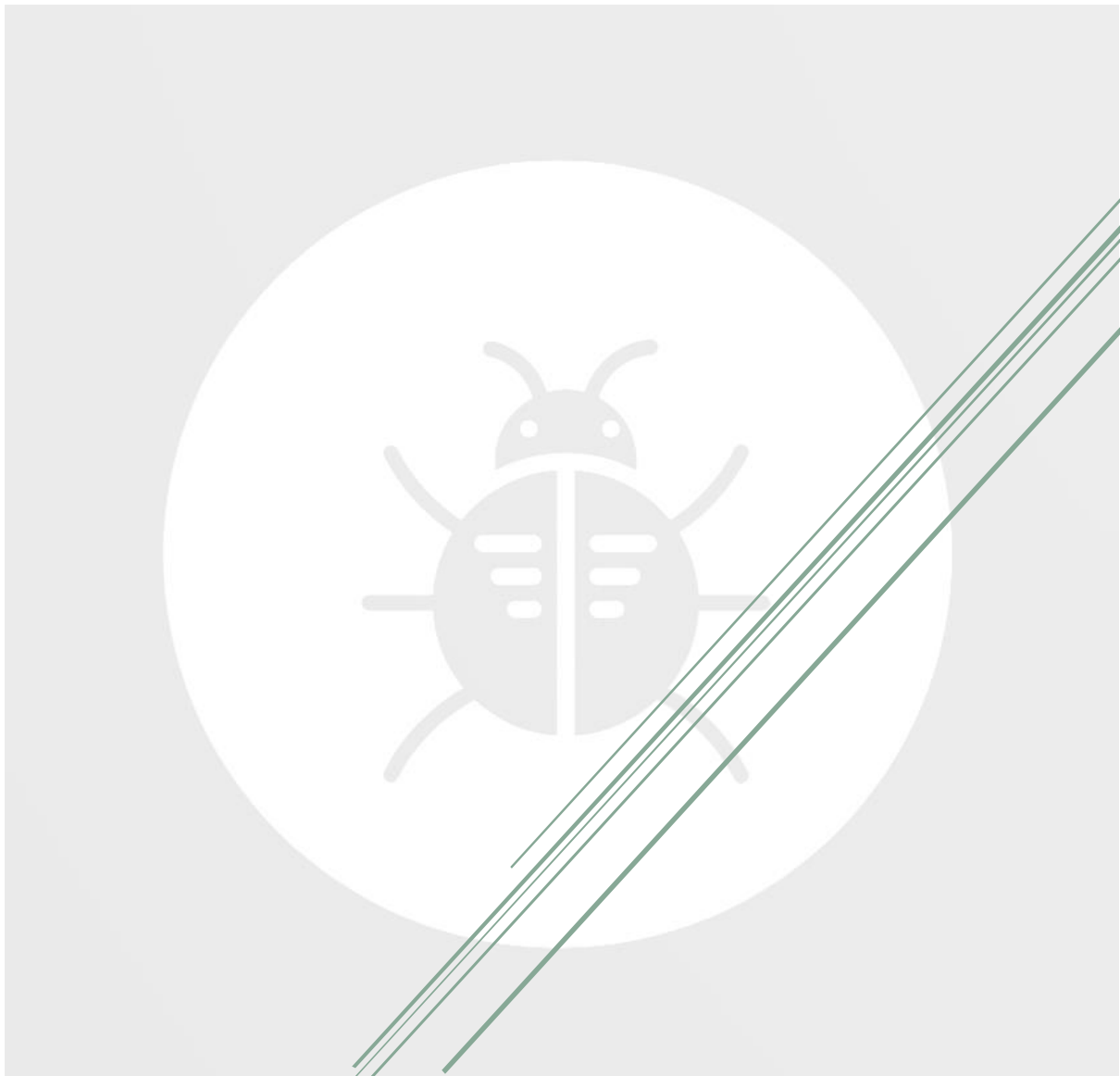


BUG'S LIFE 4-003

Zou Jia Xin, Aaron Ng, Joel Ong, Loke Yong Kang



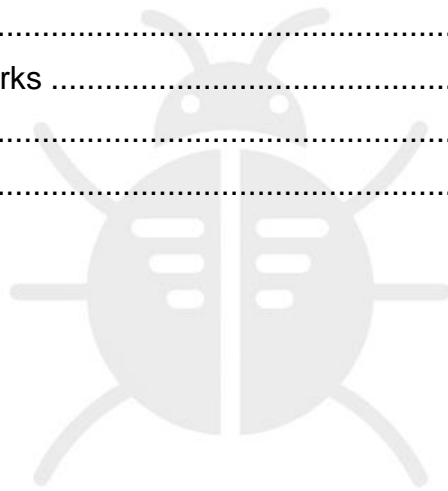
Hwa Chong Institution
Category 4 Resource Development

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Abstract

Our project is to create a website to raise awareness on the species of bugs in Singapore, their population decline and their threats.

