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Scope(s): Global
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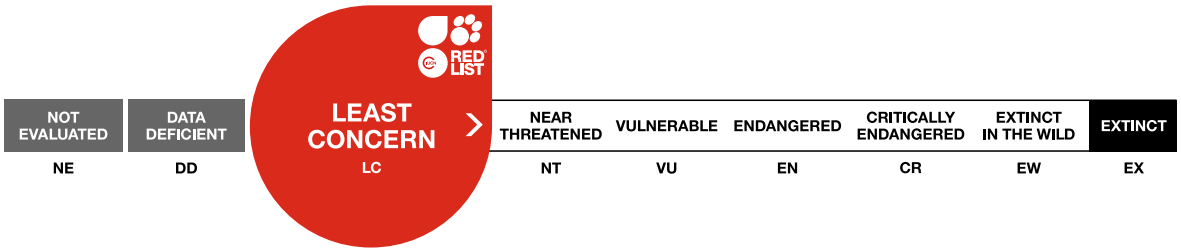
Hipposideros diadema, Diadem Leaf-nosed Bat

Assessment by: Aguilar, J. & Waldien, D.L.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Chiroptera	Hipposideridae

Scientific Name: *Hipposideros diadema* Geoffroy, 1813

Synonym(s):

- *Hipposideros nicobarensis* (Dobson, 1871)
- *Phyllorhina nicobarensis* Dobson, 1871
- *Rhinolophus diadema* É. Geoffroy, 1813

Common Name(s):

- English: Diadem Leaf-nosed Bat, Diadem Horseshoe-bat, Diadem Leafnosed-bat, Diadem Roundleaf Bat

Taxonomic Source(s):

Simmons, N.B. and Cirranello, A.L. 2020. Bat Species of the World: A taxonomic and geographic database. Available at: https://batnames.org/home.html. (Accessed: 05 August 2020).

Taxonomic Notes:

This species is recognized by Simmons and Cirranello (2020) and may have 15 subspecies (Bonaccorso 1998). Additional research is needed to clarify taxonomic relationships and distribution among the subspecies.

Assessment Information

Red List Category & Criteria: Least Concern ver 3.1

Year Published: 2021

Date Assessed: April 30, 2021

Justification:

Hipposideros diadema is assessed as Least Concerned as the species does not meet the requirements for a threatened status of the IUCN Red List. It is a widespread species with a broad distribution throughout Southeast Asia, as well as parts of South Asia and Oceania, surpassing the extent of occurrence and area of occupancy requirements to classify as a vulnerable species. There is a presumed large population of *H. diadema* due to broad distribution. It is suspected to be experiencing a low-level decline due to significant habitat loss and cave disturbances throughout its range, although that decline is unlikely to be at a rate great enough to qualify the species for listing in a threatened category.

Previously Published Red List Assessments

2008 – Least Concern (LC)
https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T10128A3169874.en

1996 – Lower Risk/least concern (LR/LC)

Geographic Range

Range Description:

The species is widespread and ranges from the Andaman and Nicobar Islands of India of South Asia throughout Southeast Asia and south to northeastern Australia (Srinivasulu *et al.* 2016, Aul *et al.* 2014). It is prevalent throughout Southeast Asia including Brunei, Cambodia, East Timor, Indonesia (including Borneo, Sulawesi, Java, Sumatra, and Lesser Sunda Islands), Laos, Malaysia (Peninsular Malaysia and Borneo), Myanmar, Philippines, Thailand, and Vietnam (Huang *et al.* 2014, Francis 2019, Nowak 1999),the species has not been recorded from Singapore (pers. com. Huang 2021). Within Oceania, it has been recorded in Papua New Guinea, through the Bismarck Archipelago, the Autonomous Region of Bougainville, the Solomon Islands, and as far south as the forests of northeastern Queensland, Australia, (Francis 2019, Nowak 1999). It is found from sea level to 1,300 m asl.

Country Occurrence:

Native, Extant (resident): Australia; Cambodia; India; Indonesia (Jawa, Kalimantan, Lesser Sunda Is., Maluku, Papua, Sulawesi, Sumatera); Lao People's Democratic Republic; Malaysia (Peninsular Malaysia, Sabah, Sarawak); Myanmar; Papua New Guinea; Philippines; Solomon Islands; Thailand; Timor-Leste; Viet Nam

Distribution Map

Legend

EXTANT (RESIDENT)

Compiled by:

IUCN (International Union for Conservation of Nature) 2021

The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

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Population

Data are limited on the species population size and trend. There is a presumed large population size that is suspected to be experiencing a low-level population decline due to significant habitat loss and cave disturbance. It can be locally common on the Nicobar Islands where colonies of up to 500 bats have been documented (Aul and Vijaykumar 2003, Aul *et al.* 2014). Furthermore, maternity colonies (females and young) of ca 8,000 *H. diadema* have been observed in Papua New Guinea (Bonoccorso 1998).

