ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 11, Issue 4, pp: (24-33), Month: October - December 2024, Available at: www.paperpublications.org

THE DIVERSITY, ABUNDANCE AND DISTRIBUTION OF BUTTERFLY'S SPECIES IN GASHAKA GUMTI NATIONAL PARK, TARABA STATE, NIGERIA

David Musa Garkida[1], Delphine Leila David[2], Hussaina John Danburam[2]

[1]Department of Geography, Taraba State University, Jalingo

[2]Department of Biological Sciences, Taraba State University, Jalingo

DOI: https://doi.org/10.5281/zenodo.14282407

Published Date: 5-December-2024

Abstract: **This study evaluates the diversity, abundance, and distribution of butterfly species in Gashaka Gumti National Park (GGNP), Taraba State, Nigeria. Butterflies, vital ecological indicators and pollinators, are integral to understanding environmental health and biodiversity conservation. Employing fruit-baited traps and transect walks, butterfly species were sampled over six months, capturing seasonal variations. A total of 100 species comprising 771 individuals were recorded, with *Tereas hecabe* being the most dominant species (12.84% of total abundance). The Shannon-Weiner Diversity Index (H') for the park was calculated at 3.797, reflecting high species richness but uneven distribution. Rare species represented 35% of the species pool, underscoring the park's ecological complexity and the importance of habitat heterogeneity. The findings highlight GGNP's role as a biodiversity hotspot and stress the need for targeted conservation strategies to maintain its ecological integrity.**

Keywords: **Butterfly, Diversity, Abundance, Distribution, Gashaka-Gumti.**

I. INTRODUCTION

The Lepidoptera, a significant group within the Arthropod phylum, primarily consists of butterflies, serving as valuable indicators for climatic conditions, seasonal variations, and ecological shifts. Despite their pivotal role in ecosystem health and their interdependence with plants, butterflies have often been overlooked by conservation biologists and policymakers [1].

Recognizing butterflies as crucial environmental health indicators and essential pollinators for flowering plants is vital for achieving sustainability and conserving floral diversity [2]. Although butterflies are taxonomically well-studied globally since the 18th century, their importance as surrogate representatives of environmental quality changes are underscored [3]. Particularly in Tropical Africa, such as Nigeria, where anthropogenic activities such as deforestation and other human activities threaten biodiversity, the conservation of butterflies is crucial [4].

Nigeria has experienced substantial forest loss, with about 410,000 ha (3.7%) of natural forest lost due to deforestation between 2000 and 2010 [5]. In response to such challenges, protected areas, known as National Parks, have been established to preserve biodiversity. These parks, considered biodiversity hotspots, play a vital role in maintaining ecological integrity. Gashaka Gumti National Park (GGNP) is one of such parks, and this study aims to evaluate the diversity, abundance, and distribution of butterfly species within GGNP to gauge the environmental health in and around the park.

ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 11, Issue 4, pp: (24-33), Month: October - December 2024, Available at: www.paperpublications.org

Insects, particularly arthropods, are excellent indicators of habitat health, due to their rapid response to environmental changes and high taxonomic diversity. Lepidoptera, as the second-largest order of arthropods, are easily identified, making them valuable for biodiversity surveys [6]. Species richness and relative abundance of individuals are critical aspects of diversity, influencing conservation planning and natural resource management [7].

The study emphasizes the ecological value of National Parks, such as GGNP, in preserving biodiversity, with butterflies serving as key indicators. By comprehensively assessing butterfly diversity in protected areas, this research aims to provide insights into the park's role in biodiversity conservation. Furthermore, understanding the diversity, abundance and distribution of butterfly species will contribute to the broader understanding of the ecological dynamics within GGNP.

The aim of this study is to evaluate the diversity, abundance and distribution of butterfly's species in Gashaka Gumti National Park, Taraba State, Nigeria.

II. MATERIALS AND METHODS

Description of the Study Area

Gashaka Gumti National Park, situated between latitude 7° 56° to 7'' 59' N and longitude 11° 48' to 11° 54' E, spans a total area of approximately 6,731 km² (Figure 1). It is geographically divided into the Gumi sector in Adamawa State and the Gashaka sector in Taraba State [8]. The park's nomenclature is a composite of Gashaka village in Taraba State and Gumti village in Adamawa State, reflecting the historical significance of these settlements. The establishment of Gashaka Gumti National Park resulted from the amalgamation of Gashaka Game Reserve and Gumti Game Reserve, enacted by the Federal Government of Nigeria through Decree number 36 of 1991.

Conceived as a protected area, the park serves multifaceted purposes, encompassing nature conservation, recreation, ecotourism, scientific and medical research. Additionally, it endeavors to foster the artistic, craft, and cultural heritage of the indigenous communities in proximity to the park. Aligned with national conservation efforts, Gashaka Gumti National Park stands as a testament to the commitment to preserving biodiversity, promoting sustainable tourism, and recognizing the cultural values of the region [8]. This initiative underscores the integral role of such protected areas in contributing to the ecological, recreational, and cultural tapestry of Nigeria.

