

Hymenoptera – Bees and Wasps

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Bees and wasps of the order Hymenoptera are diverse insects that play pivotal ecological functions in maintaining the health and stability of ecosystems. Bees are highly effective pollinators, and a high proportion of native Southeast Asian flora have co-evolved to rely on their visitation for reproduction and survival (Orr et al., 2021; Corlett, 2004; Kato et al., 1996; Momose et al. 1998). Wasps are major regulators of arthropod populations through predation and parasitism, and are also pollinators for particular plants (Brock et al., 2021; Corlett, 2004). Given the importance of bees and wasps and their ecological interactions in natural and managed ecosystems, it is imperative that there are efforts to monitor and conserve the native fauna by researchers and citizen scientists (Lim et al., 2024; Warrit et al., 2023). The bees of Singapore comprise about 142 species (including distinct morphospecies pending further integrative taxonomic review, and two recently detected exotic species) in four families. Their conservation statuses have been assessed and summarized in a country checklist (Ascher et al., 2022), which considered each taxon's habitat usage, distribution, and last verified record, compiled through surveys and citizen science databases (e.g. Ascher et al., 2019; Liow et al., 2001; Soh & Ngiam, 2013). The wasps, a paraphyletic group far exceeding bees in species diversity, are not as well understood in Singapore (Ascher & Lee, 2024). Work is underway to resolve the taxonomy of wasp families and assess their statuses, starting with the aculeate wasps, such as the social vespids and the thread-waisted wasps of family Sphecidae (Lee et al., 2023; Ascher et al., in press). In the following accounts, we highlight the species requiring the most attention for local conservation monitoring. In addition, we list a few key examples of species with inadequate data that may be concluded as threatened with further research.

Scientific Name:

Lipotriches (Austronomia)
goniognatha (Cockerell, 1919)

Common Name:

Angle-jawed Austral-Nomia

Family:

Halictidae

National Status: Data Deficient (DD)

Habitat and Ecology: Solitary bee that putatively builds underground nests. Little is known about its ecology but it may be associated with freshwater marshland.

Distribution: Thai-Malay Peninsula, Singapore, Cambodia, Myanmar, Indonesia and Philippines.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: This species is only known from two records at Kranji in the last 50 years. C.F. Baker first recorded the visually distinctive male of this species in Singapore in 1918. It was later rediscovered in 2009 through malaise trapping in the Kranji area. After another gap in records, it was observed in 2023 at Kranji Coastal

Photo: Zestin Soh



Male *Lipotriches goniognatha* resting on a sedge in Kranji Coastal Nature Park, Singapore.

Nature Park foraging on wetland-associated sedges (Cyperaceae) along the fringe of a freshwater marshy pond, indicating a possible association with this specific habitat. We have provisionally listed it as Data Deficient as knowledge of this species locally remains limited and it may be overlooked.

Conservation Measures: Preservation and restoration of high-quality wetland habitat, particularly at Kranji, the only site where it is currently known to occur. Seek to establish information on population distribution and habitat usage through recording by researchers and citizen scientists.

Scientific Name:

Lipotriches (Austronomia) *takauensis*
(Friese, 1910)

Common Name:

Takau Austral-Nomia

Family:

Halictidae

National Status: Near Threatened (NT)

Habitat and Ecology: Solitary bee that putatively builds underground nests. Found along edges of mature forests.

Photo: Zestin Soh



Female *Lipotriches takauensis* visiting *Uria crinita* at Dairy Farm Nature Park, Singapore.

Distribution: Thailand, Malay Peninsula, Singapore, Vietnam, South China (Hainan, Hong Kong), and Java.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: D.H. Murphy collected specimens of this species in 1961 at Changi Mangrove and in 1976 at Linden Drive. Recent records are from transitional habitats in the vicinity of

mature forests, such as Dairy Farm, Bukit Timah, Rifle Range, and Pulau Ubin.

Conservation Measures: Preservation and restoration of high-quality forest patches as well as adjacent transitional habitats, as they are likely used by this species for foraging and/or nesting. Restoration of native flora in degraded or urbanised habitats located near forests. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Nomia (Maculonomia) apicalis
Smith, 1857

Common Name:

Black-tipped Forest-Nomia

Family:

Halictidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Solitary, ground-nesting bee found in mature secondary and primary forests. Known to forage for pollen from *Melastoma malabathricum*.

Distribution: Malay Peninsula (Johor), Singapore, and Sumatra. Records from elsewhere including Thailand may pertain to other taxa in this complex.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: A.R. Wallace collected the male holotype of this species in Singapore around 1854. Subsequent observations in Singapore span until 1976, when recorded at Dairy Farm, and 1999 when last observed nationally at Nee Soon. All recent records from 2008 onward of

Photo: Zestin Soh



Female *Nomia apicalis* visiting *Melastoma malabathricum* in Johor, Malaysia.

bees bearing close resemblance pertain to a related, undescribed *Nomia (Maculonomia)* species. The true *Nomia apicalis* appears restricted to old-growth forests in the vicinity of the Central Catchment Nature Reserve and Bukit Timah, while the similar morphospecies exhibits broader habitat tolerances and is much more widespread locally.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around the Central Catchment Nature Reserve, where it occurs. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Nomia (Maculonomia) fuscipennis
Smith, 1875

Common Name:

Dusky-winged Forest-Nomia

Family:

Halictidae

National Status: Near Threatened (NT)

Habitat and Ecology: Solitary, ground-nesting bee found in mature secondary and primary forests. Often found foraging from *Melastoma malabathricum*.

Distribution: Malay Peninsula, Singapore, Sumatra, Borneo, and Java.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: This species occurs in forested sites mainly in and around the Central Catchment Nature Reserve and Bukit Timah Nature Reserve. Where it occurs it can be a frequent visitor to *Melastoma malabathricum* and *Leea* spp.

Photo: Zestin Soh



Female *Nomia fuscipennis* visiting *Melastoma malabathricum*.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around the sites where it occurs, such as the Central Catchment Nature Reserve, Bukit Timah Nature Reserve, and their surrounding nature parks. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Nomia (Maculonomia) elegans
Smith, 1857

Common Name:

Elegant Forest-Nomia

Family:

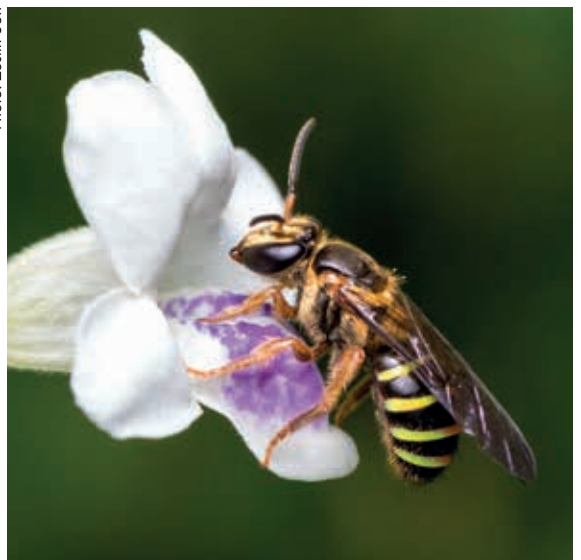
Halictidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Solitary, ground-nesting bee found in mature secondary and primary forests.