1. Introduction

1.1 Rationale

Insects play a significant role in our ecosystems, but they are declining at an alarming rate. Yet there is little awareness of the diversity and roles of these insects.

1.2 Objectives

- To raise awareness about the declining population of insects
- To help people gain a better understanding about the variety and types of insect species in Singapore and allow for greater interest in them

1.3 Target Audience

The general public that does not know much about insects



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2. Review of Existing Resources

Informal Macro Outing Group. (n.d.). Retrieved from

<https://natureimog.wordpress.com/>

National Parks Board. (2015). SGBioAtlas (2.0.6) [Mobile application software]/
Retrieved

<https://play.google.com/store/apps/details?id=sg.gov.nparks.BiodiversityApp>

The Biodiversity of Singapore. (n.d.). Retrieved August 07, 2020, from

<https://singapore.biodiversity.online/species/>

Kok, R. D. (2019). https://www.nparks.gov.sg/sbg/research/publications/gardens-bulletin-singapore/-/media/sbg/gardens-bulletin/gbs_71_01_y2019v71_01/71_01_06_y2019_v71p1_gbs_pg87.pdf.

Gardens' Bulletin Singapore, 71(1), 89-139. doi:10.26492/gbs71(1).2019-07

Home.(2020, July 20). Retrieved August 07, 2020, from <https://lkcnhm.nus.edu.sg/>

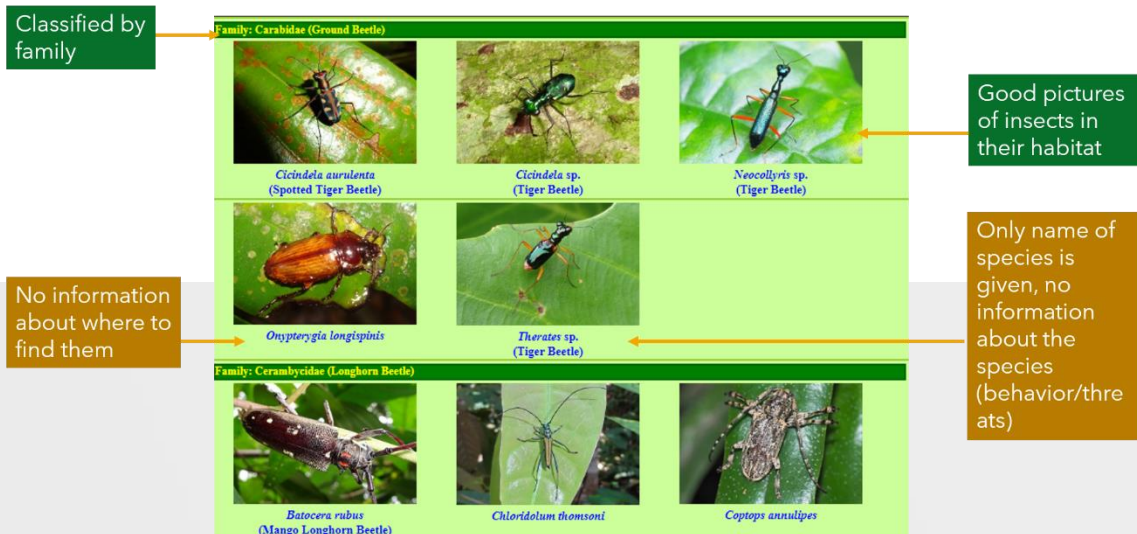
On a scale of 1 to 10 (1 being the least)	Beetles@sg	NickyBay	Singapore Biodiversity	Natureimog	Sgwild animals	LKCNHM resources	SGBio Atlas	Nparks papers
Photos	5	9	7	6	6	5	8	7
Navigation	5	6	9	6	6	6	9	8
Description	6	6	5	4	1	8	7	9

Although all the resources have photos of insects for the public to learn more about them, most do not classify the insects by order and people are not able to find the species they are looking for. They may not even know the name of the insect they have found and cannot learn more about it.