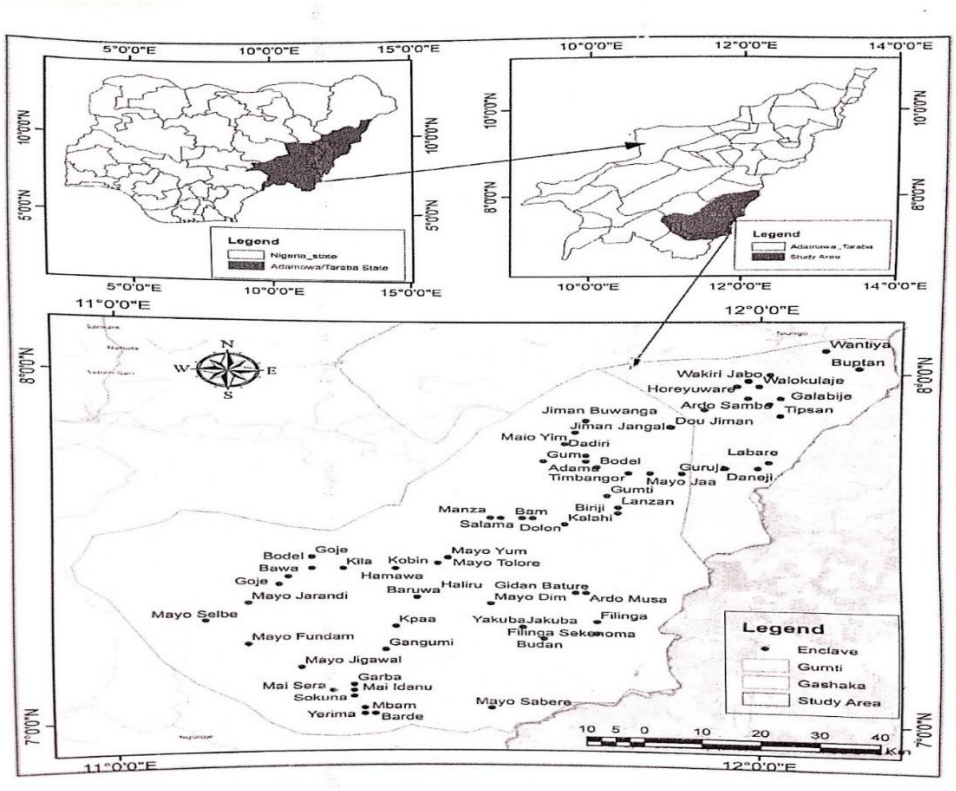

Figure 1: Map of Nigeria showing the Gashaka Gumti National Park

Source: Taraba State Geographic Information System (TAGIS), 2023.

Sampling Techniques

The study will employ a combination of fruit-baited charaxes traps and transect walk-and-count methods to survey butterflies in sacred sites. A single transect, spanning 250 meters, extending from the forest edge to its interior, with five (5) charaxes traps will be strategically positioned within each sacred site. A minimum separation of 50 meters and a maximum of 250 meters will be maintained between individual traps to ensure representative sampling. The traps will be deliberately set in similar microhabitats characterized by closed canopy forest conditions.

Sampling will take place monthly during both the dry season (February, March and April) and during the raining season (May, June and July), aligning with the availability of local field guides in the respective sacred sites. The sampling process will involve baiting charaxes traps with mashed, fermenting, or rotting banana mixed with beer. After a 4-day period, trap collections will be retrieve. Simultaneously, transect walks will be conducted along the established route and sacred grove edges, focusing on sunny conditions between 9:00 am and 4:00 pm.

All butterflies observed within 2.5 meters on either side of the transect route and along the sacred grove edge, within a 5-meter range in front of the observer, will be documented. Unidentified specimens will be photographed for later identification. The methodology will aim at comprehensively capturing butterfly diversity in the selected sacred sites, emphasizing consistent sampling strategies across seasons and meticulous trap placement within the forest landscape.

Species Handling and Identification

Specimens obtained from charaxes traps will be handle using standard procedures outlined by Magurran and McGill [9], involving the secure compression of the thorax to immobilize the specimens. Following capture, the specimens will be carefully place in glassine envelopes for subsequent processing in the laboratory. This comprehensive processing includes identification, drying, spreading, pinning, photographing, and labeling. Each specimen will undergo meticulous labeling with a unique code, detailing the precise location and date of collection.