There are 15 subspecies recognized, four of which are found in Papua New Guinea (Bonaccorso 1998). The subspecies *H. d. masoni* on the Andaman Islands which differs from the subspecies *H. d. nicobarensis* that is endemic to the Nicobar Islands (Srinivasulu *et al.* 2016). Additional research is needed to clarify the taxonomic relationships among the the subspecies and evaluate if any may warrant elevation to species-level.

Current Population Trend: Decreasing

Habitat and Ecology **(see Appendix for additional information)**

The species primarily roosts in caves, but has also been found roosting in buildings, hollow trees, under palms, and underground chambers (Nowak 1999, Francis 2019). Within a crowded cave, *H. diadema* may roost on walls or near the floor of wet caves (Bonoccorso 1998). In Australia, it was recorded within three different cave types including fully developed tourist caves, self-guided/underdeveloped tourist caves, and non-tourist caves (Pavey 1998). On the Nicobar Islands, it has been recorded in bunkers with a colony size of 20-25, as well as colony sizes greater than 150 within caves (Aul *et al.* 2014). Maternity colonies of 8,000 *H. diadema* have been observed in Papua New Guinea (Bonoccorso 1998). Further, it is known to roost with other species in colonies that may reach over 100,000 individuals (Payne *et al.* 1985). It has been recorded roosting with *Rhinolophus affinis* at a cave in Penggerukan, North Sumatra (Whitten *et al.* 2000). In the Philippines, it was found to co-exist with other species in caves including *Hipposideros pygmaeus*, *Rhinolophus arcuatus*, *Rhinolophus virgo*, and *Rousettus amplexicaudatus* (Nuñeza and Galorio 2014), and co-roost with *Pipistrellus javanicus* (Galorio and Nuñeza 2014). Individuals were found to use multiple day roosts but did not change roost every day (Pavey 1998). Ectoparasite loads among *H. diadema* was recorded to be lowest among individuals within more complex caves and lower densities (Phelps and Kingston 2018), as close contact among females in maternity colonies has been shows to increase parasitism transmission (Christe *et al.* 2007).

It forages in various forested habitats, including highly disturbed areas (Francis 2019). A study in Australia found some flexibility in its foraging ecology, as some individuals occupied up to three types of vegetation including an open forest and vine thicket, although woodland was the most common (Pavey 1998). However, they still required similar habitat components among each type, specifically an area with leafless twigs for perching overlooking an open space. Its wing morphology and high constant echolocation frequency of 59-66kHz are more efficient for foraging in densely vegetated habitats, as higher frequency calls rapidly attenuate in air (Denzinger and Schnitzler 2013). Therefore, they are less effective in locating prey in more open forests or disturbed habitats such as coffee plantations (Kingston 2003, Meijaard 2005). According to Huang *et al.* (2019), species similar to *H. diadema* that roost in caves and have higher constant-frequency calls are more tolerant to coffee plantations than plant-roosting species with lower broadband-frequency calls. However, *H. diadema* is still less likely to be

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found in an open disturbed habitat such as a coffee plantation, as vegetation simplification decreases prey availability (Wickramasinghe *et al.* 2004), limits their echolocation efficiency and may increase predation pressure (Gardner 1998). This hypothesis is supported in a study by Huang *et al.* (2014) that only recorded sightings *H. diadema* within the primary rainforests of Bukit Barisan Selatan National Park, Sumatra, Indonesia, and only half of the sampled polyculture plantations, while recording no sightings within the sampled disturbed forest and monoculture plantations.

Hipposideros diadema is an insectivore, mostly feeding on Coleopterans, Lepidopterans, and Orthopteras, however, it has also been classified as an "occasional carnivore" that will occasionally feed on small birds and spiders (Pavey and Burwell 1997). Samples of *H. diadema* stomach contents in Australia consists of 78% Coleoptera and 20% Lepidoptera (Milne *et al.*2006). In the Philippines, Galorio and Nuñeza (2014) found fruit bits in their stomachs, suggesting they either consumed fruits or the insects attracted to fruits, as bats can echolocate prey that are hidden on a fruit surface (Korine and Kalko 2005). They also found bird feathers and unidentified hair fibers within the stomachs, supporting the theory of occasional carnivory. The species is a perch hunting species, with continuous flight as a secondary behavior (Pavey 1998). It hangs from a perch and scans the area using echolocation until it detects its prey and then makes a fast, direct flight to catch it (Francis 2019). It typically has 1-3 foraging areas with an average foraging range of 1.08km from the day roost (Pavey 1998) but can range up to 10km (Bonoccorso 1998). It also usually goes out for 1-2 foraging bouts per night (Pavey 1998), selecting several perches over 1km^2 (Francis 2019).