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<https://natureimog.wordpress.com/>



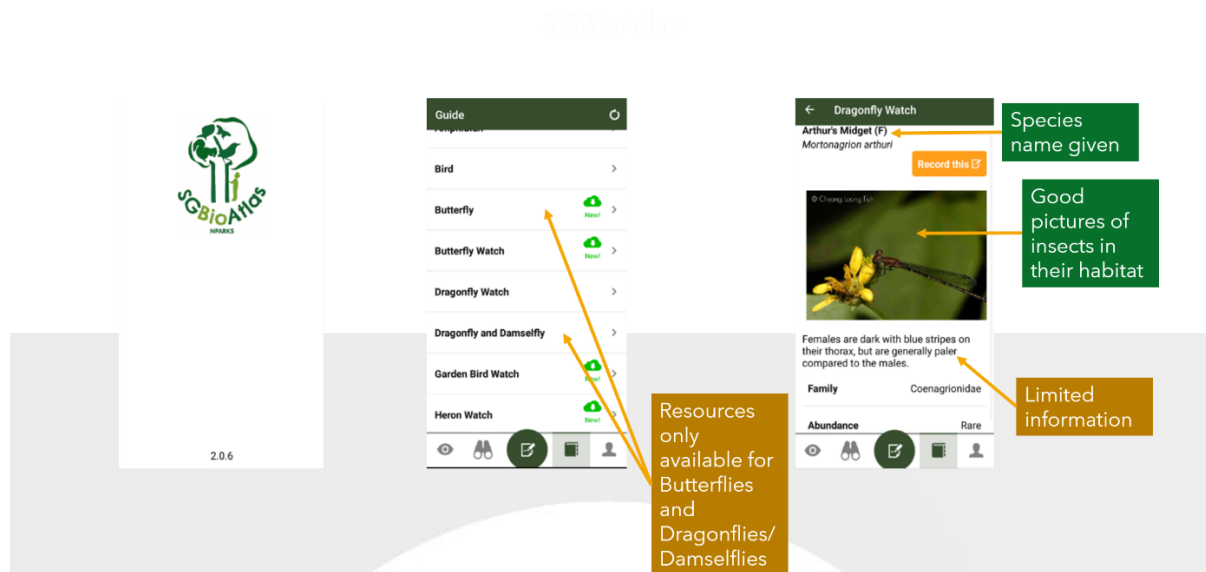
This website provides good pictures of insects classified by order in their habitats. However many of the insects in the pictures are not identified and not much information about the species can be found. The public would not be able to learn more about the insects and appreciate them.



This website provides good pictures of insects in their habitat but insects are not classified by order causing people to have a hard time navigating the website. Not much information about the insect is given, and people are unable to learn about them.

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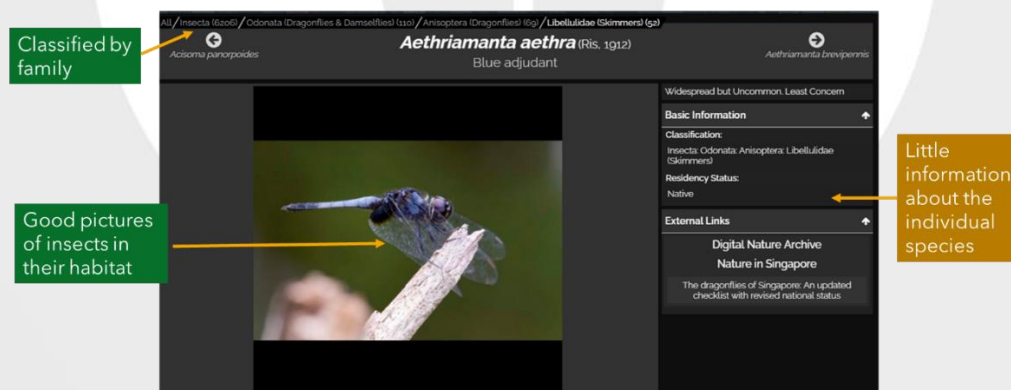
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This app provides good pictures of insects classified by order in their habitat. It provides a brief description about the insect.