Distribution: In Singapore, this species is reported from Seletar historically. Elsewhere it occurs in the Malay Peninsula, Java, and Borneo.

Photo: Zestin Soh



Male *Nomia fuscipennis* visiting *Asystasia gangetica* in Temburong District, Brunei.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: This species was first described from specimens collected by A.R. Wallace from Malacca, and subsequently redescribed from Singapore as *Nomia tuberculifrons* Cockerell, 1920, based on specimens of both sexes collected at Seletar in 1911. There are no subsequent country records.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve.

Scientific Name:
Nomia (Maculonomia) penangensis
Cockerell, 1920

Common Name:
Penang Forest-Nomia

Family:
Halictidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Solitary, ground-nesting bee found in mature secondary and primary forests. Recorded foraging from various Melastomataceae and Asteraceae in Malaysia.

Distribution: Thai-Malay Peninsula and Singapore to Indochina and Southern China including Hong Kong.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: The historical presence of this species in Singapore was recently established based on a male specimen collected by C.F. Baker, most likely around 1918, deposited in the entomological collection of the Smithsonian National Museum of Natural History. It has not been observed locally since.



Photo: Zestlin Soh

Female *Nomia penangensis* visiting *Asystasia gangetica* in Negeri Sembilan, Malaysia.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve. Protection of large forest trees used for nesting and resin gathering.

Scientific Name:
Ceylalictus (Ceylalictus)
communis (Blüthgen, 1934)

Common Name:
Kuala Lumpur Steppe Bee

Family:
Halictidae

National Status: Data Deficient (DD)

Habitat and Ecology: Solitary bee that builds underground nests in beach sand. Known to visit the native coastal shrub *Pluchea indica*, albeit infrequently.

Distribution: Thai-Malay Peninsula, Singapore.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: This diminutive species has been intermittently documented from 2015 to 2021. Nesting aggregations were recently discovered in manmade sand pits within parks at Katong and along the Southern Ridges, indicating a probable preference for natural sandy shores for nesting. Moreover, although large numbers of nesting

Photo: Zestin Soh



Female *Ceylalictus communis* at a sandy nesting site in Kent Ridge Park, Singapore.

found at the sites, bees are very seldom observed at flowers, hence information on their foraging behaviour and ecology is limited. Focused surveys conducted in coastal habitats across Singapore could offer insights into its pollen hosts, preferred nesting sites, and current status.

Conservation Measures: Preservation of known nesting aggregations at Katong and the Southern Ridges. Seek to establish information on the species' natural history and population through monitoring and recording by researchers and citizen scientists.

Scientific Name:
Lasioglossum (Ctenonomia)
halictoides (Smith, 1858)

Common Name:
Beach Combed-Sweat Bee

Family:
Halictidae

National Status: Near Threatened (NT)

Habitat and Ecology: Solitary or primitively eusocial, ground-nesting bee. Found in coastal habitats in association with their preferred pollen source, the

Photo: Zestin Soh



Female *Lasioglossum halictoides* visiting *Ipomoea pes-caprae* in Pulau Ubin, Singapore.

Beach Morning Glory (*Ipomoea pes-caprae*). Likely to nest in sandy substrate.

Distribution: Malay Peninsula, Taiwan, Philippines, Indonesia, Borneo, and Papua New Guinea.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: In Singapore this species is confined to coastal areas, including sandy beaches and coastal scrub, especially where its predominant native food plant *Ipomoea pes-caprae* occurs. It has been recorded on mainland

Singapore near Pasir Ris, as well as on offshore islands such as St John's, Lazarus, and Pulau Ubin.

Conservation Measures: Preservation and restoration of *Ipomoea pes-caprae*, *Melanthera biflora* and other native coastal flora at natural beaches and other coastal sites across Singapore. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Lasioglossum (Ctenonomia)
semirussatum (Cockerell, 1920)

Common Name:
Singapore Combed-Sweat Bee

Family:
Halictidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Solitary or primitively eusocial, ground-nesting bee. Known only from primary hill dipterocarp forest.

Distribution: Singapore (Bukit Timah)

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: This species is known globally only from Bukit Timah, Singapore. The male holotype from Singapore was collected around 1917-1918 by C.F. Baker. It was later rediscovered in 1976 at Bukit Timah by D. H. Murphy. There have been



Specimen of a male *Lasioglossum semirussatum* from Singapore, stored in the Smithsonian United States National Museum.

no subsequent records of this distinctively coloured bee from any location.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists at the Bukit Timah Nature Reserve and its surrounding nature parks. Preservation and restoration of high-quality forest patches and native flora in those sites.

Scientific Name:

Patellapis (Pachyhalictus) intricata
(Vachal, 1895)

Common Name:

Vachal's Reticulate-Furrow Bee

Family:

Halictidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Solitary, ground-nesting bee found in mature secondary and primary forests. Known to forage for pollen from *Melastoma malabathricum*.

Distribution: Eastern India, Myanmar, Yunnan (China), Thailand, Malay Peninsula (Johor), Singapore, Java, and (reportedly) Sulawesi.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: D.H. Murphy last recorded this species in Singapore at Bukit Timah and Rifle Range Road in 1975 and 1976 respectively.

Photo: Zestin Soh



Female *Patellapis intricata* visiting *Melastoma malabathricum* in Johor, Malaysia.

It has a distinctively lamellate pronotum and is therefore readily identified. Notably, all recent specimens of *Patellapis (Pachyhalictus)* found in Singapore pertain to the locally common and widespread *P. murbanus*.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists at potential sites, such as the nature reserves. Preservation and restoration of high-quality forest patches and native flora in those sites.

Scientific Name:

Anthidiellum (Pycnanthidium) smithii smithii (Ritsema, 1874)

Common Name:

Smith's Rotund-Resin Bee

Family:

Megachilidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary, cavity-nesting bee that builds its nest with plant resin. Found in mature secondary forests and parks.

Distribution: Thailand, Malay Peninsula, Singapore, Borneo, and the Philippines (Palawan), with another subspecies occurring east in Indonesia to Ambon.

Photo: Zestin Soh



Female *Anthidiellum smithii smithii* constructing its nest with plant resin in a nesting block at HortPark, Singapore.

Threats: Habitat loss and associated declines in suitable nesting sites, resin sources and forage plants.

Scientific Interest and Potential Value: The sole representative of its genus in Singapore, this species was first documented locally in 2014 in forested areas at Dairy Farm and Bukit Timah. It was subsequently recorded in HortPark in 2019, where it uses the nesting blocks set up for solitary bees, and later found visiting

non-native *Pittosporum pentandrum* on Pulau Ubin in 2022. Its native host plants are unknown.

