The Wildlife (Protection) Act and conservation prioritization of butterflies of the Western Ghats, southwestern India

Krushnamegh Kunte

Various schedules of the Wildlife (Protection) Act, 1972 (henceforth WPA), dictate the level of legal protection given to species of Indian animals. Shortcomings of the schedules of the WPA with respect to insects have been pointed out, but no solutions have been suggested. Here I have used butterflies of the Western Ghats as a case study, analysed their conservation values with multiple species attributes and then compared my findings with the species listed under the WPA. Analysis shows that a large proportion of species with high conservation values, many of them narrowly endemic and endangered, are not listed under the WPA, indicating the need to expand the listings. This methodology can be used to objectively assess conservation values of other animals and their inclusion in the WPA.

Keywords: Biodiversity hotspots, environmental law, insect diversity, Wildlife Protection Act.

THE most important legal system for protection of endangered animals in India is the Wildlife (Protection) Act, 1972 (ref. 1), henceforth WPA. The more recent Biological Diversity Act and Biological Diversity Rules[2] govern the use and protection of biodiversity, but both rely on the schedules of the WPA as a guideline for protecting species. WPA was a laudable legal measure for its time and it has proven valuable in the past several decades, especially with respect to conservation of large mammals and other vertebrates. The effectiveness of WPA in the conservation of invertebrates, however, is less clear. Several limitations of invertebrate lists under the schedules of the WPA have been highlighted in the past, particularly: (a) taxonomic inconsistencies and inaccuracies[3], (b) lack of objectivity[3,4], and (c) inadequacy of the listings of the schedules[4]. Of potentially dire consequence is the exclusion from the WPA schedules of many species that are narrowly endemic to small geographic areas within the confines of the country, are highly endangered and do not have any special legal protection.

The butterfly fauna of the Western Ghats (Table 1)[5,6], which is one of the global biodiversity hotspots and an important conservation area, exemplifies the problems posed by current listings under the six WPA schedules. According to the WPA, taxa listed under Schedule I have the highest level of legal protection, Schedule II offers the second highest level of protection and so on down to Schedule IV. Schedule V lists vermin and pests, and Schedule VI lists six plants. Among the first four schedules, butterflies are listed under Schedules I, II and IV, but many of the Western Ghats endemics and rare species have not been included[4]. There seem to be no data available in peer-reviewed literature describing the conservation importance of Indian butterfly species and subspecies. The rationale behind assigning taxa to specific WPA schedules has also not been published in any publicly available government documents. This has prevented objective assessment of the current listings and any future opportunities to improve them.

One way to remedy this situation is to analyse conservation values of butterfly species, which can then be used as a guide to the listing of species under WPA schedules. Conservation values based on multiple species attributes were computed earlier for birds of the Uttar Kannada District, southwestern India, by scoring their distributional ranges, habitats and taxonomic distinctiveness[7]. A similar scoring system was employed to assign conservation values to all the bird species and their habitats in the Western Ghats, to highlight conservation strategies in the face of ongoing habitat conversion and biodiversity loss[8]. Species parameters have also been used recently in assessing extinction proneness in tropical butterflies[9], and should be useful in the present context. Here I present an analysis of butterfly fauna of the Western Ghats, using multiple species parameters in assigning conservation values to all species. The results are compared with the WPA schedules and I also discuss how the approach presented here can be instrumental in improving the WPA schedules to ade-

Krushnamegh Kunte is in the Section of Integrative Biology, University of Texas at Austin, 1 University Station, C 0930, Austin, TX 78712, USA. e-mail: krushnamegh@mail.utexas.edu

Table 1. Family-wise breakdown of butterfly diversity and endemism in the Western Ghats

Family	Genera	Species	WG endemics[a]	WG + SL endemics[b]	Total endemics
Papilionidae	4	19	5	0	5
Pieridae	14	34	3	1	4
Nymphalidae	45	97	12	4	16
Riodinidae	1	1	0	0	0
Lycaenidae	54	100	3	3	6
Hesperiidae	46	82	10	0	10
Total	164	333	33	8	41

[a]WG, Species endemic to the Western Ghats; [b]WG + SL, Endemics shared with Sri Lanka.

quately protect species that need legal protection for their long-term conservation.

Methods

Study area and butterfly species

The Western Ghats stretches along the western coast of peninsular India from Surat Dangs in southern Gujarat to southwestern Tamil Nadu (8–20°N), covering an area of ~160,000 sq. km and ranging in elevation from sea level to ~2700 m. The northern parts and extreme southern tip are less moist, while the central and southern Western Ghats receive heavy annual precipitation of up to 6000 mm, which supports dense evergreen forests rich in species diversity and endemism. The two most biodiverse areas of the Western Ghats, i.e. Coorg–Nilgiris and southern Western Ghats, are separated by the Palghat Gap (Figure 1), giving rise to local endemism and increasing overall diversity in the area. Most of the flora and fauna of the Western Ghats are derived from the Oriental region (Holloway[10] and references therein). Endemism varies from over 60% for amphibians and reptiles to 4% for birds, but the overall levels of diversity and endemism in the Western Ghats are high[11], prompting their inclusion in the global biodiversity hotspots. A list of the Western Ghats butterflies was prepared from faunistic literature[5,6,12–14].

Figure 1. Map of the Western Ghats showing the four zoo-geographic divisions.

Conservation scores

Each butterfly species was given scores for four parameters (global distribution, local distribution, habitat preference and status) as discussed below. Values were assigned for various states of the parameters such that restricted global and local distributions, rarity and occurrence in threatened or very specialized habitats, each received the highest score. Widespread global and local distributions, commonness and occurrence in widespread, less threatened or diversity of habitats, each received a low score. Then a composite conservation value was calculated for each butterfly species by adding its four scores. Since scores were assigned from 1 to 10 for each of the four parameters, the highest possible conservation value for a species was 40 and the lowest value was 4.

Parameter values could be assigned in a number of ways and the method used here was arbitrary. What was critical for the present purpose was the relative rank of various states of the parameters. By extension, the relative conservation values (in this case out of 40) of different species were important, not absolute numbers computed for each species. In order to preserve and present my original data values were not normalized. The values can be normalized from my raw data for comparison with similar studies in other groups or areas. Given the limited space here, it is not feasible to give the complete list of butterflies of the Western Ghats with parameter values and conservation scores for each species. This dataset can be requested by e-mail. It will also be made available in a free public domain soon.