Species identification will be carried out at the species level, utilizing diverse taxonomic resources such as Google Lanes and butterfly guidebooks. In cases where identification poses challenges, collaboration with forest guides or butterfly specialists will be sought to ensure accurate classification. The systematic approach employed in handling and processing these specimens aims to preserve the integrity of the collected data, allowing for detailed analysis and contributing to the broader understanding of butterfly populations and their ecological dynamics.

Experimental Design

The work will be based on a field survey (involving visual spotting) and laboratory analysis. The Gashaka-Gumti National Park will be stratified into three (3) habitat types on the bases of vegetation, land use, and fragmentation. The fragmented sites will also be chosen to reflect varying land use/land cover types and the degree of disturbance. Butterfly species will be assessed quantitatively across the different habitats and cultivated land areas with an adjustable handheld sweep net, a global positioning system (GPS) and a digital camera. Butterflies samples will be collected on a line transects at a distance of 100 meters on each transect. A total of 15 line transects measuring 50 meters apart will be used in each habitat type and unidentified butterflies will be caught using a sweep net having 150 cm handle and 25 cm orifice to identify the species and sex of each individual. The sampling will cover a period of 6 months from “February 2024-July 2024”.

Each survey will be carried out twice between 8:00 am and 12:00 pm and once between 4:00 pm and 6:00 pm every day in order to establish butterfly diversity, distribution and abundance. The unidentified butterfly specimens will be collected from several microhabitats within the location sites; grasses, flowers, hedges, and walls. Each of the specimens collected will be kept in a well-labeled Ziploc showing location, habitat type and date of collection. Collected specimens will be euthanized by a ball of cotton wool soaked in chloroform solution. The specimens will be further air-dried and photographed. Identification will be done using taxonomical keys of Sáfián and Warren (2015) [10], as well as online identification platforms such as the Virtual Museum of South.

Method of Data Analysis

Data collected will be analyzed using the Statistical Package for the Social Scientist (SPSS 26). Butterfly species, individual diversity, and abundance will be calculated using the Shannon Weiner index (H) [9]. The species richness (S) will be counted, and the species number.

ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 11, Issue 4, pp: (24-33), Month: October - December 2024, Available at: www.paperpublications.org

Shannon Weiner index (H') H'=— ∑pi(In) (pi)…… i

H'=Shannon index

Pi= Number of individuals of species Total number of samples

In=natural log

Calculation of Relative abundance:

$$\text{Species relative abundance} = \frac{\text{Species abundance} \times 100}{\text{Total abundance}}$$

Evenness Index (E) which refers to how close in numbers each species is in an environment, calculated as:

$$E = \frac{H}{H_{max}}$$

E=evenness index

H'=Shannon Weiner index

Hmax=the highest value of Shannon Weiner index

III. RESULTS AND DISCUSSION

Overall Abundance of Butterfly Species in Gashaka-Gumti National Park

Table 1 describes the overall abundance of Butterfly species in Gashaka-Gumti National Park. One hundred (100) species were recorded with a total abundance of 771 individuals. *Tereas hecabe* recorded the highest frequency with 99 individuals, accounting for 12.84% of the total population. This species is the most dominant butterfly across the park followed by *Precis terea* with 53 individuals (6.88%), *Danaus chrysippus* (41 individuals, 5.32%), *Papilio menestheus* with 40 individuals (5.19%), *Acraea admatha* (35 individuals, 4.54%) amongst others. Several species were represented by 1 individual which ranks amongst the lowest, each with a relative abundance of 0.13% including *Amauris niallius, Aphanaeus area, Aphnaeus orcas Bematistes epaea, Bematistes vestalis, Bunaea aleinoe, charaxes jasius, charaxes Laodice, Colotis ellppe, Colotis evippa, Dasychira cedestis, Epamera laon, Hypena scabra, Lepidochrysops quassi, lobobunaea phaedusa, Othreis fullonia, papilio nireus, Pentila pauli, Polygonia satyrus, Polytychus roseus, Precis Sophia, Ypthina doleta, Zizeeria knyssna.* A total of 35 species (35% of the total listed) had only one individual recorded, reflecting a diverse but uneven distribution.

Overall Diversity of Butterfly Species in Gashaka-Gumti National Park

Table 2 shows the overall Shannon-Weiner Diversity Index H' of Butterfly species in Gashaka Gumti National Park. The overall Diversity Index of butterfly recorded across five months was 3.79719.