Conservation Measures: Preservation and restoration of quality forest patches across Singapore. Increasing availability of nesting sites in parks through setting up of artificial nesting blocks. Monitoring of extant populations and discovery of its native host plants by researchers and citizen scientists.

Scientific Name:

Megachile (Aethomegachile) ramera
Cockerell, 1918

Common Name:

Singapore Leafcutter

Family:

Megachilidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary, cavity-nesting bee that builds its nest with pieces of leaves cut from particular plants. Found in mature secondary and primary forest. Known to forage from *Cratogeomys cochinchinense*.

Distribution: Malay Peninsula, Singapore, and possibly Borneo (identity uncertain).

Threats: Habitat loss and associated declines in suitable nesting sites, sources of nesting material, and forage plants.

Scientific Interest and Potential Value: The type specimen of this species was collected in Singapore by C.F. Baker around 1918. Presently, all documented

Photo: Zestin Soh



Female *Megachile ramera* from the Central Catchment Nature Reserve, Singapore.

records of this species are limited to forested sites within and around the Bukit Timah Nature Reserve and the Central Catchment Nature Reserve. While it has been observing nesting in a cavity in Thomson Nature Park in 2020, the species of plants that it relies on for nesting resources that it relies on are still unknown.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Bukit Timah Nature Reserve, the Central Catchment Nature Reserve, and their surrounding nature parks. Monitoring of extant populations and discovery of its nesting resources and poorly known male by researchers and citizen scientists.

Scientific Name:
Megachile (Callomegachile)
indonesica (Engel & Schwarz, 2011)

Common Name:
 Indonesian Resin Bee

Family:
 Megachilidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary, cavity-nesting bee that builds its nest with plant resin. Found in and around mature secondary forests.

Distribution: Singapore, Sumatra and Java.

Threats: Habitat loss and associated declines in suitable nesting sites, sources of nesting material, and forage plants.

Scientific Interest and Potential Value: This species was first documented in Singapore in 2014 during the widespread flowering of Tiger Orchids (*Grammatophyllum speciosum*) at sites within and near the Bukit Timah Nature Reserve and Central Catchment Nature Reserve. It potentially serves as a pollinator for these orchids as it has been observed carrying their pollinia. This species has subsequently been observed



Photo: Zestin Soh
 Female *Megachile indonesica* carrying pollinia from a tiger orchid, *Grammatophyllum speciosum* in the vicinity of the Central Catchment Nature Reserve, Singapore.

in 2017 at the Singapore Botanic Gardens foraging for nectar from *Teijsmanniodendron pteropodum*, but its native pollen hosts are still unknown. This species belongs to a locally occurring mimicry ring that comprises at least five *Megachile* species that share similar coloration of black body and orange wings tipped with black.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Bukit Timah Nature Reserve, the Central Catchment Nature Reserve, and their surrounding nature parks. Monitoring of extant populations and discovery of its native host plants by researchers and citizen scientists.

Scientific Name:
Megachile (Callomegachile)
ornata Smith, 1853

Common Name:
 Ornate Resin Bee

Family:
 Megachilidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary, cavity-nesting bee that builds its nest with plant resin. Found in and around mature secondary forests.



Photo: Zestin Soh
 Female *Megachile ornata* from the vicinity of the Central Catchment Nature Reserve, Singapore.

Distribution: Nepal, Thailand, Malay Peninsula, Singapore, Sumatra, and Borneo.

Threats: Habitat loss and associated declines in suitable nesting sites, sources of nesting material, and forage plants.

Scientific Interest and Potential Value: This species has only been documented for Singapore once, in 2014, when it was found visiting flowering Tiger Orchids (*Grammatophyllum speciosum*) at sites within and near the Bukit Timah Nature Reserve and Central Catchment

Nature Reserve. Based on known records globally it appears that this species relies on high-quality forests, although its biology remains poorly understood. For example, its native pollen hosts are still unknown.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it likely occurs, such as the Bukit Timah Nature Reserve, the Central Catchment Nature Reserve, and their surrounding nature parks. Monitoring of extant populations and discovery of its native host plants by researchers and citizen scientists.

Scientific Name:
Megachile (Callomegachile s.l.) tuberculata Smith, 1857

Common Name:
Tuberculate Resin Bee

Family:
Megachilidae

National Status: Near Threatened (NT)

Habitat and Ecology: Solitary, cavity-nesting bee that builds its nest using resin gathered from plants. Found in and around mature secondary and primary forests. Known to forage from various Fabaceae.

Distribution: Malay Peninsula, Singapore, Sumatra, Borneo, and Java.

Threats: Habitat loss and associated declines in suitable nesting sites, sources of nesting material or forage plants.

Scientific Interest and Potential Value: Among the largest representatives of the family Megachilidae in the Sundaic region and distinctive with impressively long mandibles used for gathering resin. This species is associated with mature forest sites in and around the



Photo: Zestin Soh

Female *Megachile tuberculata* from the Southern Ridges, Singapore.

Bukit Timah Nature Reserve and Central Catchment Nature Reserve (including Nee Soon Swamp Forest), but recent findings have extended its presence to other sites. Notably, it has been observed in a community garden near Zhenghua Nature Park, and at HortPark, a semi-urban park along the Southern Ridges. These observations attest to its ability to forage on floral resources situated at considerable distances from forests. However, its native pollen hosts are still unknown.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it likely occurs, such as the Bukit Timah Nature Reserve, the Central Catchment Nature Reserve, and their surrounding nature parks. Monitoring of extant populations and discovery of its native host plants by researchers and citizen scientists.

Scientific Name:
Megachile (Carinula) butteli
Friese, 1918

Common Name:
Buttel-Reepen's Resin Bee

Family:
Megachilidae

National Status: Data Deficient (DD)

Habitat and Ecology: Solitary, cavity-nesting bee that builds its nest using resin gathered from plants.

Distribution: Thai-Malay Peninsula, Singapore, Borneo (Sarawak).

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: Described from Perak, Malaysia, this is an enigmatic species that has been documented only twice in Singapore. The first

Photo: Zestlin Soh



Male *Megachile butteli* from the Central Catchment Nature Reserve, Singapore.

was a male foraging on *Cratoxylum cochinchinense* at Upper Peirce Reservoir Park in 2012. Subsequently, a specimen of the distinctive female was found at the Sungei Buloh Wetland Reserve in 2021. While it is likely associated with mature forests, additional observations of this diminutive species are necessary to confirm its distribution.

Conservation Measures: Preservation and restoration of high-quality forest patches. Seek to establish information on natural history and population distribution through monitoring and recording by researchers and citizen scientists.

Scientific Name:
Xylocopa (Biluna) iridipennis
Lepeletier, 1841

Common Name:
Purple-winged Bamboo-Carpenter

Family:
Apidae

National Status: Data Deficient (DD)

Habitat and Ecology: Subsocial or solitary carpenter bee that excavates nests in dead bamboo. Found in forests with mature bamboo stands.

Distribution: Singapore (and potentially the broader Thai-Malay Peninsula).