Table 2. Association between global distribution and status of butterflies of the Western Ghats

	RAPA[a]	RAWI	UNPA	UNWI	COPA	COWI	ABPA	ABWI	Total
NWG[b]	5		3	1	9	2			20
WG	1	1	2	1	4	4			13
WGSL	1	2	1		1	3			8
PI	1	1			1	7			10
IS	3		1	9	1	17			31
OR	17	14	7	21	4	71		1	135
OEH	2	3		5	1	22			33
OAU	2		1	7	1	26		3	40
OAF	2		2	1		13			18
OH					1	1			2
GL	2	1		1	1	17		1	23
Total	36	22	17	46	24	183	0	5	333

[a]Status within the Western Ghats – RA, Rare; UN, Uncommon; CO, Common; AB, Abundant; PA, Patchily distributed; WI, Widely distributed. Conservation scores – RAPA, 10; RAWI, 9; UNPA, 7; UNWI, 6; COPA, 4; COWI, 3 and ABWI, 1.

[b]Global distribution – NWG, Narrowly endemic to the Western Ghats (occur only in the southern and Coorg–Nilgiris regions; conservation score is 10); WG, Endemic to the Western Ghats, conservation score is 8; WGSL, Endemic to the Western Ghats–Sri Lanka biodiversity hotspot, conservation score is 6; PI, Restricted to Peninsular India, conservation score is 5; IS, Restricted to the Indian Subcontinent, conservation score is 4. The following distributions are over larger zoogeographic scales: OR, Oriental region, conservation score is 3; OEH, Oriental region and eastern Palaearctic (China, Japan, Korea, etc., conservation score is 2); OAU, Oriental and Australian regions, conservation score is 2; OAF, Oriental and African regions, conservation score is 2; OH, Oriental and Palaearctic, conservation score is 2, and GL, Distributed over three or more zoogeographic regions, or 'global', conservation score is 1.

Global distributions

Global distributions were assigned to species in terms of zoogeographic regions following Cox[15]: (1) Oriental region (India east- and southeast-ward up to Indonesia, the Philippines and Taiwan), (2) Australian region (New Guinea–Irian Jaya, Australia, New Zealand and associated Pacific Islands), (3) African region (including parts of the Middle East), (4) Palaearctic region (northern Eurasia), (5) Nearctic region (North America, including parts of Central Mexico), and (6) Neotropical region (southern North America, Central and South America). I classified the more restricted Oriental distributions into Indian subcontinent (Pakistan to northern Myanmar and the Himalayas to Sri Lanka), and Peninsular India and Sri Lanka–Western Ghats biodiversity hotspot (for narrower endemics, see the next section). Several faunistic works were consulted for global distribution of species[5,16–24]. Values for each of these distributional categories and other parameters are given in Tables 2 and 3.

Local distribution (within the Western Ghats)

The Western Ghats was subdivided in the following four natural zoogeographic sections[7]: (1) northern – southeastern Gujarat to Goa, (2) central – Goa to Coorg, (3) Coorg and Nilgiris, and (4) southern – south of the Palghat Gap to the southern tip of the Western Ghats (Figure 1). Local distribution of species was extracted from a variety of sources[4–6,13] and unpublished observations.

Habitat preferences

The major butterfly habitats were classified in broad categories reflecting the precipitation gradient, altitude and vegetation types, as follows:

(1) Low and mid-elevation evergreen and semi-evergreen forests (sea level up to 1500 m): This is one of the most endangered habitats in India; hence species inhabiting this habitat received the highest conservation score.

(2) Montane evergreen forests (>1800 msl) known as 'shola' forests: Species found in this habitat are highly specialized on montane forests and some of them are narrow endemics. This and the next habitat are highly endangered due to tea, coffee and wattle plantations and associated human disturbance; hence their inhabitants also received the highest score.

(3) Montane grasslands and edges of shola forests above 1800 m: as above.

(4) Moist forests: Including evergreen, semi-evergreen and dense riparian moist deciduous forests. Evergreen forests are thus a subset of moist forests, the evergreen forest species being more habitat-specialized. Species assigned to this category usually do not venture into drier and more exposed parts of the deciduous forests. This habitat is increasingly threatened from damming of forest rivers, extensive human use and various development activities.

Table 3. Association between global distribution and habitat preference of butterflies of the Western Ghats

	EVS[a]	SHO	MSG	MOI	DEC	DDS	WOO	GRS	SSA	DIV	Total
NWG[b]	11	2	7								20
WG	11			2							13
WGSL	5	1		2							8
PI				3	3	2		1		1	10
IS	8			4	8	2	3	4	1	1	31
OR	53	1	2	34	22	3	12	3	2	3	135
OEH	11		1	8	4		5			4	33
OAU	10			12	3	1	9	2		3	40
OAF				1		3		13		1	18
OH			1							1	2
GL	3		1		1		7	6	1	4	23
Total	112	4	12	66	41	11	36	29	4	18	333

[a]Butterfly habitats – EVS, Low and mid-elevation evergreen and semi-evergreen forests, conservation score is 10; SHO, Montane evergreen ('shola') forests, conservation score is 10; MSG, Montane shola–grassland mosaics, conservation score is 10; MOI, Moist forests (evergreen, semi-evergreen and riparian moist deciduous forests, conservation score is 8); DEC, Deciduous forests, conservation score is 6; DDS, Dry deciduous and scrub forests, conservation score is 4; WOO, Generalist woodland species (evergreen, deciduous and scrub forests, conservation score is 3); GRS, Low and mid-elevation dry grasslands and savannahs, conservation score is 2; SSA, Streams, swamps and other open freshwater habitats, conservation score is 2 and DIV, Diverse habitat types (generalist spp.), conservation score is 1.
[b]Global distribution as in Table 2.