However, there is not much information about its behaviour. Resources are only limited to Dragonflies and Damselflies and Butterflies.

<https://singapore.biodiversity.online/species/>



This website provides good pictures of insects classified by order in their habitat but there is no description about the insect. The public is unable to learn more about them.

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Nparks Research Papers

Information about where to find them

Extremely lengthy

Good pictures of insects

Little information about the individual species

Guidance Bulletin Singapore 72 (April 1), 391-417, 2019
doi: 10.24254/gbsr/vol72/issue1/391-417

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Discovering 99%: exploring the arthropod species diversity of Bukit Timah Nature Reserve, Singapore

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ABSTRACT. Bukit Timah Nature Reserve (BTNR) is one of Singapore's most important conservation areas because it is likely to be the last refuge for many species that belong to Singapore's original forest biodiversity. We report here the results obtained from a first broad-scale survey of arthropods in BTNR. The focus was on insects because Singapore's insect fauna remains largely unknown despite the fact that insects constitute much of the animal biomass and perform many ecologically important tasks. The survey relied on specimens collected with passive traps (e.g., Malaise traps) that were set along several transects in primary and different types of secondary forests. Specimens representing several thousand species were obtained. In order to process the specimens rapidly, we sorted them based on DNA sequences of the COX gene. Sequences for more than 9,000 specimens were obtained and the DNA data were used to group the specimens into putative species. Here, we compare the species numbers, composition, and species overlap between secondary and primary forests for "true bugs" (Hemiptera). Overall, the sequences belonged to more than 1050 insect species of which ca. 450 belonged to Hemiptera. A very large proportion of the "true bug" species are only represented by 1 or 2 specimens each and we find that BTNR's species diversity is much higher than the diversity in mangroves and on the National University of Singapore (NUS) campus. We also report and illustrate some notable insect species found during the survey. They range from ship-tender beetles to beetle-flux sucking leaf beetles and mantis-flies resembling praying mantises.

Keywords: Biodiversity, Hemiptera, invertebrate sampling, Singapore, tropical rain forest

Introduction

Bukit Timah Nature Reserve (BTNR) is both the first and the last remnant of primary forest in Singapore. It has been under some form of protection since 1983. Today, it is under the care of the National Parks Board (NParks), which is responsible for its management according to the Parks and Trees Act (Cap. 225:01) (NParks, 2019). This long-term protection has ensured that several patches of primary forest have survived. Additionally, much of the remaining reserve is covered by old secondary forest which is in many places surrounded by young secondary forest.




Fig. 14. A mantis-like insect (Mantodea) with prominent spines. The most famous mantodeans are the praying mantis, where larvae bury themselves in a pit of sand and wait to trap passing ants. (Photo: H. Sin Maimon)




Fig. 15. A praying mantis from the order Mantodea. (Photo: H. Sin Maimon)

Although this paper provides a lot of information about the insects, it is very hard to understand. There is also little pictures of insects in their habitat. The public may find it difficult to learn more about them.



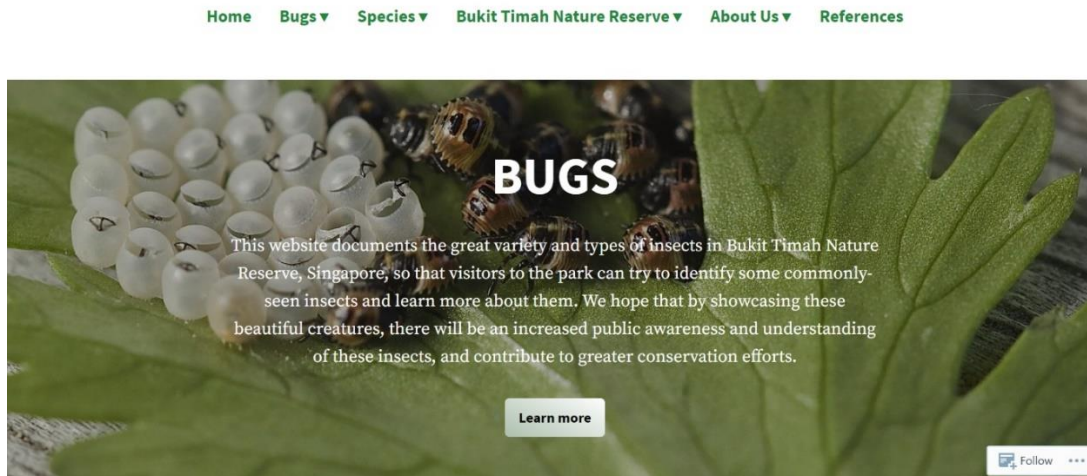
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3. Methodology

Website: <https://tinyurl.com/project-bugs-life>

Our website has extensive information about 50 insect species classified by order, with pictures of them in their habitat.