Photo: Zestlin Soh



Male *Xylocopa iridipennis* from the Singapore Botanic Gardens.

Threats: Habitat loss and associated declines in bamboo stands that provide suitable nesting sites.

Scientific Interest and Potential Value: Species of the subgenus *Biluna* utilise bamboo internodes for nesting, entering from a hole they create with their mandibles. This species has been noted in the previous edition of the Red Data Book as the “Parasitic Carpenter Bee”, but this and all other *Xylocopa* are in fact non-parasitic pollen collectors. This bee has at least one historical record from Singapore in 1929, and has more recently been observed at Kent Ridge, one-north Park, the Singapore Botanic Gardens’ Eco Garden, and Pulau

Ubin, but sightings are rare. Targeted searches at and adjacent to bamboo patches in Singapore would clarify its status. *Xylocopa iridipennis* has been treated by most recent authors as a subspecies of *Xylocopa auripennis*, but considerable DNA sequence divergence between these forms suggests that these are specifically distinct.

Conservation Measures: Seek to establish detailed information on population distribution through monitoring by researchers and citizen scientists.

Scientific Name:

Xylocopa (Zonohirsuta) dejeanii
penangensis Cockerell, 1918

Common Name:

Collared Carpenter

Family:

Apidae

National Status: Endangered (EN)

Habitat and Ecology: Solitary or subsocial carpenter bee that excavates its nests in dead wood, such as fallen logs. Found in mature secondary and primary forests. Known to forage for pollen from *Melastoma malabathricum* and *Dillenia suffruticosa*.

Distribution: Thai-Malay Peninsula and Singapore (ssp. *penangensis*), with other subspecies occurring from Eastern India, Indochina, and China south to the Philippines (Palawan), Sumatra, Borneo, and Java.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: Despite its notable size and distinctive appearance, recent field surveys in Singapore have not yielded any sightings of this bee. Earlier records of this species around 1918 by

Photo: Zestin Soh



Female *Xylocopa dejeanii* in Temburong District, Brunei.

C.F. Baker and a specimen collected by D.H. Murphy in 1962 from MacRitchie confirm its historical presence in Singapore. An online video taken in 2014 in Singapore (without specific location information) suggests that it may persist here, but if so it is likely to be highly localised.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it may still persist, such as the Central Catchment Nature Reserve. Seek to establish information on population distribution through monitoring by researchers and citizen scientists.

Scientific Name:

Ceratina (Lioceratina) ridleyi
Cockerell, 1910

Common Name:

Ridley's Small Carpenter

Family:

Apidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary or subsocial bee that excavates its nest in a dead pithy stem. Found in mature secondary and primary forests, often in the semi-shaded understory. Known to forage from *Ophiorrhiza singapurensis* (Rubiaceae).

Distribution: Thai-Malay Peninsula and Singapore.

Threats: Habitat loss and associated declines in suitable nest sites or forage plants.

Scientific Interest and Potential Value: The type specimen was collected in Singapore around 1895 by

Photo: Zestin Soh



Female *Ceratina ridleyi* visiting *Asystasia gangetica*.

H.N. Ridley, and named after him. This rare species has more recently been found visiting flowering shrubs in the shaded understory of MacRitchie Forest, Nee Soon Swamp Forest, and the Bukit Timah Nature Reserve.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Bukit Timah Nature Reserve and its surrounding nature parks. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Ceratina (Xanthoceratina) fuliginosa Cockerell, 1916

Common Name:

Dusky-winged Small Carpenter

Family:

Apidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary or subsocial bee that excavates its nest in a dead pithy stem. Found in mature secondary and primary forests.

Distribution: Singapore, Thailand, Indochina, Philippines (Palawan), Java, Sumatra, and Borneo.

Photo: Zestin Soh



Female *Ceratina fuliginosa* visiting *Bidens* from the vicinity of Dairy Farm Nature Park, Singapore.

Threats: Habitat loss and associated declines in suitable nest sites or forage plants.

Scientific Interest and Potential Value: This species is locally known from sites located in and around the Bukit Timah Nature Reserve and the Central Catchment Nature Reserve. An uncommon form of this species displays a dark body with diminished yellow markings and a heart-shaped yellow blotch on its thorax.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Central Catchment Nature Reserve and its surrounding nature parks. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Ceratina (Xanthoceratina)
metaria Cockerell, 1920

Common Name:
Bounded Small Carpenter

Family:
Apidae

National Status: Data Deficient (DD)

Habitat and Ecology: Solitary or subsocial bee that excavates its nest in a dead pithy stem. Found in mature secondary and primary forests.

Distribution: Thai-Malay Peninsula, Singapore.

Threats: Habitat loss and associated declines in suitable nesting sites or forage plants.

Scientific Interest and Potential Value: First described from Penang, this distinctive small carpenter bee has been exclusively found locally in the Central



Photo: Zestin Soh

Female *Ceratina metaria* visiting starfruit, *Averrhoa carambola* in Pulau Ubin, Singapore.

Catchment Nature Reserve and Pulau Ubin, suggesting its likely association with mature forest habitats (which is typical of its subgenus). Its small size might result in potential oversight, leading to its classification as Data Deficient.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Central Catchment Nature Reserve and its surrounding nature parks, as well as on Pulau Ubin. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Nomada malayana Cameron,
1909

Common Name:
Malay Nomad

Family:
Apidae



Photo: Insect Diversity Lab, NUS

Female specimen of *Nomada malayana*.

National Status: Vulnerable (VU)

Habitat and Ecology: Nest cleptoparasite whose hosts are ground-nesting bees, putatively of the tribe Halictini. Found in mature forest habitat.

Distribution: Malay Peninsula, Singapore, Borneo (Sarawak).

Threats: Habitat loss and associated declines in populations of their hosts.

Scientific Interest and Potential Value: Described from Kuching in Borneo, this species is known for Singapore based on specimens collected from Bukit Timah in 1976 and from a remnant forest patch in Sentosa in 2014.

Conservation Measures: Preservation and restoration of high-quality forest patches across Singapore, and planting of native flora in degraded or urbanised habitats. Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists at potential sites.

Scientific Name:
Nomada penangensis Cockerell,
1920

Common Name:
Penang Nomad

Family:
Apidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Nest cleptoparasite whose hosts are ground-nesting bees, putatively of the tribe Halictini. Found in mature forest habitat.

Distribution: Malay Peninsula (Penang) and Singapore.

Threats: Habitat loss and associated declines in populations of their hosts.

Scientific Interest and Potential Value: Described from Penang, this species has only been recorded in Singapore from the Alumni Car Park Garden of the old



Photo: Insect Diversity Lab, NUS

Female specimen of *Nomada penangensis*.

National University of Singapore Campus (near the Singapore Botanic Gardens) in 1975. This and other species of the *furva* group of *Nomada* are presumed to be cleptoparasites of *Lasioglossum*.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Bukit Timah Nature Reserve and its surrounding nature parks. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Nomada sandacana Cockerell,
1920

Common Name:

Sandakan Nomad

Family:

Apidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Nest cleptoparasite whose hosts are ground-nesting bees, putatively of the tribe Halictini. Found in mature forest habitat.