(5) Moist deciduous forests: This habitat is more secure than the above-mentioned habitats, but suffers from felling, burning and intensive human use.
(6) Dry deciduous forests and scrublands: Most of these are highly disturbed deciduous forests that have been thinned and converted to dry habitats due to intense use by humans and livestock.
(7) Woodlands: Species assigned to this category inhabit a wide range of woodland habitats, from openings in evergreen forests to wooded areas in urban settings. These are woodland generalists.
(8) Low and mid-elevation dry grasslands and savannahs: These are usually maintained as grazing land for livestock by human-induced fires.
(9) Non-forest streams, swamps and other open freshwater habitats: Although this habitat is important for migratory birds, fish and other animals, it is not so important for butterflies since few habitat generalist species use it non-exclusively.

Habitat information on butterfly species was gathered from various sources[4,13,25–26] and unpublished observations.

Status

Status, i.e. frequency of occurrence and patchiness of geographical distribution, was assigned to butterfly species in the Western Ghats from the literature as well as unpublished observations. Common species received lower scores than rare species, and species with patchy populations received higher scores than those with more widespread populations (Table 2).

Previous analyses have frequently used taxonomic distinctiveness in computing conservation values[7,8,27,28]. This component could feature prominently in future studies on Indian butterflies when we have a better understanding of phylogenetic relationships between various species groups and when species arrangements in some important genera have stabilized further. Several taxonomic efforts are currently under way to resolve these issues[29–31], and it should be possible to use the resulting information in near future.

The present analysis should be considered with two important caveats in mind. First, the scoring scheme used here is open to some arbitrariness. Secondly, different sets of species attributes may be important while calculating conservation scores for different groups of organisms. Thus, in a more inclusive effort in future, a multi-criterion analysis should be performed followed by sensitivity analysis for the various species attributes, so that these two issues can be addressed in more detail.

Results

Thirty-three of the 333 butterfly species found in the Western Ghats are endemic, and an additional eight endemics are shared between the Western Ghats and Sri Lanka biodiversity hotspots, making the total number of endemic and narrowly endemic species as 41 or 12.31% of the Western Ghats butterfly fauna (Table 1). The mean conservation value of all the 333 species was 20.1 ± 7.13 (range 9–40). The mean conservation value of non-endemic species was 18.51 ± 5.85 (range 9–33; 292 spp.), that of the species endemic to the Western Ghats and Sri Lanka was 31.37 ± 4.93 (range 21–40; 41 spp.). The difference between the distribution of conservation values of

endemic and non-endemic species was significant (Kolmogorov–Smirnov test: $D = 0.7445$, $P < 0.0001$). However, the ranges of their conservation values overlapped to a large extent (Figure 2), indicating that endemism alone was not a good correlate of overall conservation values.

Table 2 gives a breakdown of species according to their global distribution and status within the Western Ghats. The proportion of rare and patchily distributed species was highest among narrow endemics, i.e. those occurring only in Coorg–Nilgiris and southern Western Ghats (five out of 20 species, or 25%), followed by other endemics, including those shared with Sri Lanka (seven out of 41 species, or 17%) and non-endemic species (29 out of 292 species, or 10%). Table 3 gives a breakdown of species according to their global distribution and habitat preference within the Western Ghats. An unusually high proportion of narrowly endemic species occupied three highly endangered habitats: evergreen forests (11 species, or 55% of the narrow endemics) and montane shola–grassland mosaics (9 species, or 45%). Thus, endemism, rarity, patchy distributions and preference for endangered habitats were generally associated. Note in Table 3 the marked absence of endemic species in dry, open habitats such as deciduous forests and scrub/savannahs, which are mostly a result of recent human-caused alterations in the Western Ghats.

Table 4 gives a family and WPA schedule-wise breakdown of Indian butterflies. It also includes a family-wise breakdown of 82 out of the total 333 butterfly species of the Western Ghats, with conservation values in the top quartile of the analysis. Although the schedules consider all the Indian taxa while the present study analyses conservation values of only the Western Ghats butterflies, the comparison bares important issues. The most striking result from this comparison is the taxonomic bias against family Hesperiidae as listed in the WPA schedules, whereas many hesperiids have high conservation values. Nymphalidae, Lycaenidae and Hesperiidae are the most diverse families both in India and in the Western Ghats[5,6], and their endemism levels in the Western Ghats are similar (Table 1). Diversity, endemism and resulting conservation values of the three families were accurately represented in the present analysis: the three families had comparable number of species in the top quartile of conservation values. In contrast, the WPA schedules covered a mere 3% of species under Hesperiidae (Table 4). Moreover, only a minor proportion of the species having the highest conservation values is included in any WPA schedule, highlighting the inadequacies of the listings of the WPA schedules and the need to expand them.

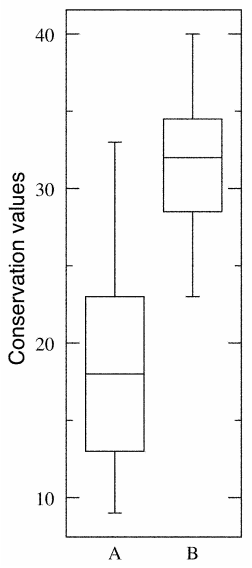

Figure 2. Distribution of conservation values of non-endemic species (A) and species endemic to the Western Ghats and Sri Lanka (B).

Discussion

Here I have attempted to compute conservation values of butterflies of the Western Ghats. Conservation values have been used to further assess the adequacy of butterfly listings under the WPA schedules. The present analysis indicates that the WPA does not protect many endemic and non-endemic species with high conservation values. For example, the WPA schedules do not list the following Western Ghats species with highest conservation values: *Eurema nilgiriensis*, *Mycalesis igilia*, *M. davisoni*, *M. orcha*, *Thoressa evershedi* and *T. sitala* (all with conservation values in the range 34–40, out of 40). On the other hand, narrowly endemic, patchily distributed and taxonomically the most distinctive butterfly in the Western Ghats, *Parantirrhoea marshallii* (conservation value 38), and other highly restricted Western Ghats endemics such as *Zipaetis saitis*, *Papilio buddha* and *Appias wardii* are all listed under Schedule II. These deserve to be listed under Schedule I. Thus, the WPA schedules should be expanded to include high conservation priority species currently missing from the schedules altogether, and species listed under various WPA schedules need reshuffling in order to grant a more appropriate level of protection to them according to their conservation values.