Table 1: Overall Abundance of Butterfly Species in Gashaka-Gumti National Park

S/N	Specie	Frequency	Relative Abundance %
1	*Acraea admatha*	35	4.5396
2	*Acraea bonasia*	2	0.2594
3	*Acraea eponina*	2	0.2594
4	*Acraea lycra*	4	0.5188
5	*Acraea terpsichore*	5	0.6485
6	*Adonis blue*	2	0.2594
7	*Amauris egialea*	29	3.7610
8	*Amauris niallius*	1	0.1297
9	*Anthene larydas*	31	4.0207
10	*Aphanaeus area*	1	0.1297
11	*Aphnaeus orcas*	1	0.1297
12	*Appias sylvia*	2	0.2594
13	*Aurivithus aratas*	1	0.1297
14	*Axiocevses harpas*	2	0.2594

15	*Bematistes epaea*	1	0.1297
16	*Bematistes vestalis*	1	0.1297
17	*Bicyclus asochis*	2	0.2594
18	*Bicyclus asochis*	6	0.7780
19	*Bunaea aleinoe*	1	0.1297
20	*Catana crithea*	2	0.2594
21	*Catopsilia florella*	6	0.7780
22	*charaxes cingha*	2	0.2594
23	*charaxes etheodes*	3	0.3892
24	*charaxes jasius*	1	0.1297
25	*charaxes laodice*	1	0.1297
26	*charaxes pleione*	4	0.5188
27	*charaxes tiridates*	3	0.3892
28	*charexes cynthia*	2	0.2594
29	*Citrinnophila erastus*	8	1.0373
30	*Colotis ellppe*	1	0.1297
31	*Colotis evippa*	1	0.1297
32	*Cymothoe beckeri*	8	1.0373
33	*Cymothoe thedbene*	9	1.1673
34	*Danaus chrysippu*	41	5.3165
35	*Dasychira cedestis*	1	0.1297
36	*Epamera laon*	1	0.1297
37	*Eunica amulia*	4	0.5188
38	*Eupheiedra cyparisa*	1	0.1297
39	*Euriphene tadana*	2	0.2594
40	*Graphium agamemnon*	3	0.3892
41	*Graphium antheus*	28	3.6324
42	*Graphium dosen*	4	0.5188
43	*Graphium policines*	6	0.7780
44	*Graphium pylades*	3	0.3892
45	*Hamearis Lucina*	4	0.5188
46	*Herse convolvuli*	6	0.7780
47	*Hycharaxes ttiridates*	2	0.2594
48	*Hypena scabra*	1	0.1297
49	*Hypolimnas dubius*	19	2.4643
50	*Hypolimnas misippus*	13	1.6857
51	*Kallima rumia*	5	0.6485
52	*Large skipper*	3	0.3892
53	*Large white*	3	0.3892
54	*Lepidochrysops quassi*	1	0.1297
55	*Limenitis arthenus*	8	1.0373
56	*Liptena libyssa*	3	0.3892
57	*lobobunaea phaedusa*	1	0.1297
58	*Lolaus eurisus*	2	0.2594
59	*Loptosia medusa*	4	0.5188
60	*March ratillary*	6	0.7780
61	*Melanis pixe*	4	0.5188
62	*Melanitis leda*	2	0.2594
63	*Melanitis parmeno*	3	0.3892
64	*Mourning doak*	3	0.3892
65	*Mylothris chloris*	1	0.1297
66	*Nepheronia argia*	19	2.4643
67	*Nepheronia orgid*	3	0.3892
68	*Othreis fullonia*	1	0.1297
69	*papilio bromius*	13	1.6857
70	*Papilio dardanus*	6	0.7780
71	*papilio demoleus*	14	1.8155

ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 11, Issue 4, pp: (24-33), Month: October - December 2024, Available at: www.paperpublications.org

72	*Papilio menestheus*	40	5.1899
73	*papilio nireus*	1	0.1297
74	*papilio phorcas*	29	3.7610
75	*papilio zenobius*	2	0.2594
76	*Pardeloodes edipus*	2	0.2594
77	*Peacock butterfly*	12	1.5558
78	*Pentila pauli*	1	0.1297
79	*Pentila tripunctata*	9	1.1673
80	*Polygonia interrogatiouis*	2	0.2594
81	*Polygonia satyrus*	1	0.1297
82	*Polytychus roseus*	1	0.1297
83	*Precis chorimene*	14	1.8155
84	*Precis octaunia*	22	2.8532
85	*Precis Octellia*	3	0.3892
86	*Precis Sophia*	1	0.1297
87	*Precis terea*	53	6.8758
88	*Pyrausta tyralis*	6	0.7780
89	*Speakled wood*	7	0.9077
90	*Spindasis mozambica*	5	0.6485
91	*Syntarucus telicanus*	12	1.5558
92	*Syssphinx bicolor*	4	0.5188
93	*Taxila haquinus*	7	0.9077
94	*Telipna acrae*	2	0.2594
95	*Tereas hecabe*	99	12.8424
96	*Thermoniphas micylus*	4	0.5188
97	*Viceroy*	4	0.5188
98	*Ypthina doleta*	1	0.1297
99	*Zamarada corroborate*	2	0.2594
100	*Zizeeria knyssna*	1	0.1297
	Total Abundance	771	100.0