Distribution: Borneo (Sabah) and Singapore.

Threats: Habitat loss and associated declines in populations of their hosts.

Scientific Interest and Potential Value: This species was described from Sandakan in Sabah, Malaysian Borneo, and unreported in Singapore until specimens in LKCNHM were tentatively identified as this species.

Photo: Insect Diversity Lab, NUS



Female specimen of *Nomada sandacana*.

One specimen was collected in 1975, at the Alumni Car Park Garden of the old National University of Singapore Campus (near Singapore Botanic Gardens).

Conservation Measures: Preservation and restoration of high-quality forest patches across Singapore, and planting of native flora in degraded or urbanised habitats. Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists.

Scientific Name:

Amegilla (Glossamegilla)
insularis (Smith, 1857)

Common Name:

Island Forest-Digger

Family:

Apidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary, ground-nesting bee found in mature secondary and primary forests, often in semi-shaded understorey. Known to forage from *Melastoma malabathricum* and other understorey shrubs.

Photo: Zestlin Soh



Male *Amegilla insularis* visiting *Alpinia zerumbet* at Bukit Batok Nature Park, Singapore.

Distribution: Malay Peninsula, Myanmar, Singapore, Sumatra, and Borneo.

Threats: Habitat loss and associated declines in suitable nest sites or forage plants.

Scientific Interest and Potential Value: This relatively large, swift-flying bee is found in forested sites in and around the Bukit Timah Nature Reserve, Central Catchment Nature Reserve, and at the Sungei Buloh Wetland Reserve. Existing records are scattered and typically single individuals, suggesting small population sizes. It is likely a pollinator of forest understorey shrubs with long floral tubes, including gingers. This species is

the most likely local host for the rare cuckoo bee *Thyreus abdominalis rostratus*.

Conservation Measures: Preservation of high-quality forest patches across Singapore. Restoration of native flora in degraded habitats or urbanised areas. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Thyreus abdominalis rostratus
(Friese, 1905)

Common Name:
Beaked Cloak-and-Dagger Bee

Family:
Apidae

National Status: Endangered (EN)

Habitat and Ecology: Nest cleptoparasite whose putative hosts are large digger bees, such as *Amegilla insularis*. Found in mature secondary and primary forests.

Distribution: Eastern India, Myanmar, Malay Peninsula, Singapore, Sumatra, and Borneo, with additional subspecies occurring in China and Indonesia (including Flores and Sumatra).

Threats: Habitat loss and associated declines in associated populations of their hosts.

Scientific Interest and Potential Value: The largest member of its genus in Singapore, this impressive species was recorded by H.N. Ridley in 1901, and at



Thyreus abdominalis rostratus visiting *Asystasia gangetica* in Johor, Malaysia.

Ulu Pandan in 1920 by an unknown collector. More recently, it was rediscovered in Singapore at Nee Soon Swamp Forest in 2015 using malaise traps. M.A. Lieftinck documented this bee as a probable cleptoparasite of the large digger bee *Amegilla elephas*, but as this particular host species is not found in Singapore, it is assumed that its host here is *Amegilla insularis*. The bright blue in the setae of this genus is a structural colour produced by the scattering of light.

Conservation Measures: Preservation and restoration of high-quality forest patches in and around forested sites where it occurs, such as the Central Catchment Nature Reserve. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Thyreus novaehollandiae signatus (Meyer, 1921)

Common Name:

Diamond-waisted Cloak-and-dagger Bee

Family:

Apidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Nest cleptoparasite of digger bees (putatively *Amegilla* subgenus *Zonamegilla* spp.). Found in mature secondary and primary forests.

Distribution: Eastern India (West Bengal), Myanmar, Laos, Thai-Malay Peninsula, and Singapore (ssp. *signatus*). Other subspecies are widespread in Indonesia.

Threats: Habitat loss and associated declines in populations of their hosts.

Scientific Interest and Potential Value: This subspecies was recorded for Singapore by F.N. Chasen in November 1932, and by D.H. Murphy in 1976. There have been no further country records. The specific epithet for this species is misleading since

Photo: Ian Dugdale



Thyreus novaehollandiae signatus visiting a *Cosmos* in Phetchaburi, Thailand.

the type specimens were likely collected in the Lesser Sunda Islands of Indonesia, particularly Timor, rather than in Australia (the published incorrect location is "Nouvelle-Hollande"), where no verified records exist. Its local host is potentially the small-bodied *Amegilla korotonensis*, which is relatively uncommon here.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the nature reserves. Establishing the identity of its hosts through recording by researchers and citizen scientists in countries where the species still persists.

Scientific Name:

Geniotrigona thoracica (Smith, 1857)

Common Name:

Long-chinned Stingless Bee

Family:

Apidae

National Status: Critically Endangered (CR)

Habitat and Ecology: Eusocial stingless bee that builds its hive using plant resin within tree cavities. Found in mature secondary and primary forests, and is likely dependent on particular trees (e.g. dipterocarps) for resin sources.

Photo: Zestin Soh



Geniotrigona thoracica visiting starfruit, *Averrhoa carambola* in Negeri Sembilan, Malaysia.

Distribution: Myanmar, Thailand, Malay Peninsula, Singapore, Sumatra, and Borneo.

Threats: Loss of habitat, including nesting sites or host plants for pollen and nectar. Potentially loss of resin sources for nest building.

Scientific Interest and Potential Value: A.R. Wallace collected the type worker of this species from Singapore around 1854. The most recent records of this species in Singapore date back to 1976 in Taban Valley at Bukit Timah. Given that it is the largest stingless bee in the region, with distinctive coloration and nest entrance structure, it seems improbable that it

would have been overlooked by researchers if it were still present here. Consequently, it is probable that this species has been locally extirpated. In the region, hives of this species are employed in meliponiculture for their honey and hive products.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve. Protection of large forest trees used for nesting and resin gathering.

Scientific Name:
Heterotrigona (Sundatrigona)
moorei (Schwarz, 1937)

Common Name:
Moore's Stingless Bee

Family:
Apidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Obligately myrmecophilous eusocial stingless bee that builds its hive within active arboreal carton nests of *Crematogaster* ants. Found in mature secondary and primary forests.

Distribution: Thai-Malay Peninsula and Singapore to Indochina and Southern China including Hong Kong.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: Known for Singapore based on the type of *Trigona (Tetragona) matsumurai* (Sakagami, 1959). There have been no subsequent local sightings.



Photo: Chui Shao Xiong

Specimen of *Heterotrigona moorei* (not from Singapore).

Conservation Measures: Seek rediscovery of extant populations and information on its local ant associations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve.

Scientific Name:

Homotrigona (Homotrigona) fimbriata (Smith, 1857)

Common Name:

Bristle-faced Stingless Bee

Family:

Apidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Eusocial stingless bee that builds its hive within tree cavities using resin gathered from plants. Found in mature secondary and primary forests, and is likely dependent on particular trees (e.g. dipterocarps) for resin sources.