The finding that narrow endemics generally have higher conservation values is not surprising. However, particular attention should be paid to the fact that some rare and sparsely distributed non-endemics also have high conservation values. This is important because the Western Ghats populations of these more widespread species represent either subspecies or long-isolated populations that contain unique intraspecific genetic diversity and possess evolutionary potential, which is an important component of overall species diversity of the Western Ghats. In contrast, given their abundance in a variety of habitats, including urban landscapes, species endemic to the Indian subcontinent (e.g. *Pachliopta hector*) or the Western

Table 4. Family-wise comparison of taxa and their relative percentages (rounded-off to the nearest integer) listed under various schedules in the Wildlife (Protection) Act of India with taxa in the top quartile of conservation values in this study

	Schedules of the Wildlife (Protection) Act				
	I	II	IV	Total	This study
Papilionidae	14	21	0	35 (8%)	4 (5%)
Pieridae	6	21	4	31 (7%)	5 (6%)
Nymphalidae	61	141	5	211 (47%)	28 (34%)
Riodinidae	0	4	0	4 (1%)	0 (0%)
Lycaenidae	47	113	1	161 (36%)	21 (26%)
Hesperiidae	0	3	9	12 (3%)	24 (30%)
Total	128	303	19	450 (100%)	82 (100%)

Ghats (e.g. *Troides minos*) may not need legal protection under the WPA. For these reasons, I argue that endemism alone should not be used to list species in the WPA schedules; rather, a multi-parameter system similar to the one proposed here should be evolved and employed in future policy decisions and legal conservation efforts.

An analysis of conservation values of the birds of the Western Ghats has earlier shown that evergreen forests and montane shola–grassland mosaics support a high proportion of endemic and endangered bird species[8]; the present analysis shows that this is also true for the butterfly species. Hence, further attention is needed in offering better protection to these bird and butterfly habitats, since extinction of the species will follow widespread decline in their habitats even if the WPA protects them.

In summary, the analysis presented here offers a rationale, viz. conservation values of species based on multiple species attributes, for including species in the WPA schedules and providing them legal protection. This analysis can be extended to the flora and fauna of the entire country, particularly flowering plants, vertebrates and invertebrates on which similar information is available, such as butterflies and odonates (dragonflies and damselflies). As conservation biologists assess the status of various species and organismal groups, rank species by their conservation values and make the information available in peer-reviewed, publicly available research journals, government bodies can use this information for designing and implementing conservation strategies, including placement of species in appropriate WPA schedules according to their conservation values. This kind of strategy calls for concerted efforts of and regular interaction between researchers, conservation planning and decision-making bodies, and forest officials. The government approach to conservation also needs to be more dynamic, unlike the current static approach that lacks any schemes for periodic revisions and reassessments of important policy frameworks such as the WPA. This is crucial since conservation concerns are not unchanging even for apparently unthreatened species, as the alarming decline in vulture populations recently painfully demonstrated[32]. Thus, periodic assessments of the WPA listings, particularly of those taxa on which new information is continuously being generated, will better equip us in dealing with the changing conservation scene. This is more likely to succeed in protecting India's biodiversity wealth in the long term.

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Appendix to:

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Butterflies of the Western Ghats with their distributions, status and habitat preference, from which their conservation values were calculated (see the end of the table). Species are arranged in descending order by their conservation values.

Sr. #	Scientific name	Global distribution[a]	Local distribution[b]	Status[c]	Habitat preference[d]	Conservation value[e]
1	*Mycalesis igilia*	NWG	CONI	RAPA	EVS	40
2	*Mycalesis davisoni*	NWG	S	RAPA	EVS	40
3	*Eurema nilgiriensis*	NWG	CONI	RAPA	MSG	40
4	*Parantirrhoea marshallii*	NWG	CONIS	RAPA	EVS	38
5	*Zipaetis saitis*	NWG	CONIS	RAPA	EVS	38
6	*Thoressa evershedi*	NWG	S	UNPA	EVS	37
7	*Mycalesis orcha*	NWG	CONIS	UNPA	EVS	35
8	*Thoressa sitala*	NWG	CONIS	UNPA	EVS	35
9	*Appias wardii*	WG	CS	RAPA	EVS	34
10	*Mycalesis oculus*	NWG	S	COPA	MSG	34
11	*Mycalesis adolphei*	NWG	CONI	COPA	MSG	34
12	*Ypthima ypthimoides*	NWG	S	COPA	MSG	34
13	*Rapala lankana*	WGSL	CONIS	RAPA	EVS	34
14	*Arnetta mercara*	NWG	CONIS	COPA	EVS	34
15	*Oriens concinna*	NWG	CONIS	UNWI	EVS	34
16	*Amathusia phidippus*	OR	S	RAPA	EVS	33
17	*Logania distanti*	OR	CONI	RAPA	EVS	33
18	*Udara singalensis*	WGSL	S	UNPA	SHO	33
19	*Tajuria maculata*	OR	CONI	RAPA	EVS	33
20	*Hypolycaena nilgirica*	WGSL	CONIS	RAWI	EVS	33
21	*Caltoris canaraica*	WG	CS	RAWI	EVS	33
22	*Colias nilgiriensis*	NWG	CONIS	COPA	MSG	32
23	*Ypthima philomela*	IS	CONIS	RAPA	EVS	32
24	*Ypthima chenui*	NWG	CONIS	COPA	MSG	32
25	*Parantica nilgiriensis*	NWG	CONIS	COPA	SHO	32
26	*Celatoxia albidisca*	NWG	CONIS	COPA	SHO	32
27	*Quedara basiflava*	NWG	CONIS	COPA	EVS	32
28	*Papilio budha*	WG	CS	UNPA	EVS	31
29	*Eurema andersonii*	OR	CONIS	RAPA	MSG	31
30	*Discophora lepida*	WGSL	CS	RAWI	EVS	31
31	*Prosotas noreia*	OR	CONIS	RAPA	EVS	31
32	*Aeromachus dubius*	NWG	CONIS	COWI	MSG	31
33	*Thoressa astigmata*	WG	CS	UNPA	EVS	31
34	*Suastus minuta*	OR	CONIS	RAPA	EVS	31
35	*Potanthus pallida*	OR	CONIS	RAPA	EVS	31
36	*Neptis viraja*	IS	CS	RAPA	EVS	30
37	*Catochrysops panoramus*	OAU	CONI	RAPA	MOI	30
38	*Nacaduba caluria*	OAU	CONIS	RAPA	EVS	30
39	*Arhopala alea*	WG	CS	UNWI	EVS	30