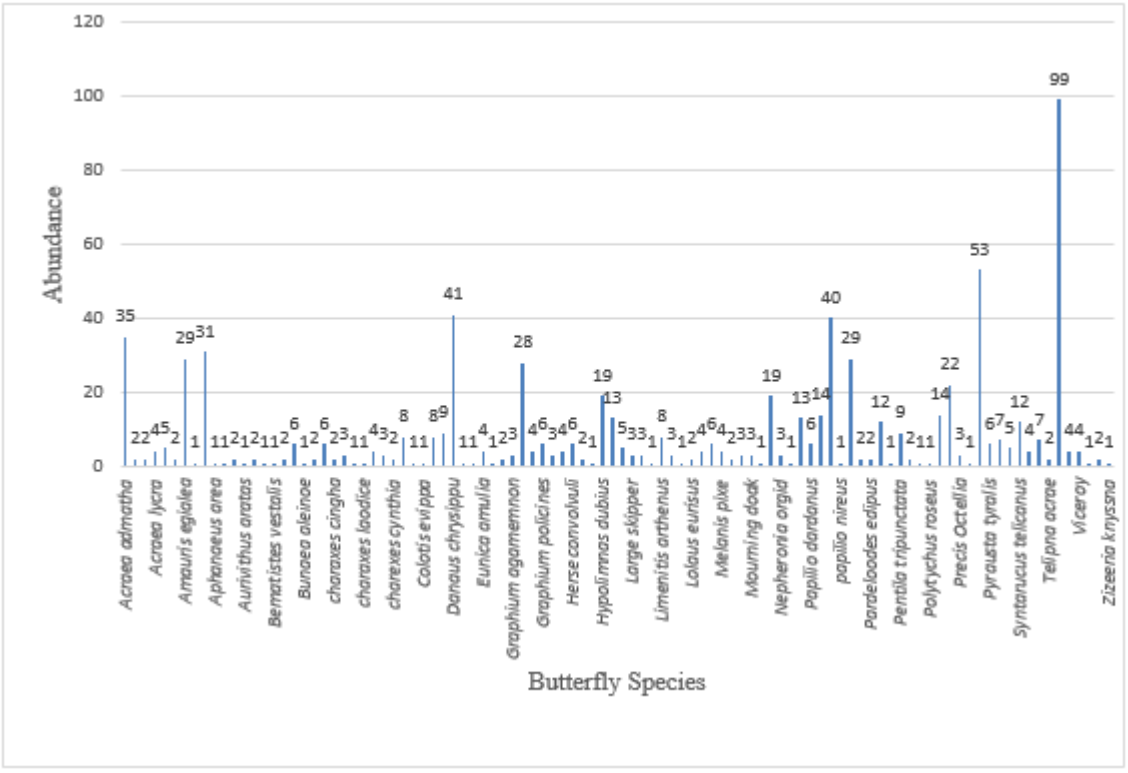

Figure 2: Overall Abundance of Butterfly Species in Gashaka-Gumti National Park

ISSN 2349-7823

International Journal of Recent Research in Life Sciences (IJRRLS)
Vol. 11, Issue 4, pp: (24-33), Month: October - December 2024, Available at: www.paperpublications.org

