick's PhD studies data (see Kendrick 2002) and subsequent voucher material from 2002 to present), Natural History Museum, UK, and Nankai University; (2) books covering the moth fauna of Borneo, Taiwan, China, Nepal, Japan and Thailand; and (3) peer-reviewed literature for moths of the Oriental Region as will be referenced in Kendrick (*in prep.*), An Illustrated Guide to the Moths of Hong Kong, Hong Kong Lepidopterists' Society, Tuen Mun; ~1000pp & ~100 plates.
- 3.1.4 It should be highlighted that there are no published IUCN assessments for any of Hong Kong's moths. Other conservation assessment for moths in the region is also scarce. Therefore, consideration of conservation status of moth species (for both local and global context) is based upon the assessments done for the 2016 BSAP process and expanded for the Illustrated Guide to HK Moths, as undertaken on the HK Moth Recording Database (database available on iNaturalist). Each recorded species was assessed for its local status (including local distribution and commonness). Where significant, conservation importance at a global context was evaluated following IUCN (2001) criteria, as well as its distribution in Hong Kong: widespread, local, or restricted (Kendrick 2002). Provisional IUCN Red List ratings are given to species in accordance with the IUCN Red List Criteria.

#### 3.2 Survey Dates

- 3.2.1 Surveys were conducted in 2018 and 2020. In the 2018 surveys, moth recording took place during the middle of wet season, whereas in 2020 recording took place near the start and end of the wet season, the latter periods are considered to be the most favourable for surveying adult moths in Hong Kong (Kendrick, 2002). Survey dates were targeted to avoid dates at or near full moon (+/- 4 days) and to avoid weather with heavy rain as far as possible.

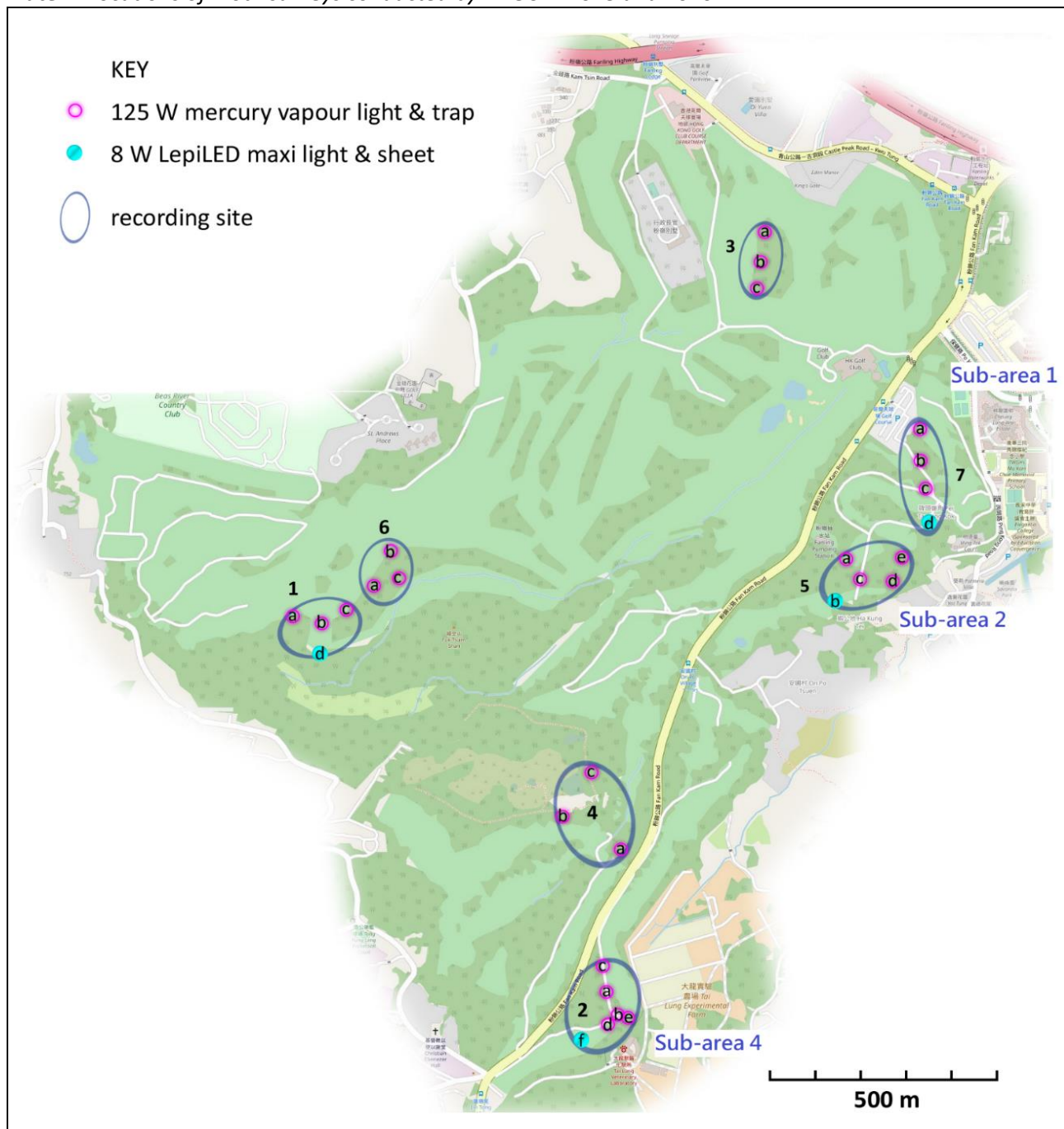
**Table 5.** Survey dates for moths in 2018 and 2020