40	*Salanoemia sala*	OR	CONIS	RAWI	EVS	30
41	*Potanthus pava*	OEH	CONIS	RAPA	EVS	30
42	*Neptis nata*	OR	CS	RAPA	EVS	29
43	*Neptis soma*	OR	CS	RAPA	EVS	29
44	*Horaga viola*	OR	CS	RAPA	EVS	29
45	*Curetis siva*	NWG	CS	COWI	EVS	29
46	*Choaspes benjaminii*	OEH	CONIS	RAWI	EVS	29
47	*Erionota thrax*	GL	CONIS	RAPA	EVS	29
48	*Pachliopta pandiyana*	WG	CS	COPA	EVS	28
49	*Papilio liomedon*	WG	CS	COPA	EVS	28
50	*Papilio dravidarum*	WG	CS	COPA	EVS	28
51	*Mycalesis anaxias*	OR	CONIS	UNPA	EVS	28
52	*Athyma nefte*	OR	CS	RAWI	EVS	28
53	*Euthalia telchinia*	OR	CS	RAWI	EVS	28
54	*Idea malabarica*	WG	CS	COPA	EVS	28
55	*Acytolepis lilacea*	OR	CONIS	UNPA	EVS	28
56	*Rachana jalindra*	OR	CS	RAWI	EVS	28
57	*Burara gomata*	OR	CS	RAWI	EVS	28
58	*Gerosis bhagava*	OR	CS	RAWI	EVS	28
59	*Cupitha purreea*	OR	CONIS	RAWI	MOI	28
60	*Hyarotis microsticta*	OR	CS	RAWI	EVS	28
61	*Appias lalage*	OR	S	COPA	MSG	27
62	*Euripus consimilis*	OR	NCS	RAPA	EVS	27
63	*Arhopala atrax*	OR	NCS	RAPA	EVS	27
64	*Arohopala abseus*	OR	NCS	RAPA	EVS	27
65	*Horaga onyx*	OR	NCS	RAPA	EVS	27
66	*Sovia hyrtacus*	WG	CS	COWI	EVS	27
67	*Thoressa honorei*	WG	CS	COWI	EVS	27
68	*Prioneris sita*	WGSL	CS	COPA	EVS	26
69	*Polyura schreiberi*	OR	NCS	RAWI	EVS	26
70	*Pantoporia sandaka*	OR	CS	UNPA	EVS	26
71	*Kaniska canace*	OEH	CONIS	UNWI	EVS	26
72	*Doleschallia bisaltide*	OR	NCS	RAWI	EVS	26
73	*Ionolyce helicon*	OAU	CONIS	UNWI	EVS	26
74	*Zeltus amasa*	OR	CS	UNPA	EVS	26
75	*Pelopidas subochracea*	IS	CS	UNWI	EVS	26
76	*Neptis clinia*	OEH	CS	RAWI	MOI	25
77	*Athyma selenophora*	OR	CS	UNWI	EVS	25
78	*Parthenos sylvia*	OAU	CS	UNPA	EVS	25
79	*Arhopala bazaloides*	OR	CS	UNWI	EVS	25
80	*Spindasis abnormis*	PI	NCS	RAPA	DEC	25
81	*Hyarotis adrastus*	OR	CS	UNWI	EVS	25
82	*Potanthus confucius*	OEH	NCS	RAWI	EVS	25
83	*Potanthus palnia*	OEH	S	COWI	EVS	25
84	*Pieris canidia*	OH	CONIS	COPA	MSG	24
85	*Pareronia ceylanica*	IS	CS	COPA	EVS	24
86	*Ypthima avanta*	IS	NCS	UNWI	EVS	24
87	*Rohana parisatis*	OR	NCS	UNPA	EVS	24
88	*Vanessa indica*	OEH	CONIS	COPA	MSG	24

89	*Udara akasa*	OR	CONIS	COWI	SHO	24
90	*Tajuria jehana*	IS	CS	UNWI	MOI	24
91	*Tajuria melastigma*	IS	CS	UNWI	MOI	24
92	*Hypolycaena othona*	OR	NCS	UNPA	EVS	24
93	*Bindahara phocides*	OAU	CS	UNWI	EVS	24
94	*Burara jaina*	OR	NCS	RAWI	MOI	24
95	*Bibasis sena*	OR	NCS	RAWI	MOI	24
96	*Hasora taminatus*	OAU	CS	UNWI	EVS	24
97	*Psolos fuligo*	OR	CONIS	COWI	EVS	24
98	*Oriens goloides*	OR	CONIS	COWI	EVS	24
99	*Polytremis lubricans*	OEH	CONIS	UNWI	MOI	24
100	*Troides minos*	WG	NCS	COWI	MOI	23
101	*Graphium antiphates*	OR	CS	COPA	EVS	23
102	*Mycalesis subdita*	PI	CS	COPA	MOI	23
103	*Cethosia nietneri*	WGSL	NCS	COWI	EVS	23
104	*Cirrochroa thais*	WGSL	NCS	COWI	MOI	21
105	*Athyma ranga*	OR	CS	COPA	EVS	23
106	*Dophla evelina*	OR	NCS	UNWI	EVS	23
107	*Kallima horsfieldi*	WG	NCS	COWI	MOI	23
108	*Celastrina lavendularis*	OAU	CONIS	COWI	EVS	23
109	*Neopithecops zalmora*	IS	CS	COWI	EVS	23
110	*Nacaduba hermus*	OR	NCS	UNWI	EVS	23
111	*Thaduka multicaudata*	OR	NCS	UNWI	EVS	23
112	*Zinaspa todara*	OR	CS	UNWI	MOI	23
113	*Creon cleobis*	OR	CS	UNWI	MOI	23
114	*Tagiades gana*	OR	NCS	UNWI	EVS	23
115	*Caprona agama*	OR	CS	RAPA	DDS	23
116	*Pelopidas conjuncta*	OR	NCS	UNWI	EVS	23
117	*Baoris farri*	IS	CS	COWI	EVS	23
118	*Melanitis zitenius*	OR	CS	COWI	EVS	22
119	*Mycalesis visala*	OR	CS	COWI	EVS	22
120	*Phalanta alcippe*	OAU	CS	COPA	EVS	22
121	*Libythea lepita*	OEH	CS	UNWI	MOI	22
122	*Kallima inachus*	OEH	N	RAPA	MOI	22
123	*Nacaduba pactolus*	OAU	NCS	UNWI	EVS	22
124	*Iraota timoleon*	OEH	NCS	UNWI	EVS	22
125	*Catapaecilma major*	OR	NCS	RAWI	DEC	22
126	*Halpe porus*	OR	CS	COWI	EVS	22
127	*Caltoris philippina*	OAU	NCS	UNWI	EVS	22
128	*Appias lyncida*	OR	NCS	UNWI	MOI	21
129	*Mycalesis patnia*	WGSL	NCS	COWI	MOI	21
130	*Libythea myrrha*	OR	NCS	UNWI	MOI	21
131	*Anthene emolus*	OR	NCS	UNWI	MOI	21
132	*Spindasis schistacea*	IS	NCS	UNPA	DEC	21
133	*Rathinda amor*	IS	NCS	COWI	EVS	21
134	*Ancema blanka*	OR	NCS	UNWI	MOI	21
135	*Pratapa deva*	OR	NCS	UNWI	MOI	21
136	*Tapena twaithesi*	OR	NCS	UNWI	MOI	21
137	*Odontoptilum angulata*	OR	NCS	UNWI	MOI	21