Table 2: Overall Diversity of Butterfly Species in Gashaka-Gumti National Park

S/N	Specie	Frequency	Pi	ln(pi)	-(pi*lnpi)
1	*Acraea admatha*	35	0.045396	-3.092340	0.140379
2	*Acraea bonasia*	2	0.002594	-5.954541	0.015446
3	*Acraea eponina*	2	0.002594	-5.954541	0.015446
4	*Acraea lycra*	4	0.005188	-5.261394	0.027296
5	*Acraea terpsichore*	5	0.006485	-5.038250	0.032673
6	*Adonis blue*	2	0.002594	-5.954541	0.015446
7	*Amauris egialea*	29	0.037610	-3.279743	0.123335
8	*Amauris niallius*	1	0.001297	-6.647688	0.008622
9	*Anthene larydas*	31	0.040207	-3.217124	0.129324
10	*Aphanaeus area*	1	0.001297	-6.647688	0.008622
11	*Aphnaeus orcas*	1	0.001297	-6.647688	0.008622
12	*Appias sylvia*	2	0.002594	-5.954541	0.015446
13	*Aurivithus aratas*	1	0.001297	-6.647688	0.008622
14	*Axiocevses harpas*	2	0.002594	-5.954541	0.015446
15	*Bematistes epaea*	1	0.001297	-6.647688	0.008622
16	*Bematistes vestalis*	1	0.001297	-6.647688	0.008622
17	*Bicyclus asochis*	2	0.002594	-5.954541	0.015446
18	*Bicyclus asochis*	6	0.007780	-4.854755	0.037763
19	*Bunaea aleinoe*	1	0.001297	-6.647688	0.008622
20	*Catana crithea*	2	0.002594	-5.954541	0.015446
21	*Catopsilia florella*	6	0.007780	-4.854755	0.037763
22	*charaxes cingha*	2	0.002594	-5.954541	0.015446
23	*charaxes etheodes*	3	0.003892	-5.545177	0.021596
24	*charaxes jasius*	1	0.001297	-6.647688	0.008622
25	*charaxes laodice*	1	0.001297	-6.647688	0.008622
26	*charaxes pleione*	4	0.005188	-5.261394	0.027296
27	*charaxes tiridates*	3	0.003892	-5.545177	0.021596
28	*charexes cynthia*	2	0.002594	-5.954541	0.015446
29	*Citrinnophila erastus*	8	0.010373	-4.569103	0.047426
30	*Colotis ellppe*	1	0.001297	-6.647688	0.008622
31	*Colotis evippa*	1	0.001297	-6.647688	0.008622
32	*Cymothoe beckeri*	8	0.010373	-4.569103	0.047426
33	*Cymothoe thedbene*	9	0.011673	-4.448542	0.051937
34	*Danaus chrysippu*	41	0.053165	-2.933147	0.155957
35	*Dasychira cedestis*	1	0.001297	-6.647688	0.008622
36	*Epamera laon*	1	0.001297	-6.647688	0.008622
37	*Eunica amulia*	4	0.005188	-5.261394	0.027296
38	*Eupheiedra cyparisa*	1	0.001297	-6.647688	0.008622
39	*Euriphene tadana*	2	0.002594	-5.954541	0.015446
40	*Graphium agamemnon*	3	0.003892	-5.545177	0.021596
41	*Graphium antheus*	28	0.036324	-3.311296	0.120279
42	*Graphium dosen*	4	0.005188	-5.261394	0.027296
43	*Graphium policines*	6	0.007780	-4.854755	0.037763
44	*Graphium pylades*	3	0.003892	-5.545177	0.021596
45	*Hamearis Lucina*	4	0.005188	-5.261394	0.027296
46	*Herse convolvuli*	6	0.007780	-4.854755	0.037763
47	*Hycharaxes ttiridates*	2	0.002594	-5.954541	0.015446
48	*Hypena scabra*	1	0.001297	-6.647688	0.008622
49	*Hypolimnas dubius*	19	0.024643	-3.698905	0.091153
50	*Hypolimnas misippus*	13	0.016857	-4.083930	0.068798
51	*Kallima rumia*	5	0.006485	-5.038250	0.032673

52	*Large skipper*	3	0.003892	-5.545177	0.021596
53	*Large white*	3	0.003892	-5.545177	0.021596
54	*Lepidochrysops quassi*	1	0.001297	-6.647688	0.008622
55	*Limenitis arthenus*	8	0.010373	-4.569103	0.047426
56	*Liptena libyssa*	3	0.003892	-5.545177	0.021596
57	*lobobunaea phaedusa*	1	0.001297	-6.647688	0.008622
58	*Lolaus eurisus*	2	0.002594	-5.954541	0.015446
59	*Loptosia medusa*	4	0.005188	-5.261394	0.027296
60	*March ratillary*	6	0.007780	-4.854755	0.037763
61	*Melanis pixe*	4	0.005188	-5.261394	0.027296
62	*Melanitis leda*	2	0.002594	-5.954541	0.015446
63	*Melanitis parmeno*	3	0.003892	-5.545177	0.021596
64	*Mourning doak*	3	0.003892	-5.545177	0.021596
65	*Mylothris chloris*	1	0.001297	-6.647688	0.008622
66	*Nepheronia argia*	19	0.024643	-3.698905	0.091153
67	*Nepheronia orgid*	3	0.003892	-5.545177	0.021596
68	*Othreis fullonia*	1	0.001297	-6.647688	0.008622
69	*papilio bromius*	13	0.016857	-4.083930	0.068798
70	*Papilio dardanus*	6	0.007780	-4.854755	0.037763
71	*papilio demoleus*	14	0.018155	-4.008385	0.072753
72	*Papilio menestheus*	40	0.051899	-2.957848	0.153553
73	*papilio nireus*	1	0.001297	-6.647688	0.008622
74	*papilio phorcas*	29	0.037610	-3.279743	0.123335
75	*papilio zenobius*	2	0.002594	-5.954541	0.015446
76	*Pardeloodes edipus*	2	0.002594	-5.954541	0.015446
77	*Peacock butterfly*	12	0.015558	-4.161243	0.064708
78	*Pentila pauli*	1	0.001297	-6.647688	0.008622
79	*Pentila tripunctata*	9	0.011673	-4.448542	0.051937
80	*Polygonia interrogatiouis*	2	0.002594	-5.954541	0.015446
81	*Polygonia satyrus*	1	0.001297	-6.647688	0.008622
82	*Polytychus roseus*	1	0.001297	-6.647688	0.008622
83	*Precis chorimene*	14	0.018155	-4.008385	0.072753
84	*Precis octaunia*	22	0.028532	-3.557163	0.101491
85	*Precis Octellia*	3	0.003892	-5.545177	0.021596
86	*Precis Sophia*	1	0.001297	-6.647688	0.008622
87	*Precis terea*	53	0.068758	-2.679573	0.184284
88	*Pyrausta tyralis*	6	0.007780	-4.854755	0.037763
89	*Speakled wood*	7	0.009077	-4.701759	0.042675
90	*Spindasis mozambica*	5	0.006485	-5.038250	0.032673
91	*Syntarucus telicanus*	12	0.015558	-4.161243	0.064708
92	*Syssphinx bicolor*	4	0.005188	-5.261394	0.027296
93	*Taxila haquinus*	7	0.009077	-4.701759	0.042675
94	*Telipna acrae*	2	0.002594	-5.954541	0.015446
95	*Tereas hecabe*	99	0.128424	-2.053942	0.263846
96	*Thermoniphas micylus*	4	0.005188	-5.261394	0.027296
97	*Viceroy*	4	0.005188	-5.261394	0.027296
98	*Ypthina doleta*	1	0.001297	-6.647688	0.008622
99	*Zamarada corroborate*	2	0.002594	-5.954541	0.015446
100	*Zizeeria knyssna*	1	0.001297	-6.647688	0.008622
	S=100	771			3.79719

