Natural Biodiversity of Saint Lucia

While there is no doubt that the Lesser Antillean mountainous islands are extremely biodiverse for their size and have a high rate of endemism, that does not necessarily mean we have a good knowledge of this biodiversity. In this article I will assess the status of our biodiversity knowledge. Microscopic organisms will be excluded from this study.

Firstly natural biodiversity needs to be defined. In this article all species of living organisms likely to be present in Saint Lucia before 1650, about the time of the the first plantations and permanent settlements, are considered native. All species arriving after this date will be treated as non-native specise and will not be included in the biodiversity assessment. This removes the need to guess If a species arrived here naturally or was deliberately or inadvertently introduced by Amerindians.

Biodiversity of Saint Lucia's Terrestrial and Freshwater Invertebrates

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This analysis attempts to assess Saint Lucia's likely natural biodiversity and the degree of knowledge that we have of that biodiversity.

Inevitably, it involves extrapolation from limited local data, in addition to what can be gleaned from nearby islands, and the tropics in general.

1. Arthropods

1.1 Insects

1.1.1 Coleoptera

Beetles are the only major group of invertebrates for which there is good local data. This is because of studies by Kraft (2009), Ivie's 2009 collections and identifications (2016 update) and Peck's 2016 paper. It resulted in the identification of 817 species of beetle. Peck's report estimated that there might be about 1400 beetle's species in total.

Peck, Stewart B. (2016). "The beetles of the Lesser Antilles (Insecta, Coleoptera): diversity and distributions." Insecta Mundi, Gainesville, Issue 0460: 1–360.

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In summary 817 species were recorded out of a likely total of about 1400,

Thus, there is a shortfall in biodiversity knowledge shortfall (BKS) for beetles in Saint Lucia.

This shortfall can be calculated as ***predicted species minus recorded species number divided by predicted species and turned into a percentage.***

If all species are recorded BKS is 0%

If no species are recorded BKS is 100%

For Coleoptera (1400 – 817) /1400 x 100 calculates as about a 40% biodiversity knowledge shortfall (BKS).

Beetles were often considered to make up to 40 percent of all insect species in the tropics. If so, that would result in 3500 insect species.

However, very intensive and sophisticated collecting in some small areas of neotropical forests has dramatically challenged this assumption.

1.1.2 Diptera

The Costa Rjca Zurquí All-Diptera Biodiversity Inventory of 4 hectares of cloud forest identified 4332 species of Diptera and estimated that there could be 8000 species. Most are tiny flies which are very difficult to collect and to identify. This study suggests that Diptera species will likely almost equal or even surpass Coleoptera species in such environments.

Borkent, Art, et al. "Remarkable fly (Diptera) diversity in a patch of Costa Rican cloud forest: Why inventory is a vital science." Zootaxa, vol. 4402, no. 1, 2018, pp. 53–90.

High humidity, constant moisture and abundant decaying organic matter along with abundant mosses and epiphytes make cloud forest ideal for delicate, soft-bodied flies and their larvae. Saint Lucia has 150 hectares of land over 750 m in elevation. Of this at least 100 hectares is cloud forest, the rest being more exposed elfin shrublands. In addition, there is a vast area of humid rainforest.

General information indicates that small flies such as phorids, whilst being very weak fliers, are readily carried long distance on lower and upper levels of the atmosphere. Thus, it is reasonable to assume they have successfully colonized Saint Lucia over the last 20 million years or so.

My conservative estimate is there are about 1200 species of Diptera in Saint Lucia. 134 species of Diptera are recorded.

This calculates as about 88% BKS

Daltry, J.C. (2009) Biodiversity Assessment of Saint Lucia's Forests, With Management Recommendations. Technical Report No. 10 to the National Forest Demarcation and Bio-Table D Flies (Diptera) of Saint Lucia. (Unpublished data from M. Ivie, R. Winton, J. Runyon and Stephen D. Gaimari.Physical Resource Inventory Project, FCG International Ltd, Helsinki, Finland)

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1.1.3 Hemiptera

True bugs, such as hoppers and cicadas and many agricultural pests (scale insects, aphids, mealy bugs and white flies) are poorly documented in Saint Lucia, Research has concentrated on the pests (for example 83 species of scale insects) but many of these species are probably not native.

Malumphy, Chris. "An annotated checklist of scale insects (Hemiptera: Coccoidea) of Saint Lucia, Lesser Antilles." Zootaxa, vol. 3846, no. 1, 2014, pp. 69–86

Using global tropical information, there averages about 1 Hemiptera species for every 4 Coleoptera species. Thus, I estimate 350 species.