138	*Caprona alida*	OR	NCS	RAPA	DDS	21
139	*Baracus vittatus*	IS	CS	COWI	MOI	21
140	*Papilio polymnestor*	PI	NCS	COWI	MOI	20
141	*Cepora nadina*	OR	NCS	COWI	EVS	20
142	*Appias indra*	OR	NCS	COWI	EVS	20
143	*Lethe drypetis*	PI	NCS	COWI	MOI	20
144	*Vindula erota*	OR	NCS	COWI	EVS	20
145	*Pantoporia hordonia*	OR	NCS	COWI	EVS	20
146	*Tarucus indica*	PI	NCS	RAWI	GRS	20
147	*Nacaduba berenice*	OAU	NCS	UNWI	MOI	20
148	*Spindasis ictis*	IS	NCS	UNWI	DEC	20
149	*Spindasis elima*	IS	NCS	UNWI	DEC	20
150	*Cheritra freja*	OR	NCS	COWI	EVS	20
151	*Zesius chrysomallus*	IS	NCS	UNWI	DEC	20
152	*Rapala varuna*	OAU	NCS	UNWI	MOI	20
153	*Tagiades litigiosa*	OR	NCS	COWI	EVS	20
154	*Aeromachus pygmaeus*	OR	CS	COWI	MOI	20
155	*Halpe homolea*	OR	NCS	COWI	EVS	20
156	*Notocrypta paralysos*	OR	NCS	COWI	EVS	20
157	*Potanthus psuedomaesa*	OR	NCS	COWI	EVS	20
158	*Pelopidas agna*	OR	NCS	COWI	EVS	20
159	*Caltoris kumara*	OR	CS	COWI	MOI	20
160	*Papilio helenus*	OEH	NCS	COWI	EVS	19
161	*Papilio paris*	OEH	NCS	COWI	EVS	19
162	*Melanitis phedima*	OEH	NCS	COWI	EVS	19
163	*Orsotriaena medus*	OAU	CS	COWI	MOI	19
164	*Argynnis hyperbius*	GL	NCS	COPA	MSG	19
165	*Neptis jumbah*	IS	NCS	COWI	MOI	19
166	*Euthalia lubentina*	OR	NCS	UNWI	DEC	19
167	*Cyrestis thyodamas*	OEH	NCS	COWI	EVS	19
168	*Euploea klugii*	OR	NCS	COPA	MOI	19
169	*Tarucus callinara*	OR	NCS	RAWI	WOO	19
170	*Jamides alecto*	OAU	CS	COWI	MOI	19
171	*Spindasis lohita*	OR	NCS	UNWI	DEC	19
172	*Hasora vitta*	OR	NCS	UNWI	DEC	19
173	*Tagiades jepetus*	OAU	NCS	COWI	EVS	19
174	*Notocrypta curvifascia*	OEH	NCS	COWI	EVS	19
175	*Graphium sarpedon*	GL	NCS	COWI	EVS	18
176	*Graphium agamemnon*	GL	NCS	COWI	EVS	18
177	*Papilio clytia*	OEH	NCS	UNWI	DEC	18
178	*Papilio crino*	PI	CS	COWI	DDS	18
179	*Appias libythea*	IS	NCS	UNWI	DDS	18
180	*Ixias pyrene*	OR	NCS	COWI	MOI	18
181	*Ypthima huebneri*	OR	NCS	COWI	MOI	18
182	*Cupha erymanthis*	OR	NCS	COWI	MOI	18
183	*Neptis columella*	OR	NCS	COWI	MOI	18
184	*Limenitis procris*	OR	NCS	COWI	MOI	18
185	*Tanaecia lepidea*	OR	NCS	COWI	MOI	18
186	*Euthalia aconthea*	OR	NCS	COWI	MOI	18