Distribution: Continental Asia from Myanmar, Yunnan, China and Laos south through Thailand and the Malay Peninsula to Singapore, Sumatra, and Borneo.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: A.R. Wallace collected the type specimen of this species in Singapore, possibly near the Bukit Timah area, around 1854. There have been no subsequent local sightings. Considering its significant size and distinctive features, it appears unlikely that this species went unnoticed in

Photo: Zestin Soh



Homotrigona fimbriata tending to a pot of resin in its nest in Negeri Sembilan, Malaysia.

subsequent studies of stingless bees in Singapore. Within the region, hives of this species are harvested from trees and used in meliponiculture for their honey and hive products.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve. Protection of large forest trees used for nesting and resin gathering.

Scientific Name:

Homotrigona (Lophotrigona) canifrons (Smith, 1857)

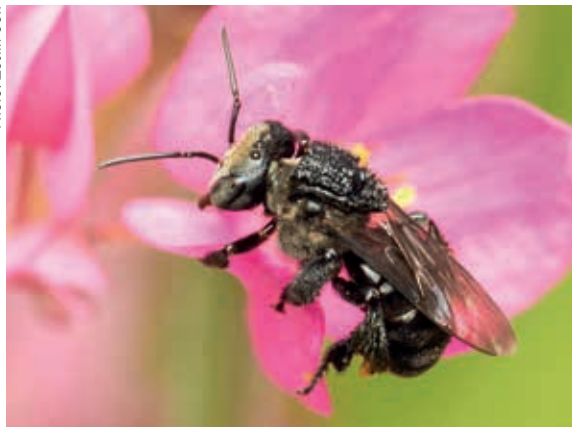
Common Name:

Woolly Stingless Bee

Family:

Apidae

Photo: Zestin Soh



Lophotrigona canifrons visiting *Antigonon leptopus* in Negeri Sembilan, Malaysia.

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Eusocial stingless bee that builds its hive within tree cavities using resin gathered from plants. Found in mature secondary and primary forests, and is likely dependent on particular trees (e.g. dipterocarps) for resin sources.

Distribution: Thai-Malay Peninsula, Singapore, Sumatra, and Borneo.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: This species was recorded in Singapore at Bukit Timah in 1911, likely

by C.F. Baker, but has not been recorded locally since. This stingless bee species is notably aggressive and has a tendency to bite intruders in the vicinity of its nest. Within the region, hives of this species are harvested from trees and used in meliponiculture for their honey and hive products.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve. Protection of large forest trees used for nesting and resin gathering.

Scientific Name:

Homotrigona (Tetrigona) apicalis (Smith, 1857)

Common Name:

Milky-tipped Stingless Bee

Family:

Apidae

National Status: Near Threatened (NT)

Habitat and Ecology: Eusocial stingless bee that builds its hives within tree cavities using resin gathered from plants. Found in mature secondary and primary forests, and is likely dependent on particular trees (e.g. dipterocarps) for resin sources.

Distribution: Myanmar, Thailand, and Indochina south to Singapore, Sumatra, Borneo, and Java.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: This is the largest extant stingless bee in Singapore. It appears restricted to sites at and within the Bukit Timah Nature Reserve, the Central Catchment Nature Reserve, and the Singapore Botanic Gardens. It is potentially dependent on dipterocarps for resin. Like many stingless

Photo: Zeslin Soh



Homotrigona apicalis visiting *Baccaurea* in the Central Catchment Nature Reserve, Singapore.

bees, it relies on large, mature trees with cavities for nesting sites. Within the region, hives of this species are harvested from trees and used in meliponiculture for their honey and hive products.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs. Protection of known nests, which are long-lived, as well as large forest trees used for nesting and resin gathering. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Lepidotrigona latipes
(Friese, 1900)

Common Name:
Broad-legged Stingless Bee

Family:
Apidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Eusocial stingless bee that builds its hive within tree cavities using resin gathered from plants. Found in mature forests.

Distribution: Singapore, Indonesia (Sumatra) and Peninsular Malaysia.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: Both the taxonomic status and the type locality of this species have been controversial, with authors such as Herbert F. Schwarz treating it as a synonym or subspecies of *Lepidotrigona nitidiventris* (Smith, 1857). Indeed the principal reported difference between the two species is in their coloration: *L. nitidiventris* having brown tegulae and black abdominal tergites, whereas they are yellowish and reddish brown, respectively, in *L. latipes*. Notwithstanding the need for further revisionary studies

Photo: Zestin Soh



A nest of *Lepidotrigona nitidiventris* from Negeri Sembilan, Malaysia, a species closely related to *Lepidotrigona latipes* and differs mainly in colour of the tegulae and abdominal tergites.

for the *L. nitidiventris* species group, we interpret the collection locality of the type specimen (from 1890) to be from Singapore based on its label. No member of this species group has been recorded in Singapore since 1890. As photographs of the *L. latipes* type specimen are not available, an image of *L. nitidiventris* is featured below.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the nature reserves. Protection of large forest trees used for nesting and resin gathering.

Scientific Name:
Lepidotrigona terminata
(Smith, 1878)

Common Name:
Gold-margined Stingless Bee

Family:
Apidae

Photo: Zestin Soh



Lepidotrigona terminata at their nest.

National Status: Vulnerable (VU)

Habitat and Ecology: Eusocial stingless bee that builds its hive within tree cavities using resin gathered from plants. Found in mature forests, including mangroves.

Distribution: Myanmar, Thailand, Indochina, and Yunnan (China) south to Singapore, Sumatra, Java, and Borneo.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: This species is best known in Singapore from Chek Jawa, where

it was first recorded for Singapore in 2015 visiting the inflorescences of *Nypa fruticans*. Sightings have since extended to other areas of Pulau Ubin as well as on Pulau Tekong. A recent mainland occurrence in Sembawang in northern Singapore is considered to be from a translocated nest rather than a natural population.

Conservation Measures: Preservation and restoration of high-quality forest patches, including mangroves, in and around areas where it occurs, such as on Pulau Ubin. Protection of known nests, which are long-lived, and large forest trees used for nesting and resin gathering. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Tetragonula (Tetragonilla)
atripes (Smith, 1857)

Common Name:
Orange-and-black Stingless Bee

Family:
Apidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Eusocial stingless bee that builds its hive at the base of trees using resin gathered from plants. Found in mature secondary and primary forests, and is likely dependent on particular trees (e.g. dipterocarps) for resin sources.

Distribution: Thai-Malay Peninsula, southern Myanmar, Singapore, Sumatra, and Borneo.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: This species was last recorded in Singapore at Bukit Timah by D.H. Murphy in 1965, but has not been found locally since.

Photo: Zeslin Soh



Tetragonula atripes visiting a *Heliconia* in Penang, Malaysia.

This species is easily identifiable by its distinctive and striking coloration.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as the Central Catchment Nature Reserve and its nature parks. Protection of large forest trees used for nesting and resin gathering.