Month	2018	2020
May	-	27 <sup>th</sup> , 28 <sup>th</sup> , 29 <sup>th</sup>
June	-	-
July	19 <sup>th</sup> , 26 <sup>th</sup> , 27 <sup>th</sup> , 30 <sup>th</sup> , 31 <sup>st</sup>	-
August	3 <sup>rd</sup> , 6 <sup>th</sup> , 20 <sup>th</sup>	-
September	-	-
October	-	16 <sup>th</sup> , 20 <sup>th</sup> , 23 <sup>rd</sup>

### 3.3 Survey Locations

3.3.1 Locations of surveys are presented below:

**Plate 1.** Locations of moth surveys conducted by HKGC in 2018 and 2020



### 3.4 Results

3.4.1 Results from surveys conducted by the Hong Kong Golf Club (HKGC) are presented in Tables 6 and 7 below and are compared with the results extracted from the published EIA Report (No. EIA-282/2022).

**Table 6.** Total number of moth species recorded from the surveys EIA results compared with HKGC data

Area	Total no. of all moth species recorded		No. of species of conservation concern recorded	
	Surveys for the EIA	Surveys by HKGC	Surveys for the EIA	Surveys by HKGC
Sub-area 1	13	142	0	10
Sub-area 2	8	297	1	24
Sub-area 3*	19	-	0	-
Sub-area 4	13	249	0	12
Sub-total for Project Site	38	453	1	34
500m Assessment Area	30	329	1	23
<b>Total</b>	<b>59</b>	<b>593</b>	<b>2</b>	<b>48</b>

\* Sub-area 3 was not surveyed by HKGC

**Table 7.** No. of moth species of global conservation importance recorded from the surveys HKGC data

Global Conservation Status <sup>1</sup>	No. of Species Recorded					
	Project Site <sup>2</sup>			Sub-total for Project Site	500m Assessment Area (Excluding Project Site)	Total
	Sub-area 1	Sub-area 2	Sub-area 4			
Provisional IUCN (CR)	0	1	1	2	0	2
Provisional IUCN (EN)	0	1	0	1	2	3
Provisional IUCN (VU)	4	10	4	12	7	20
Provisional IUCN (NT)	6	12	7	19	14	23
Not Threatened	41	66	58	93	64	108
Not Assessed	91	207	179	326	242	437
<b>Total</b>	<b>142</b>	<b>297</b>	<b>249</b>	<b>453</b>	<b>329</b>	<b>593</b>

**Notes:**

1. Provision IUCN Red List Status: CR = Critically Endangered; EN = Endangered; Vu = Vulnerable; NT = Near Threatened; species known to be common and widespread species were not assessed.
2. No surveys have been conducted by HKGC in Sub-area 3.

**Table 8.** No. of moth species of local conservation importance recorded from the surveys HKGC data

Status in Hong Kong		No. of Species Recorded					
		Project Site <sup>4</sup>			Sub-total for Project Site	500m Assessment Area (Excluding Project Site)	Total
Distribution <sup>1</sup>	Commonness <sup>2</sup>	Sub-area 1	Sub-area 2	Sub-area 4			
Restricted	Very Rare	0	1	2	3	3	6
	Rare; Endemic to HK	0	0	0	0	1	1
	Rare	3	10	5	16	8	23
	Scarce; Endemic to HK	0	1	0	1	0	1
	Scarce	0	2	0	2	0	2
Local	Rare	6	15	6	20	10	25
	Scarce	7	9	10	22	7	28
	Uncommon	2	10	8	16	2	16
	Frequent	1	2	1	3	2	3
Widespread	Rare	0	0	0	0	2	2
	Scarce; Endemic to HK	0	2	0	2	1	2
	Scarce	4	19	14	32	23	45
	Uncommon	13	31	20	51	40	77
	Frequent; Endemic to HK	1	2	1	2	1	3
	Frequent	41	86	80	124	98	163
	Common; Endemic to HK	1	2	2	3	2	3
	Common; Near Endemic to HK	1	1	0	1	0	1
	Common	49	81	80	123	88	140
	Very Common; Near Endemic to HK	0	1	1	1	1	1
Migrant	Very Common	13	20	16	26	19	27
	Rare	0	0	1	1	0	1
<b>Data Deficient<sup>3</sup></b>		0	2	2	4	21	23
<b>Total</b>		<b>142</b>	<b>297</b>	<b>249</b>	<b>453</b>	<b>329</b>	<b>593</b>