187	*Parantica aglea*	OR	NCS	COWI	MOI	18
188	*Discolampa ethion*	OR	NCS	COWI	MOI	18
189	*Tarucus ananda*	OR	NCS	COWI	MOI	18
190	*Nacaduba beroe*	OR	NCS	COWI	MOI	18
191	*Anthene lycaenina*	OR	NCS	COWI	MOI	18
192	*Amblypodia anita*	OR	NCS	COWI	MOI	18
193	*Apharitis lilacinus*	IS	NC	RAPA	GRS	18
194	*Loxura atymnus*	OR	NCS	COWI	MOI	18
195	*Celaenorrhinus leucocera*	OR	NCS	COWI	MOI	18
196	*Celaenorrhinus ambareesa*	PI	NCS	COWI	DEC	18
197	*Celaenorrhinus ruficornis*	OR	NCS	COWI	MOI	18
198	*Sarangesa dasahara*	OR	NCS	COWI	MOI	18
199	*Iambrix salsala*	OR	NCS	COWI	MOI	18
200	*Arnetta vindhiana*	PI	NCS	COWI	DEC	18
201	*Gangara thyrsis*	OR	NCS	COWI	MOI	18
202	*Graphium doson*	OEH	NCS	COWI	MOI	17
203	*Appias albina*	OAU	NCS	COWI	MOI	17
204	*Polyura agraria*	IS	NCS	UNWI	WOO	17
205	*Euthalia nais*	IS	NCS	COWI	DEC	17
206	*Abisara echerius*	OEH	NCS	COWI	MOI	17
207	*Everes lacturnus*	OAU	NCS	COWI	MOI	17
208	*Acytolepis puspa*	OAU	NCS	COWI	MOI	17
209	*Megisba malaya*	OAU	NCS	COWI	MOI	17
210	*Nacaduba kurava*	OAU	NCS	COWI	MOI	17
211	*Petrelaea dana*	OAU	NCS	COWI	MOI	17
212	*Deudorix epijarbas*	OAU	NCS	COWI	MOI	17
213	*Deudorix isocrates*	IS	NCS	COWI	DEC	17
214	*Curetis thetis*	IS	NCS	COWI	DEC	17
215	*Hasora badra*	OEH	NCS	COWI	MOI	17
216	*Psuedocoladenia dan*	OEH	NCS	COWI	MOI	17
217	*Sarangesa purendra*	IS	NCS	COWI	DEC	17
218	*Pelopidas mathias*	OAF	NCS	COWI	MOI	17
219	*Pelopidas assamensis*	OR	N	RAPA	GRS	17
220	*Graphium nomius*	OR	NCS	COWI	DEC	16
221	*Cepora nerissa*	OR	NCS	COWI	DEC	16
222	*Ixias marianne*	PI	NCS	COWI	DDS	16
223	*Pareronia valeria*	OR	NCS	COWI	DEC	16
224	*Elymnias hypermenstra*	OR	NCS	UNWI	WOO	16
225	*Ypthima ceylonica*	IS	CS	COWI	WOO	16
226	*Charaxes solon*	OR	NCS	COWI	DEC	16
227	*Tarucus nara*	IS	CS	COWI	WOO	16
228	*Chilades pandava*	OR	NCS	COWI	DEC	16
229	*Catochrysops strabo*	OR	NCS	COWI	DEC	16
230	*Arhopala pseudocentaurus*	OR	NCS	COWI	DEC	16
231	*Arhopala amantes*	OR	NCS	COWI	DEC	16
232	*Surendra quercetorum*	OR	NCS	COWI	DEC	16
233	*Apharitis acamas*	OAF	N	RAPA	GRS	16
234	*Tajuria cippus*	OR	NCS	COWI	DEC	16
235	*Deudorix perse*	OR	NCS	COWI	DEC	16

236	*Rapala iarbus*	OR	NCS	COWI	DEC	16
237	*Rapala manea*	OR	NCS	COWI	DEC	16
238	*Curetis dentata*	OR	NCS	COWI	DEC	16
239	*Coladenia indrana*	OR	NCS	COWI	DEC	16
240	*Caprona ransonnetti*	OR	NCS	COWI	DEC	16
241	*Udaspes folus*	OR	NCS	COWI	DEC	16
242	*Matapa aria*	OR	NCS	COWI	DEC	16
243	*Pelopidas thrax*	OAF	N	RAPA	GRS	16
244	*Hebomoia glaucippe*	OEH	NCS	COWI	DEC	15
245	*Charaxes bernardus*	OEH	NCS	COWI	DEC	15
246	*Acraea violae*	IS	NCS	COWI	DDS	15
247	*Jamides bochus*	OEH	NCS	COWI	DEC	15
248	*Jamides celeno*	OAU	NCS	COWI	DEC	15
249	*Hasora chromus*	OAU	NCS	COWI	DEC	15
250	*Gegenes nostradamus*	GL	N	RAPA	GRS	15
251	*Tarucus balkanica*	GL	N	RAWI	GRS	14
252	*Talicada nyseus*	OR	NCS	COWI	DDS	14
253	*Badamia exclamationis*	GL	NCS	COWI	DEC	14
254	*Gomalia elma*	OAF	NCS	UNWI	GRS	14
255	*Parnara ganga*	OR	N	UNPA	GRS	14
256	*Pachliopta hector*	PI	NCS	COWI	DIV	13
257	*Catopsilia pomona*	OAU	NCS	ABWI	DEC	13
258	*Belenois aurota*	OAF	NCS	COWI	DDS	13
259	*Colotis amata*	OAF	NCS	COWI	DDS	13
260	*Colotis etrida*	IS	NCS	COWI	GRS	13
261	*Colotis fausta*	GL	NCS	UNWI	GRS	13
262	*Colotis phisadia*	OAF	N	UNPA	GRS	13
263	*Colotis vestalis*	OAF	N	UNPA	GRS	13
264	*Lethe rohria*	OR	NCS	COWI	WOO	13
265	*Mycalesis mineus*	OR	NCS	COWI	WOO	13
266	*Ypthima asterope*	OAF	NCS	COWI	DDS	13
267	*Neptis hylas*	OR	NCS	COWI	WOO	13
268	*Athyma perius*	OR	NCS	COWI	WOO	13
269	*Junonia atlites*	IS	NCS	COWI	SSA	13
270	*Junonia iphita*	OR	NCS	COWI	WOO	13
271	*Castalius rosimon*	OR	NCS	COWI	WOO	13
272	*Caleta caleta*	OR	NCS	COWI	WOO	13
273	*Chilades laius*	OR	NCS	COWI	WOO	13
274	*Suastus gremius*	OR	NCS	COWI	WOO	13
275	*Taractrocera maevius*	IS	NCS	COWI	GRS	13
276	*Taractrocera ceramas*	IS	NCS	COWI	GRS	13
277	*Eurema blanda*	OEH	NCS	COWI	WOO	12
278	*Delias eucharis*	IS	NCS	COWI	DIV	12
279	*Leptosia nina*	OAU	NCS	COWI	WOO	12
280	*Lethe europa*	OEH	NCS	COWI	WOO	12
281	*Mycalesis perseus*	OAU	NCS	COWI	WOO	12
282	*Ypthima baldus*	OEH	NCS	COWI	WOO	12
283	*Polyura athamas*	OEH	NCS	COWI	WOO	12
284	*Junonia almana*	OR	NCS	COWI	SSA	12