The study on the abundance of butterfly species in Gashaka-Gumti National Park presents a comprehensive analysis of species richness and abundance. This dataset highlights both the diversity and the uneven distribution of butterfly species within the park, offering insights into the ecological dynamics of the area.

A total of one hundred (100) butterfly species were identified, with seven hundred and seventy-one (771) individual butterflies recorded in the park. This richness underscores the biodiversity significance of Gashaka-Gumti National Park as a critical habitat for lepidopteran species.

Research in Indian parks such as Dehing Patkai National Park and Manas World Heritage Site shows that protected regions harbor a significant richness of butterfly species, with families like Nymphalidae being particularly dominant. This suggests that conservation areas play a pivotal role in sustaining butterfly populations and their ecological functions [11].

A study in Southern Amazonia conducted by Mota *et al*. [12] found that butterfly assemblages differ significantly across vegetation types, influenced by factors such as light, humidity, and host plant availability. Diverse vegetation types promote species coexistence, highlighting the importance of conserving varied habitats for maintaining butterfly diversity.

In tropical forests, vertical stratification (differences in butterfly communities between the canopy and understory) is influenced by daily climatic variations. For example, canopy regions generally support a higher abundance due to differences in light and temperature. This finding underscores the need to consider microclimatic factors in butterfly conservation strategies [13].

Tereas hecabe emerged as the most abundant species, with 99 individuals, accounting for 12.84% of the total butterfly population. This dominance indicates that the specie is well-adapted to the park's environmental conditions, likely due to its wide ecological tolerance and availability of suitable host plants. Other notable species such as *Precis terea* (6.88%), *Danaus chrysippus* (5.32%), *Papilio menestheus* (5.19%), and *Acraea admatha* (4.54%) reflect the presence of multiple dominant taxa. These species may serve as bioindicators for specific environmental factors such as vegetation type and climate conditions within the park. For example, *Danaus chrysippus*, commonly known as the plain tiger, is often associated with open habitats and specific host plants in the Asclepiadaceae family. Its relative abundance highlights the availability of these plants and favorable conditions [14].

Thirty-five (35) species (35%) were represented by just one individual each, contributing only 0.13% to the overall abundance. The high number of single-occurrence species suggests that while the park is rich in biodiversity, the distribution of butterflies is highly uneven. Such patterns could result from several factors including:

Microhabitat specificity: Some species may require specialized habitats that are limited in the park.

Seasonality: Certain species may have been underrepresented due to their seasonal life cycles or migratory behaviors.

Sampling limitations: Temporal or spatial biases in sampling could also contribute to the observed unevenness. Rare species, while less visible, contribute to genetic diversity and ecological stability. The data indicates an uneven distribution, where a few species dominate while many others occur in low numbers, a pattern typical in tropical ecosystems [15].

The diversity of butterfly species, despite the uneven distribution, highlights the park's ecological complexity. It provides a range of niches that support various species with distinct ecological requirements. Rare species, such as those recorded in low numbers, are particularly important for conservation as they may be more susceptible to habitat disturbances or environmental changes. High diversity increases ecosystem resilience to environmental changes. It ensures functional redundancy, where multiple species can perform similar ecological roles (e.g., pollination), safeguarding ecosystem services [16].