Few species appear to be documented apart from scale insects. I estimate 85% BKS.

1.1.4 Lepidoptera

About 400 species of macromoths and butterflies are fairly well documented for Martinique. Given that inter-island dispersal rates of these strong fliers may be high, it is reasonable to assume a broadly similar checklist here. Local records are mainly anecdotal.

https://mothphotographersgroup.msstate.edu/Antilles/AntillesChecklist.shtml

However, micromoths are poorly studied and may outnumber moth species in the tropics.

I will conservatively estimate 400 species of micromoths, making a total of 800 species of Lepidoptera

I estimate a 20% shortfall if we use the Martinique data for macromoths and butterflies and a 100% shortfall for micromoths The BKS is 60%.

1.1. 5 Hymenoptera

Hymenoptera (bees, non-parasitic wasps, ants, and sawflies) are another big group of insects thought to number much fewer species than Coleoptera, perhaps about 25%

However recently both theoretical and field studies have indicated there are vast number of parasitoid wasp species in the tropics – their larval stage is parasitic, the adult stage free-living. Their main hosts are insects, and they are very host-specific, with only one or a few specific hosts. In addition, one insect species can be parasitized by several species of wasp. However, t is not known what percentage of insect species are host to parasitoid wasps. It may be that tiny insects lack enough body mass to sustain larval development or their life span is too short.

It is often estimated that about 20% of insects are parasitoid wasps.

Forbes AA, Bagley RK, Beer MA, Hippee AC, Widmayer HA. Quantifying the unquantifiable: why Hymenoptera, not Coleoptera, is the most speciose animal order. BMC Ecol. 2018 Jul 12;18(1):21. doi: 10.1186/s12898-018-0176-x. PMID: 30001194; PMCID: PMC6042248.

Burke GR, Sharanowski BJ. Parasitoid wasps. Curr Biol. 2024 May 20;34(10):R483-R488. doi: 10.1016/j.cub.2024.03.038. PMID: 38772331.

Parasitic wasps could readily colonize Saint Lucia through the upper and lower atmosphere. In addition, they could arrive as larvae or eggs inside their insect hosts, for example inside a beetle on a raft.

Taking all these factors into account, I estimate 1150 species of parasitoid wasps plus 350 other Hymenoptera, giving a total of 1400 species.

Some species of bees, wasps and ants are recorded but the massive majority are unrecorded.

I estimate 95% BKS.

1.1.6 Other Groups of Insects

Among other groups, 25 species of Odonata (dragon flies and damselflies) are documented for Saint Lucia.

Poiron, C., & Meurgey, F. (2011). The Odonata of St Lucia (Lesser Antilles). Nantes: Société d'Histoire Naturelle l'Herminier.

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1.1.7 Summary of Insects

Table1. summarizes insect biodiversity.

Saint Lucia has an immense variety of microhabitats and microclimates. It is also quite close to continental tropical America with islands i between. It is my opinion that this total of 5300 species is an underestimate.

Table 1 Biodiversity in Major Groups of Terrestrial Insects

Major Groups	**Common names**	**Estimated Species**	**%Total insects**	**BKS**
Coleoptera	Beetles	1400	26.5	40%
Diptera	Flies	1200	22.5	88%
Hemiptera	True bugs	350	6.5	85%
Lepidoptera	Moths, butterflies	800	15	60%
Hymenoptera	Wasps, ants, bees	1400	26.5	95%
Other groups		150	3	?
Total		5300		74% (weighte

1.2 Arachnids

Arachnids (spiders, ticks, mites, harvestmen) are another major group of terrestrial arthropods. Mites are essentially microscopic and are not considered here,

Global tropical literature suggests that there are about 3 coleoptera species per spider species, giving an estimate of 460. Harvestmen may add about 90 species, making a total of 550 arachnid species, omitting mites.

Sewlal (2011) documented 40 spider species, giving a BKS of 93%.

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It is worth noting that Saint Vincent and the Grenadines has recorded 181 species of spiders. However, it is not possible to know how relevant this is to Saint Lucia. Because of the ecology of arachnids, inter-island dispersal rates may be very low.

de Silva, M., Alayón, G., & Horrocks, J. A. (2006). The Spiders and their Relatives of St. Vincent and the Grenadines. Mayreau Island, St. Vincent and the Grenadines: Mayreau Environmental Development Organization. 129 p.

1.3 Crustaceans

There are terrestrial and freshwater crustacean species in Saint Lucia.