285	*Tirumala limniace*	OEH	NCS	COWI	WOO	12
286	*Euploea core*	OAU	NCS	COWI	WOO	12
287	*Leptotes plinius*	OAU	NCS	COWI	WOO	12
288	*Prosotas nora*	OAU	NCS	COWI	WOO	12
289	*Prosotas dubiosa*	OAU	NCS	COWI	WOO	12
290	*Spialia galba*	OR	NCS	COWI	GRS	12
291	*Ampittia dioscorides*	OR	NCS	COWI	SSA	12
292	*Telicota colon*	OAU	NCS	COWI	WOO	12
293	*Telicota ancilla*	OAU	NCS	COWI	WOO	12
294	*Catopsilia pyranthe*	OAU	NCS	ABWI	DDS	11
295	*Eurema brigitta*	GL	NCS	COWI	WOO	11
296	*Eurema laeta*	GL	NCS	COWI	WOO	11
297	*Colotis eucharis*	OAF	NCS	COWI	GRS	11
298	*Colotis danae*	OAF	NCS	COWI	GRS	11
299	*Phalanta phalantha*	GL	NCS	COWI	WOO	11
300	*Byblia ilithyia*	OAF	NCS	COWI	GRS	11
301	*Ariadne ariadne*	OR	NCS	COWI	DIV	11
302	*Ariadne merione*	OR	NCS	COWI	DIV	11
303	*Hypolimnas bolina*	GL	NCS	COWI	WOO	11
304	*Hypolimnas misippus*	GL	NCS	COWI	WOO	11
305	*Tirumala septentrionis*	OR	NCS	ABWI	WOO	11
306	*Danaus genutia*	GL	NCS	COWI	WOO	11
307	*Azanus ubaldus*	OAF	NCS	COWI	GRS	11
308	*Azanus uranus*	OAF	NCS	COWI	GRS	11
309	*Azanus jesous*	OAF	NCS	COWI	GRS	11
310	*Chilades parrhasius*	OAF	NCS	COWI	GRS	11
311	*Spindasis vulcanus*	OR	NCS	COWI	DIV	11
312	*Parnara bada*	OAF	NCS	COWI	GRS	11
313	*Borbo cinnara*	OAU	NCS	COWI	GRS	11
314	*Borbo bevani*	OAU	NCS	COWI	GRS	11
315	*Pachliopta aristolochiae*	OEH	NCS	COWI	DIV	10
316	*Papilio demoleus*	OAU	NCS	COWI	DIV	10
317	*Papilio polytes*	OEH	NCS	COWI	DIV	10
318	*Junonia hierta*	OAF	NCS	COWI	DIV	10
319	*Junonia orithya*	GL	NCS	COWI	GRS	10
320	*Junonia lemonias*	OEH	NCS	COWI	DIV	10
321	*Danaus chrysippus*	GL	NCS	COWI	GRS	10
322	*Euploea sylvester*	OAU	NCS	ABWI	WOO	10
323	*Spalgis epius*	OAU	NCS	COWI	DIV	10
324	*Pseudozizeeria maha*	OH	NCS	COWI	DIV	10
325	*Zizina otis*	OEH	NCS	COWI	DIV	10
326	*Zizula hylax*	GL	NCS	COWI	SSA	10
327	*Chilades trochylus*	GL	NCS	COWI	GRS	10
328	*Euchrysops cnejus*	OAU	NCS	COWI	DIV	10
329	*Eurema hecabe*	GL	NCS	ABWI	WOO	9
330	*Melanitis leda*	GL	NCS	COWI	DIV	9
331	*Cynthia cardui*	GL	NCS	COWI	DIV	9
332	*Zizeeria karsandra*	GL	NCS	COWI	DIV	9
333	*Lampides boeticus*	GL	NCS	COWI	DIV	9

[a]**: global distribution:** NWG = narrow Western Ghats endemic (occurs only in Coorg and Nilgiris southward): 10 pts
WG = Western Ghats endemic: 8 pts
WGSL = endemic to Western Ghats and Sri Lanka: 6 pts
PI = Restricted to Peninsular India (including Sri Lanka): 5 pts
IS = restricted to Indian Subcontinent: 4 pts
OR = occurs only in Oriental Region: 3 pts
OEH = occurs in Oriental and Eastern Holarctic Regions: 2 pts
OAU = occurs in Oriental and Australian Regions: 2 pts
OAF = occurs in Oriental and African Regions (including parts of Middle East): 2 pts
OH = occurs in Oriental and Palaearctic Regions: 2 pts
GL = occurs in three or more zoogeographic regions ("global"): 1 pts

[b]**: Local distribution in the Western Ghats:**
S: Southern Region only: 10 pts
CONI: Coorg and Nilgiris only: 10 pts
CONIS: Coorg-Nilgiri and Southern Regions only: 8 pts
CS: Southern and Central Regions including Coorg-Nilgiris: 6 pts
NCS: in all three regions of the Western Ghats: 4 pts
N: Northern Region only: 2 pt
NC: Northern and Central Regions only: 2 pt

[c]**: Status in the Western Ghats:**
RAPA: rare, patchy: 10 pts
RAWI: rare, widespread: 9 pts
UNPA: uncommon, patchy: 7 pts
UNWI: uncommon, widespread: 6 pts
COPA: common, patchy: 4 pts
COWI: common, widespread: 3 pts
ABWI: abundant, widespread: 1 pt

[d]**: Habitat preference:**
EVS: low and mid-elevation evergreen and semi-evergreen forests only: 10 pts
SHO: montane (shola) forests: 10 pts
MSG: montane habitats including shola and grasslands: 10 pts
MOI: moist forests (evergreen, semi-evergreen and riparian moist deciduous forests): 8 pts
DEC: deciduous forests: 6 pts
DDS: dry deciduous and scrub forests: 4 pts
WOO: generalist woodland species (evergreen, deciduous and scrub forests): 3 pts
GRS: low and mid-elevation dry grasslands and savannahs: 2 pts
SSA: streams, swamps and other open freshwater habitats: 2 pts
DIV: diverse habitat types (generalist spp): 1 pt

[e]: **Conservation value:** calculated as the sum of the scores from previous columns. The highest possible value was 40, the lowest was four.