In a similar study conducted in Cross River National Park, Nigeria, butterfly diversity was similarly high, but species dominance patterns varied, with different species thriving due to ecological and geographical differences [16]. This comparison reinforces the role of localized habitat conditions in shaping butterfly communities. A global review by Bonebrake *et al*. [15] highlighted that tropical regions such as Gashaka-Gumti often exhibit high species richness but with pronounced rarity patterns. This aligns with the finding of many single-occurrence species in this study. The high biodiversity and presence of rare species emphasize the need to maintain the integrity of Gashaka-Gumti's ecosystems. Habitat heterogeneity, including forested areas, grasslands, and riparian zones, must be preserved to support the ecological requirements of diverse butterfly species.

IV. CONCLUSION

The study of butterfly abundance in Gashaka-Gumti National Park underscores its role as a biodiversity hotspot. While certain species dominate, the presence of numerous rare species highlights the park's ecological value and the importance of tailored conservation efforts. By addressing the uneven distribution and protecting both dominant and rare species, the park can continue to serve as a sanctuary for lepidopteran biodiversity.

REFERENCES

[1] Ghazanfar M, Malik MF, Hussain M, Iqbal R, Younas M (2016) Butterflies and their contribution in ecosystem: a review. Journal of Entomology and Zoology Studies, 4, 115-118

[2] Tager C, Lovejoy TE, Bierregaard RO, Malcolm JR, Stouffer PC, Vasconcelos HL, Laurance WF, Zimmerman B, Tocher M, Borges S (2018) Matrix habitat and species richness in tropical forest remnants. *Biology Conservation*, 91, 223-229.

[3] Ghazoul B, Edwards PJ, Blanckenhorn WU, Walter T, Hofer G (2002) Shrub Encroachment Affects the Diversity of Plants, Butterflies, and Grasshoppers on Two Swiss Subalpine Pastures. Arctic and Antarctica Alp Res, 47, 345-357.

[4] Onyekwelu JC and Olusola JA (2014) Role of Sacred groove in In-situ biodiversity conservation in rainfall zone of south western Nigeria. Journal of Tropical Forest Science, 26(1): 5:15

[5] Food and Agricultural Organization (FOA) (2021) Restoration and strengthening the resilence of agric-food system in southern Iraq. Online: http://reliefweb.int/report/iraq/senior-government-and-un-officails-attend-inception-workshop-foa-s-project-restoration

[6] Perveen F and Fazal F (2013) Biology and distribution of butterfly fauna of Hazara University, Garden Campus, Mansehra, Pakistan. Journal of Animal Science, 3:28-36.

[7] Ogedegbe ABO, Ogedegbe AU and Rotimi J (2014) Diversity of Lepidopteran assemblages in five Habitat types in the Niger Delta. Nigeria. European International Journal of Science and Technology, 3(8),45-57.

[8] Akinsoji A, Adeonipekun PA, Adeniyi, TA, Oyebanji OO, Eluwole, TA. (2016) Evaluation of Flora Diversity of Gashaka Gunti National Park-1, Gashaka sector, Taraba State, Nigeria. Ethiopian Journal of Environmental Studies and Management, 9(6), 7737.

[9] Magurran AE and McGill BJ (2011) Biological Diversity: Frontiers in Measurement and Assessment. Oxford University Press, Oxford, 345 pp.

[10] Sáfián S and Warren RD (2015) Common Butterflies of IITA. International Institute of Tropical Agriculture (IITA), Ibadan, 117 pp.

[11] Bhattacharjee N and Ahmed R (2020) Species richness and butterfly diversity in Manas World Heritage Site. Journal of Biodiversity Studies. 6:120-25 Retrieved from [Springer Open] (https://basicandappliedzoology. springeropen.com).

[12] Mota LL, Santos JP, Willmott KR, Freitas AVL (2023) Butterfly assemblages differ among vegetation types in Southern Amazonia. Diversity, 15(5):624. https://doi.org/10.3390/d15050624.

[13] Richter A, Mendonça MSJr, Gawlinski K, Iserhard CA (2023) Microclimatic fluctuation influences subtropical fruit-feeding butterfly assemblages between the canopy and understory. Diversity, 15(4), 560. https://doi.org/ 10.3390/d15040560.

[14] Pollard E and Yates TJ (2020) Monitoring Butterflies for Ecology and Conservation: The Basics. *Springer Nature*. 40:134-130

[15] Bonebrake TC, Brown CJ, Bell JD, Blanchard JL, Chauvenet A, Champion C et al (2017) Managing consequences of climate-driven species redistribution requires integration of ecology, conservation and social science. Biological Reviews, 92(1), 284-303..

[16] Akinyele AO et al (2021). Butterfly Diversity and Abundance in Nigerian National Parks. Biodiversity Journal, 12(2): 112-130.