Scientific Name:

Tetragonula (Tetragonula) geissleri (Cockerell, 1918)

Common Name:

Geissler's Stingless Bee

Family:

Apidae

National Status: Near Threatened (NT)

Habitat and Ecology: Eusocial stingless bee that builds its hive at the base of trees and termite mounds, using resin gathered from plants. Found in mature secondary and primary forests.

Distribution: Thai-Malay Peninsula, Singapore, Sumatra, and Borneo.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: First recorded at Mandai in 1922, this species appears to be largely restricted to sites at and within the Bukit Timah Nature Reserve, the Central Catchment Nature

Photo: Zestin Soh



Tetragonula geissleri at their nest entrance in the Singapore Botanic Gardens.

Reserve, and the Singapore Botanic Gardens. Hives are often constructed in active mounds of the termite *Hospitalitermes umbrinus* at the base of trees. Workers have been observed foraging from extrafloral nectaries of plants locally.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs. Protection of known nests and large forest trees used for nesting and resin gathering. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Tetragonula (Tetragonula) laeviceps (Smith, 1857)

Common Name:

Smooth-headed Stingless Bee

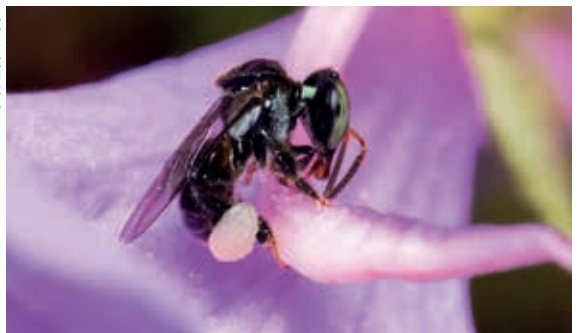
Family:

Apidae

National Status: Near Threatened (NT)

Habitat and Ecology: Eusocial stingless bee that builds its nest in tree cavities using resin gathered from plants. Found in mature secondary and primary forests, and is likely dependent on particular trees (e.g. dipterocarps) for resin sources.

Photo: Zestin Soh



Tetragonula laeviceps, alternatively known by its synonym *T. pagdeniformis*, visiting *Melastoma malabathricum* in the Central Catchment Nature Reserve.

Distribution: Thai-Malay Peninsula, Singapore, Borneo, and possibly Sumatra, Java, and Bali.

Threats: Habitat loss and associated declines in trees that provide suitable nesting sites and resin.

Scientific Interest and Potential Value: The type series and a neotype designated for this species was discovered by A.R. Wallace in Singapore. Currently all available country records are from forested sites within and around the Bukit Timah Nature Reserve and Central Catchment Nature Reserve. This species has a complicated taxonomic history and is alternatively known by its synonym *T. pagdeniformis* (Sakagami, 1978). Notably it should not be confused with *T. valdezi*, the most common stingless bee in Singapore, which is larger, has weaker thorax hair bands and a redder

abdomen, and has also previously been referred to by the same name.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Central Catchment Nature Reserve and its surrounding nature parks. Protection of large forest trees used for nesting and resin gathering. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Vespa multimaculata
Pérez, 1910

Common Name:
Many-banded Hornet

Family:
Vespidae

National Status: Nationally Extinct (NEx)

Habitat and Ecology: Eusocial wasp that builds subterranean nests under the roots of trees. Found only in mature secondary and primary forests.

Distribution: Brunei, Laos, Malaysia (Peninsular Malaysia, Sabah, Sarawak), Thailand, Indonesia (Kalimantan, Sumatra), Singapore.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: As the smallest hornet recorded from Singapore, this species is readily identifiable by its size and distinctive coloration. Although it was documented by Dover in 1929,



Photo: Mike Hooper

Female *Vespa multimaculata* visiting a palm inflorescence in Selangor, Malaysia.

there have been no subsequent sightings even after comprehensive surveys for Hymenoptera in likely areas and habitats, including the Bukit Timah Nature Reserve.

Conservation Measures: Seek rediscovery of extant populations through biodiversity monitoring by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around where extant populations would occur (if they exist), such as in the nature reserves. Protection of any rediscovered nests that do not pose a public safety risk.

Scientific Name:
Polistes meadeanus (von
Schulthess, 1913)

Common Name:
Meade-Waldo's Paper Wasp

Family:
Vespidae

National Status: Vulnerable (VU)

Habitat and Ecology: Eusocial wasp that builds its nest under a leaf. Found in mature forest habitat, typically observed in shaded understorey.

Distribution: Indonesia, Singapore, Malaysia, Vietnam and Borneo.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: In Singapore this species appears confined to the Central Catchment Nature Reserve and surrounding forested parks. Its cocoon caps are distinctively bright green and

Photo: Khiew Sin Khoon



Polistes meadeanus at their nest in the Central Catchment Nature Reserve, Singapore.

gradually transition to a pale yellow as they mature. The species closely resembles *Polybioides raphigastria* in coloration and general body shape.

Conservation Measures: Preservation and restoration of high-quality forest patches at and around sites where it occurs, such as the Central Catchment Nature Reserve, Bukit Timah Nature Reserve and their surrounding nature parks. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Polistes tenebrosus
Lepeletier, 1836

Common Name:
Dark-winged Paper Wasp

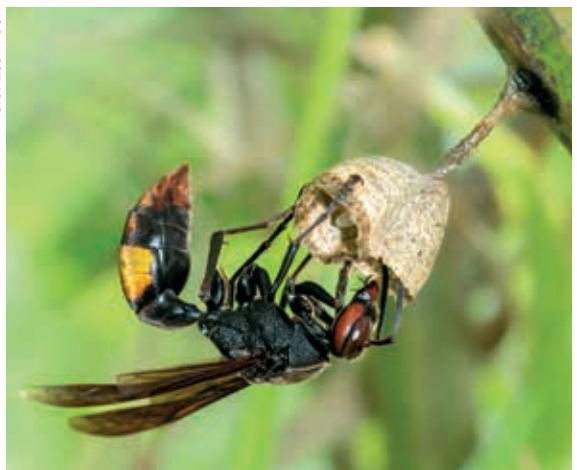
Family:
Vespidae

National Status: Vulnerable (VU)

Habitat and Ecology: Eusocial wasp that builds its nest under leaves and sheltered areas. Prefers mature forest including mangroves.

Distribution: Singapore, Malaysia, Indonesia, Myanmar, Vietnam, Philippines, Taiwan.

Photo: Zeslin Soh



Female *Polistes tenebrosus* constructing a nest in Johor, Malaysia.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: Apart from one isolated record in the Sungei Buloh Wetland Reserve, all recent records appear to be limited to Pulau Ubin. Where it does occur, it may nest within manmade structures.

Conservation Measures: Preservation and restoration of high-quality forest patches in and around areas where the species is known to occur. Refraining from removing nests that do not pose a risk to public safety. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Polybioides raphigastra (de Saussure, 1854)

Common Name:
Needle-tailed Paper Wasp

Family:
Vespidae

National Status: Data Deficient (DD)

Habitat and Ecology: Eusocial wasp that builds a pear-shaped nest in the hollows of trees or in small caves, using plant materials. Found in and around mature forests.