Homepage – Our Purpose




Raising Awareness about Decline

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Lepidoptera – Butterflies and Moths

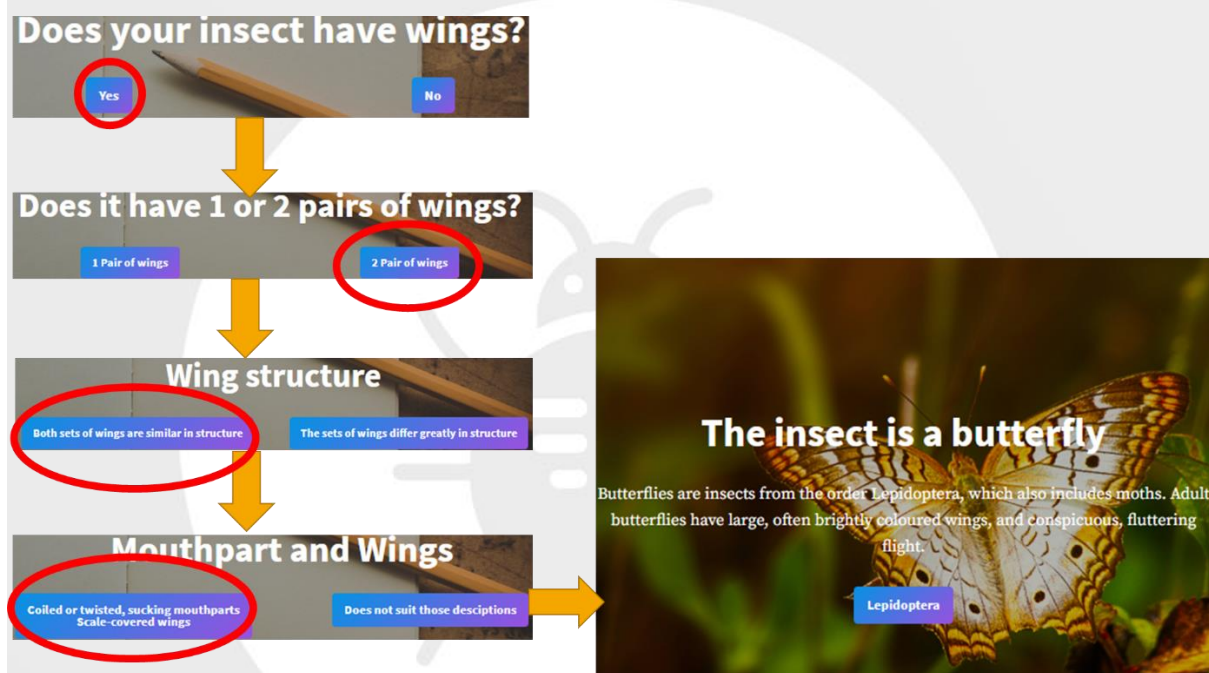
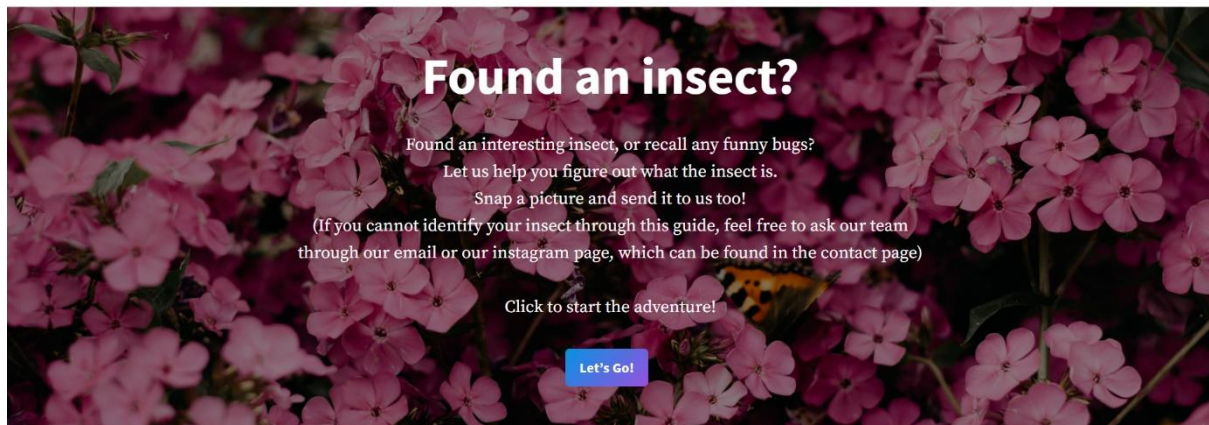
<p>Atlas Moth Name</p> <p><i>(Attacus Atlas)</i> Scientific name</p> <p>Insecta: Lepidoptera: Saturniidae: Saturniinae Classification</p> <p>These gentle giants can be found throughout Southeast Asia and are reasonably common in Singapore. Found in mangroves and nature reserves</p> <p>Where to find them</p> <ul style="list-style-type: none">• The Atlas Moth is among the biggest insects in the world today, with a wingspan reaching up to 30 cm.• While they may look intimidating, they are harmless.• Both forewings have a prominent extension at the tip, resembling the head of a snake• Caterpillars are notoriously voracious and unfussy eaters, but adults don't feed at all, seeking only to find a mate and produce the next generation before dying. <p>Photo Credit: http://www.NatureLoveYou.sg</p> <p>Behaviour</p> <p>Photo credit</p>	 <p>Clear picture of insect in natural habitat</p>
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Atlas Moth, an example of an insect on our website