**Notes:**

1. Distribution follows Kendrick (2002).



2. Commonness of species in Hong Kong is defined on a seven point scale based upon the number of observations of each species in Hong Kong: Very Rare = 1 or 2 observations of a species; Rare = 3 – 6 observations; Scarce = 7 – 13 observations; Uncommon = 14 – 27 observations; Frequent = 28 – 69 observations; Common = 70 – 229 observations; Very Common = 230 observations or more. The number of observations is based upon the percentage of recording events undertaken in Hong Kong (following Walthew (1997) for the butterflies of Hong Kong) between 2006 and 2019.
3. Data deficient represents species that are either: (1) in a complex group of externally identical or almost identical species, which are identifiable with certainty to species rank only by dissection of the reproductive organs or molecular analysis, both approaches are beyond the scope of this study due to time constraints, or (2) species whose identity has not yet been confirmed as the species is newly or recently recorded in Hong Kong, or (3) one of a species complex that can now be identified to species, which has previously been confused with other similar taxa and recorded as such, so that past data for the species is not reliable for the purpose of status and distribution analysis.
4. No surveys have been conducted by HKGC in Sub-area 3.

## 4 Night Sky Brightness

### 4.1 Survey Methodology

4.1.1 Night-time light level measurements were taken monthly between May 2020 to March 2022. The FGC is divided into twelve grid zones, each of 500m x 500m in size. Measurements were taken in a standardised location within each corresponding grid (close to the centre of the grid as far as practical) under clear sky with no or very little cloud coverage, using the Dark Sky Meter Mobile Phone Application, an equivalent to Sky Quality Meters (SQMs), which are sensitive to visual light and measures the brightness of the night sky in magnitudes per square arcsecond (mag/arcsec<sup>2</sup>).

4.1.2 Results of the average SQM readings for each grid are compared to the Bortle Scale, which is a nine-level numeric scale that measures the night sky's brightness (see **Table 9**). It quantifies the astronomical observability of celestial objects and the interference caused by light pollution. The scale ranges from Class 1, the darkest skies available on Earth, through to Class 9, inner-city skies.

### 4.2 Results

4.2.1 Results of the average SQM readings for each grid compared to the Bortle Scale (see **Table 9**) are presented in Plate 2 below. However, comparison with data or information presented in the published EIA Report is not possible since no baseline night-time light level or sky brightness measuring were conducted in the EIA for relevant impact assessments.

**Plate 2. Results of night sky brightness measurement**



**Table 9. Bortle Scale with corresponding SQM levels**

Class		Corresponding SQM level (mag/arcsec <sup>2</sup> )	General Description
1	Excellent dark-sky	21.99–22.0	The zodiacal light is visible and colorful; the gegenschein, zodiacal band, and airglow are visible; many constellations are barely recognisable amid large number of stars
2	Typical truly dark	21.89–21.99	The zodiacal light is distinctly yellowish and bright enough to cast shadows at dusk/dawn; airglow may be weakly visible near horizon; clouds are only visible as dark holes against the sky; surroundings are barely visible silhouetted against the sky
3	Rural sky	21.69–21.89	The zodiacal light is striking in spring and autumn, and color is still visible; some light pollution evident at the horizon; clouds are illuminated near the horizon, dark overhead; nearer surroundings are vaguely visible
4	Rural/suburban transition	20.49–21.69	The zodiacal light is still visible, but does not extend halfway to the zenith at dusk/dawn; light pollution domes visible in several directions; clouds are illuminated in the directions of the light sources, dark overhead; surroundings are clearly visible, even at a distance
5	Suburban sky	19.50–20.49	Only hints of zodiacal light are seen on the best nights in autumn and spring; light pollution is visible in most, if not all, directions; clouds are noticeably brighter than the sky; the Milky Way is very weak or invisible near the horizon, and looks washed out overhead
6	Bright suburban sky	18.94–19.50	The zodiacal light is invisible; light pollution makes the sky within 35° of the horizon glow grayish white; clouds anywhere in the sky appear fairly bright; surroundings are easily visible
7	Suburban/urban transition	18.38–18.94	Light pollution makes the entire sky light gray; strong light sources are evident in all directions; clouds are brightly lit; the Milky Way is nearly or totally invisible
8	City sky	Below 18.38	The sky is light gray or orange – one can easily read; stars forming familiar constellation patterns may be weak or invisible
9	Inner city sky		The sky is brilliantly lit; many stars forming constellations and many fainter constellations are invisible; the only objects to observe are the Moon, the planets, bright satellites, and a few of the brightest star clusters

## 5 References

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