It has a single breeding season that coincides with warmer temperatures and the maximum quantity of insects (Nowak 1999). The females congregate and form maternity colonies during March and April (Nowak 1998, Francis 2019). In peninsular Thailand, females with young were found in maternity roosts in April (Monadjem *et al.* 2019). In the southern hemisphere, dependent young and subadult *H. diadema* were also observed in caves from April through May (Bonoccorso 1998). The females give birth to a single pup and may carry it until it becomes independent enough to fly and feed alone or leave it within the roost when searching for food. Within the Bismarck Archipelago, lactating females are known to carry infants from June through October (Bonoccorso 1998). A young *H. diadema* will reach sexual maturity after about one year (Nowak 1999). It has an average life span of about four to seven years but can live up to twelve years in captivity (Nowak 1999).

Systems: Terrestrial

Use and Trade

Evidence of hunting of *H. diadema* include anecdotal reports from Southeast Asia. Since *H. diadema* is found in many places where bat hunting is common (Aul *et al*. 2014, Huang *et al.* 2014, Wiantoro *et at*. 2016), the species is likely being locally hunted, but there is not enough data to support that it is a major threat to its population.

Threats (see Appendix for additional information)

Human disturbance and habitat loss (e.g., cave roosts and forest foraging habitats) are the leading threats to *H. diadema* populations. Caves are the preferred roost site for *H. diadema* and are highly vulnerable to threats compared to any land resource (Galorio and Nuñeza 2014). Such threats include limestone extraction, tourism, guano extraction, and cave swiftlet nests (Galorio and Nuñeza 2014,

Kingston 2010). Destruction/disturbance of mines has also been shown to significantly threaten cave-roosting species such as *H. diadema* (Hall *et al.* 1997).

Within Southeast Asia, as much of 74% of forest may be lost by the year 2100 (Sodhi *et al.* 2004). Singapore has lost 95% of its primary forest since the 1800s with an estimated bat species loss of about 70% (Corlett 1992, Lane *et al.* 2006). Similarly, the rate of deforestation in Southeast Sulawesi was 41,814 ha/year in 1985–1997 (Kuhutanan 2002). Throughout all of Indonesia, the Global Forest Watch reports 27Mha of tree cover loss between 2001-2019 including more than 9.5Mha of humid primary forest, further limiting bat species to protected areas (2021). *Hipposideros diadema* remains flexible in its utilized foraging habitats, including within highly disturbed areas (Francis 2019). However, the species is still less likely to be found in disturbed habitats and monoculture plantations (Huang *et al.* 2014) as it is not suited for simplified vegetation, and the expansion of coffee agriculture and other plantations have been shown to significantly reduce both bat abundance and richness (Huang *et al.* 2019). The increase of such activity will also likely further increase the disturbance of nearby caves, which remains the leading threat to *H. diadema* populations. Furthermore, simultaneous or continuous stressors, such as habitat loss and human disturbance, can increase vulnerability to pathogens and parasites (Phelps and Kingston 2018). Transmission of parasites through consumption of scavenger insects has also been observed within *H. diadema* and could post a risk to other population members (Galorio and Nuñeza 2014).

Conservation Actions **(see Appendix for additional information)**

Hipposideros diadema is known from protected areas throughout its range and there are currently no known species-specific conservation initiatives in place for the species as it is a Least Concerned species. For example, it has been recorded within and around Bukit Barisan Selatan National Park, Sumatra, Indonesia, which is the second most species rich area in Southeast Asia (Huang *et al.* 2014). Furthermore, the species was also recorded in areas outside the protection of the national park, including local villages, highlighting the importance of protecting this broader diversity hotspot.

Further surveys to identify and protect cave roosts that support the highest populations (Kingston 2010) are needed. Therefore, future management recommendations can focus on effectively providing protection for species as well as maintaining any scientific, cultural, or economic values of caves. Protection of more complex caves would provide more available roost sites for *H. diadema*, reducing both competition and risk of parasite transmission among individuals. Caves utilized by large maternity colonies should also be identified and protected, as the disturbance of these sites would likely cause local population declines or extirpations.