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What bug is this?

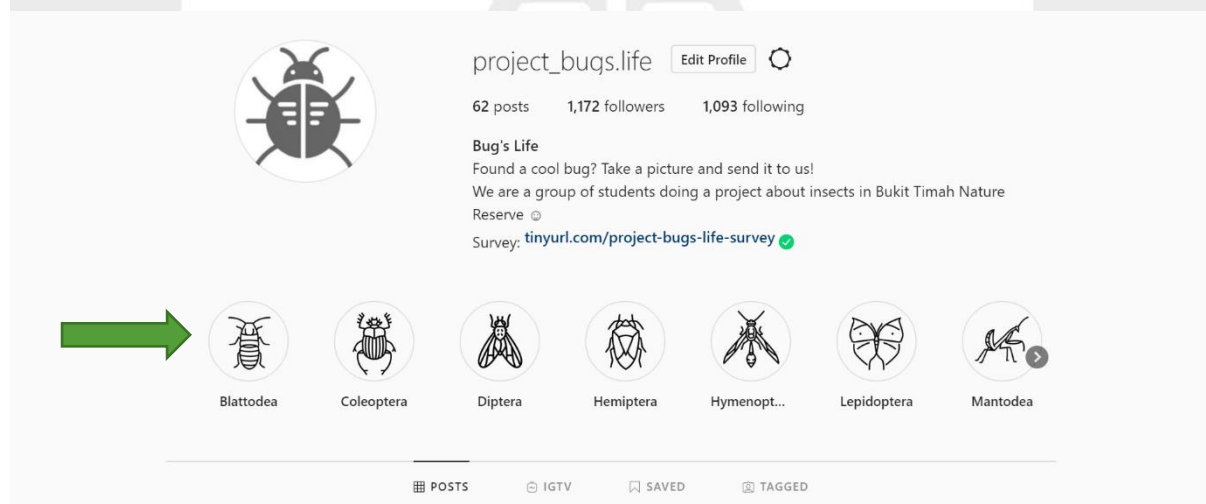


Bug Finder-where people can use the appearance of the bug to identify it to learn more about it.