The most visible group are the decapods which include freshwater shrimps and terrestrial and semi-terrestrial crabs. These are well documented in Saint Lucia.

There are 13 species of shrimp in Saint Lucia's rivers. They are all amphidromous, which means that eggs flow to the sea and larval stages take place in the plankton until ready to migrate upstream. Thus, surrounding islands have the same species. BKS is 0%. However, no recent study has been made and many of Saint Lucia's rivers are in poor health.

Barnish, Guy. The Freshwater Shrimps of Saint Lucia, West Indies (Decapoda, Natantia). Crustaceana 47,
no. 3 (1984): 314–20.
http://www.jstor.org/stable/20103993.

Terrestrial and semiterrestrial decapods species are well documented in the region. Only one species is fully terrestrial. *Guinotia dentata* (locally called bak) which lives in and by forest rivers. The other species breed in the sea and, like river shrimps, larval forms can float from island to island in the plankton. Strangely no Lesser Antillean Island has an exact list and estimates vary from 10 to 15 species.

Because of this uncertainty I estimate 30% BKS

Smaller crustacean groups mainly amphipods (landhoppers) and isopods (woodlice) are found in very damp spot). There are probably only a few species of each and they remain undocumented in Saint Lucia

I estimate 10 species with a 100% BKS.

Microcrustaceans such as Ostracods and Copepods are less than 1mm in length and are excluded from this assessment.

I give Crustaceans a weighted average of 40% BKS.

1.4 Myriapods

There is no full list of Myriapod (centipedes and millipedes) species for Saint Lucia or surrounding islands.

One Saint Lucian endemic is known.

https://sta.uwi.edu/fst/lifesciences/myriapods\

Le Conservatoire Botanique National de Martinique estimates 50 species for Martinique. It illustrates about 15 species.

https://www.martinique.developpement-durable.gouv.fr/IMG/jpg/poster_myriapodes_paysage.jpg

I will assume about 30 species with only a handful recorded, and an estimated BKS of 75%.

2. Molluscs

Sant Lucia has freshwater and terrestrial snails and slug (gastropods).

Studies of freshwater snails in Saint Lucia have concentrated on *Biomphalari*a species which act as intermediate hosts for Bilharzia, and their biocontrol, an introduced species *Melanoides tuberculata*. This has dramatically changed populations. There is little information available on other native freshwater species. I estimate 80 % BKS.

Martinique has recorded 10 native freshwater snail species and 8 non-native species, plus two native pea clam species.

Guide to the Freshwater Molluscs of the Lesser Antilles, Pointier, J.-P. (2008), ConchBooks.
ISBN / GTIN: 978-3-939767-15-2
Edité par ConchBooks. Hackenheim (Allemagne)

Again, little local information is available on terrestrial gastropods.

Naesiotus luciae is described as a Saint Lucian endemic.

Dominica however has had over the years been well studied. 43 terrestrial gastropod species are known of which about 16 are endemic.

https://en.wikipedia.org/wiki/List_of_non-marine_molluscs_of_Dominica

Robinson, David & Hovestadt, Adriaan & Fields, Angela & Robinson, A & Breure, Bram. (2009). The land Mollusca of Dominica (Lesser Antilles), with notes on some enigmatic or rare species. Zool. Med. Leiden Benjamin Franklin Parkwayrobinson@ansp.org). A. Hovestadt, Dr. Abraham Kuyperlaan. 83. 615-650.

Saint Lucia could expect a similar biodiversity.

So I estimate abut 40 species for Saint Lucia, with 90% BKS.

This combines to 50 species with 87%BKS.

This excludes microsnails which are poorly documented in the Lesser Antilles.

3. Annelids

The main group are earthworms many of which are not native.

No local study has been done but a study in Martinique found 36 native species, including 7 arboreal species of which 5 are endemic.

https://www.sciencedirect.com/science/article/abs/pii/S0038071723001001

Given that Martinique is larger than Saint Lucia, I estimate a native species count of about 25 with a100% BKS.

Table 2 Biodiversity in Major Groups of Terrestrial AND FRESHWATER NONINSECT GROUPSFInsects

Major Groups	**Common names**	**Estimated Species**	**BKS**
Arachnida	Spiders, harvestmen	560	93%
Crustacea	Crabs, shrimps	35	40%
Myriapoda	Millipedes, centipedes	30	75%
Mollusca	Snails, slugs	50	87%

Annelida	Earthworms	25	100%
Total		700	Weighted average 90%

For all macroscopic terrestrial and freshwater invertebrate species I estimate that there is a biodiversity knowledge shortfall of 76%.