Distribution: Malay Peninsula, Singapore, Borneo.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: This species was documented in Singapore in 1902 by P. Cameron at Bukit Timah (as *Icaria sulciscutis*), and subsequently



Photo: Zestin Soh

Polybioides raphigastra visiting *Melastoma malabathricum* in Johor, Malaysia.

from Geylang in 1980. There have been no local records since. Its diminutive size and well-camouflaged nests could contribute to the possibility of being overlooked, hence it is categorized as Data Deficient.

Conservation Measures: Seek to establish information on population distribution and habitat usage through recording by researchers and citizen scientists. Preservation and restoration of high-quality forest patches across Singapore. Refraining from removing nests that do not pose a risk to public safety.

Scientific Name:
Ropalidia flavopicta (Smith 1857)

Common Name:
Yellow-painted Paper Wasp

Family:
Vespidae



Photo: Yam Tim Wing

A nest of *Ropalidia flavopicta* on a tree trunk in the Central Catchment Nature Reserve, Singapore.

National Status: Data Deficient (DD)

Habitat and Ecology: Eusocial wasp that gathers plant fibres to build nests that comprise combs covered by a flat envelope. Nests are built on a broad solid surface, such as tree bark or rock.

Distribution: Singapore, Vietnam, Malay Peninsula, Borneo, Sumatra.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: Recorded in sites in or around the Central Catchment Nature

Reserve and surrounding forested parks. Its small size and well-camouflaged nests could contribute to the possibility of being overlooked, hence it is categorized as Data Deficient.

Conservation Measures: Seek to establish information on population distribution and habitat usage through recording by researchers and citizen scientists. Preservation and restoration of high-quality forest patches in and around the Central Catchment Nature Reserve and surrounding nature parks. Refraining from removing nests that do not pose a risk to public safety.

Scientific Name:
Metischnogaster drewseni (de Saussure, 1857)

Common Name:
Drewsen's Hover Wasp

Family:
Vespidae

National Status: Data Deficient (DD)

Habitat and Ecology: Primitively eusocial wasp which builds long nests suspended on aerial horsehair-like fungal rhizomorphs.

Distribution: Singapore, Malaysia (Peninsular, Sarawak), Indonesia, Philippines (Palawan).

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: Currently known from only two documented occurrences in

Photo: John XO Lee



A specimen of *Metischnogaster drewseni* from Singapore.

Singapore, specifically in Mandai and Bukit Kalang. It is likely to be restricted to mature forest.

Conservation Measures: Seek to establish information on population distribution and habitat usage through recording by researchers and citizen scientists. Preservation and restoration of high-quality patches of forest across Singapore. Refraining from removing nests that do not pose a risk to public safety.

Scientific Name:

Sphex argentatus
Fabricius, 1787

Common Name:

Silver Digger Wasp

Family:

Sphecidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary wasp that builds an underground nest. It specializes in hunting Orthoptera, typically katydids (Tettigoniidae), as provisions for its larvae. Occurs in coastal forests.

Distribution: Singapore, Indonesia, New Guinea, India, Japan, Taiwan, Philippines, China, Australia, Spain, Democratic Republic of Congo, Kenya, South Africa, Sudan.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: In Singapore this species seems to be associated with the coast, being recorded exclusively at Semakau and Changi. Due to its distinct visual characteristics, it is unlikely to be missed during observations.

Photo: Adrian Nebbett



Sphex argentatus visiting a *Celosia* in Malaysia.

Conservation Measures: Preservation and restoration of coastal forest and natural beach habitats in and around sites where it is known to occur. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Chlorion lobatum
(Fabricius, 1775)

Common Name:

Emerald Cricket-Hunter

Family:

Sphecidae

Photo: Bruce Swales



Female *Chlorion lobatum* at Coney Island, Singapore.

National Status: Near Threatened (NT)

Habitat and Ecology: Solitary wasp that builds an underground nest. It specializes in hunting Orthoptera, typically crickets (Gryllidae), as provisions for its larvae. Occurs in coastal forest.

Distribution: Singapore, Malaysia, Indonesia (Sumatra), Vietnam, China, India, Nepal, Bangladesh, Myanmar, West Indies.

Threats: Habitat loss and associated declines in suitable nesting sites.

Scientific Interest and Potential Value: This distinctive species is mainly associated with coastal forest sites, and in Singapore is largely known from Coney Island, Pulau Ubin and Changi Beach, although it may also occur at mature forests further inland such as at MacRitchie.

Conservation Measures: Preservation and restoration of high-quality coastal forest and natural beach habitats at and around areas where it is known to occur. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:
Bembix melancholica
Smith, 1858

Common Name:
Melancholic Sand Wasp

Family:
Crabronidae

National Status: Vulnerable (VU)

Habitat and Ecology: : Solitary wasp that occurs in and around the sandy areas of mangroves and coastal forest. Specializes in hunting large flies (Diptera). Nectars from native flowering shrubs such as *Leea indica*.

Distribution: Thai-Malay Peninsula, Singapore, and Borneo.

Threats: Habitat loss and associated declines in suitable hosts.

Scientific Interest and Potential Value: In Singapore, this large and distinctively marked wasp is



Photo: Zestin Soh

Male *Bembix melancholica* from Chek Jawa, Pulau Ubin.

found predominantly at Pulau Ubin, such as at Chek Jawa, and on the nearby mainland including Coney Island.

Conservation Measures: Preservation and restoration of high-quality habitats, including mangroves and coastal forest, particularly at sites where it is known to occur. Monitoring of extant populations by researchers and citizen scientists.

Scientific Name:

Megascolia procer procer
(Illiger, 1802)

Common Name:

Atlas Mammoth Wasp

Family:

Scoliidae

National Status: Vulnerable (VU)

Habitat and Ecology: Solitary wasp that digs in the ground or decaying wood in search of their hosts, the larvae of large scarab beetles. Mainly occurs in and around mature mangroves and forests. Nectars from native flowering shrubs such as *Premna serratifolia*.

Distribution: Thai-Malay Peninsula, Singapore, Sumatra and Borneo.

Threats: Habitat loss and associated declines in suitable hosts.

Scientific Interest and Potential Value: This wasp is the largest representative of its family and one of the largest wasps in the world. Despite its conspicuous size and markings, it is rarely observed locally. Country records are predominantly from the Sungei Buloh Wetland Reserve and Admiralty Park, but have also recently been extended to the Singapore Botanic

Photo: Meena Vathiyam



Male *Megascolia procer* in the vicinity of Admiralty Park, Singapore.

Gardens. Its occurrence is likely restricted by habitat association and the presence of suitable beetle hosts, one of which is reported to be the locally rare Atlas Beetle (*Chalcosoma atlas*).

Conservation Measures: Preservation and restoration of high-quality habitats, including mangroves and coastal forest, particularly at sites where it is known to occur. Monitoring of extant populations by researchers and citizen scientists.

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