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Instagram: project_bugs.life https://www.instagram.com/project_bugs.life/

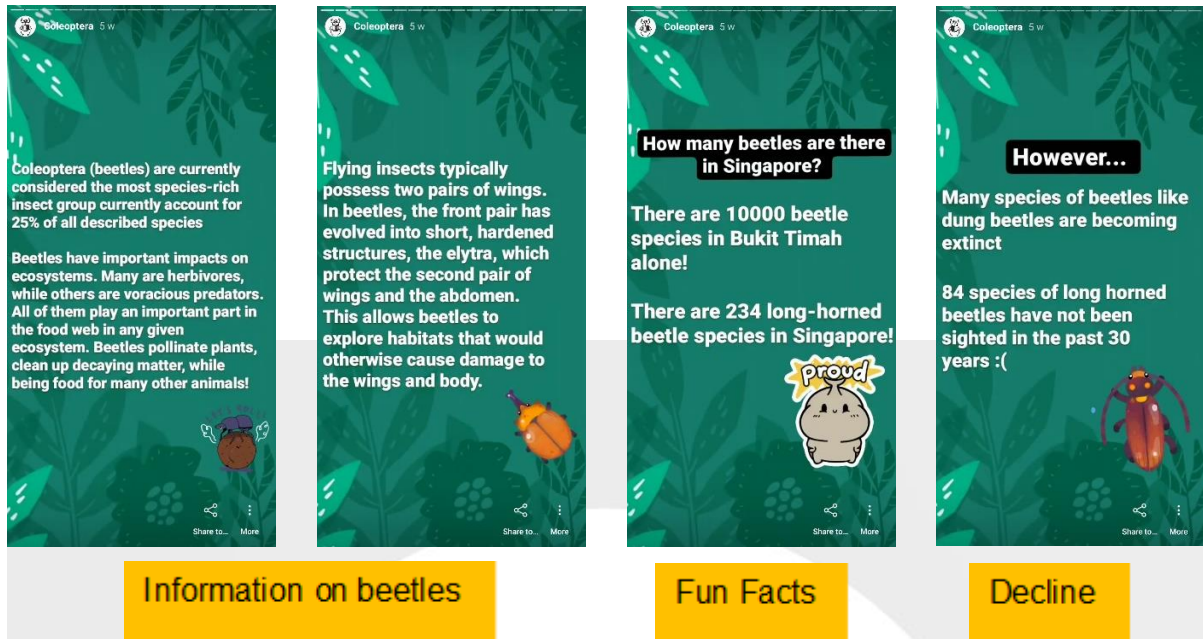


Information about each insect order can be found on our Instagram page. Tap on the bug icon (arrow) you are interested to know more about and you can view it!