Research on the current population status and trends of *H. diadema* is lacking, yet crucial in creating effective conservation actions for the species. Similarly, further research on the ecology of maternity roosts would provide more information regarding the impacts of cave disturbance on their population. Huang *et al.* states that species differ in vulnerability to anthropogenic land use changes (2019), therefore, further species-specific studies must be performed to better analyze species sensitivity and form effective conservation plans. This is especially critical for *H. diadema* as it is found near many growing plantations/monocultures (Huang 2019, Huang 2014). Lastly, the extent of hunting of *H. diadema* is unknown and should be quantified to determine its exact impact on their population. Further taxonomic research on the species is needed.

Credits

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Disclaimer

External Resources

For Supplementary Material, and for Images and External Links to Additional Information, please see the Red List website.

Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.6. Forest - Subtropical/Tropical Moist Lowland	Resident	Suitable	Yes
1. Forest -> 1.9. Forest - Subtropical/Tropical Moist Montane	Resident	Suitable	Yes
2. Savanna -> 2.1. Savanna - Dry	-	Suitable	-
7. Caves and Subterranean Habitats (non-aquatic) -> 7.1. Caves and Subterranean Habitats (non-aquatic) - Caves	Resident	Suitable	Yes
7. Caves and Subterranean Habitats (non-aquatic) -> 7.2. Caves and Subterranean Habitats (non-aquatic) - Other Subterranean Habitats	-	Suitable	-
14. Artificial/Terrestrial -> 14.3. Artificial/Terrestrial - Plantations	-	Marginal	-
14. Artificial/Terrestrial -> 14.4. Artificial/Terrestrial - Rural Gardens	-	Marginal	-
14. Artificial/Terrestrial -> 14.5. Artificial/Terrestrial - Urban Areas	-	Marginal	-

Use and Trade

(http://www.iucnredlist.org/technical-documents/classification-schemes)

End Use	Local	National	International
Food - human	Yes	No	No

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.3. Tourism & recreation areas	Ongoing	-	-	Low impact: 3
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.1. Small-holder plantations	Ongoing	-	-	Low impact: 3
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.2. Agro-industry plantations	Ongoing	-	-	Low impact: 3
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
3. Energy production & mining -> 3.2. Mining & quarrying	Ongoing	-	-	Low impact: 3
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		

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5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.1. Intentional use (species is the target)	Ongoing	-	-	Low impact: 3
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.2. Unintentional effects (species is not the target)	Ongoing	-	-	Low impact: 3
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.3. Persecution/control	Ongoing	-	-	Low impact: 3
	Stresses:	2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.3. Unintentional effects: (subsistence/small scale) [harvest]	Ongoing	-	-	Low impact: 3
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.4. Unintentional effects: (large scale) [harvest]	Ongoing	-	-	Low impact: 3
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
6. Human intrusions & disturbance -> 6.1. Recreational activities	Ongoing	-	-	Low impact: 3
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		
6. Human intrusions & disturbance -> 6.3. Work & other activities	Ongoing	-	-	Low impact: 3
	Stresses:	2. Species Stresses -> 2.2. Species disturbance		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Action in Place
In-place research and monitoring
Action Recovery Plan: No
Systematic monitoring scheme: No
In-place land/water protection
Conservation sites identified: No
Area based regional management plan: No
Occurs in at least one protected area: Yes
Invasive species control or prevention: No
In-place species management

Conservation Action in Place
Harvest management plan: No
Successfully reintroduced or introduced benignly: No
Subject to ex-situ conservation: No
In-place education
Subject to recent education and awareness programmes: Unknown
Included in international legislation: No
Subject to any international management / trade controls: No

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Action Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.3. Habitat & natural process restoration
4. Education & awareness -> 4.3. Awareness & communications

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Research Needed
1. Research -> 1.1. Taxonomy
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.4. Harvest, use & livelihoods
1. Research -> 1.5. Threats
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.2. Harvest level trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Extreme fluctuations in the number of locations: No
Lower elevation limit (m): 0
Upper elevation limit (m): 1,300
Population
Continuing decline of mature individuals: Yes
Extreme fluctuations: No
Population severely fragmented: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 5
Congregatory: Congregatory (year-round)

The IUCN Red List Partnership

The IUCN Red List of Threatened Species™ is produced and managed by the IUCN Global Species Programme, the IUCN Species Survival Commission (SSC) and The IUCN Red List Partnership.

The IUCN Red List Partners are: ABQ BioPark; Arizona State University; BirdLife International; Botanic Gardens Conservation International; Conservation International; Missouri Botanical Garden; NatureServe; Re:wild; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; and Zoological Society of London.