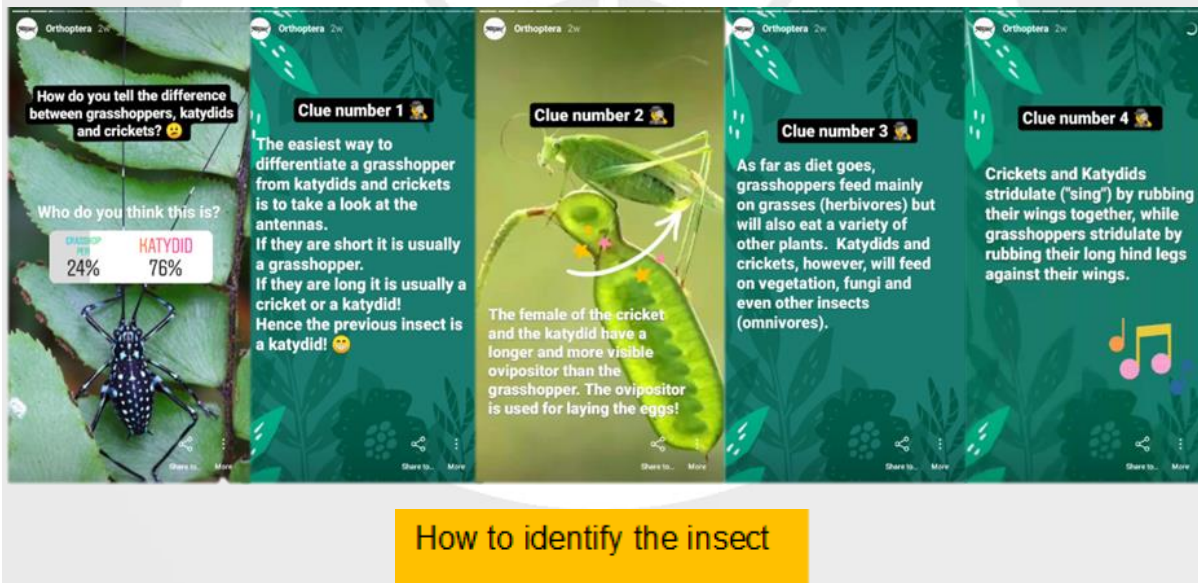
Instagram – Insect orders

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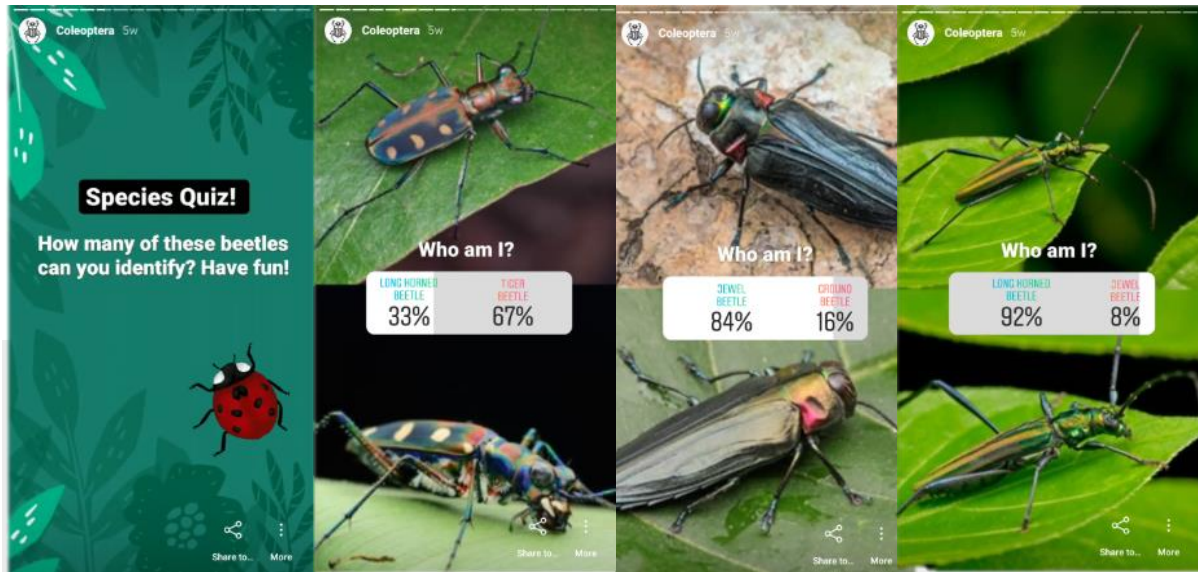
Instagram – Information about the order



Instagram – Information about the order

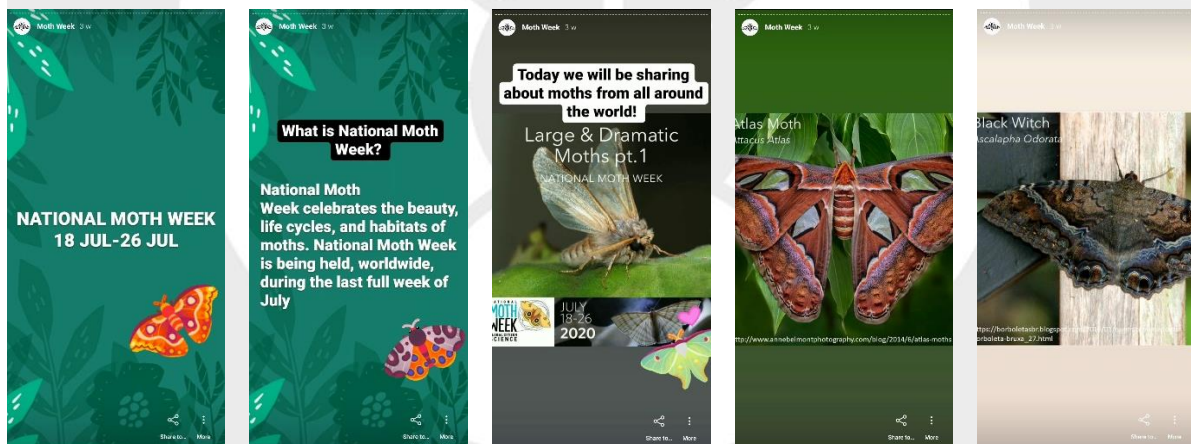
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Quizzes on insect

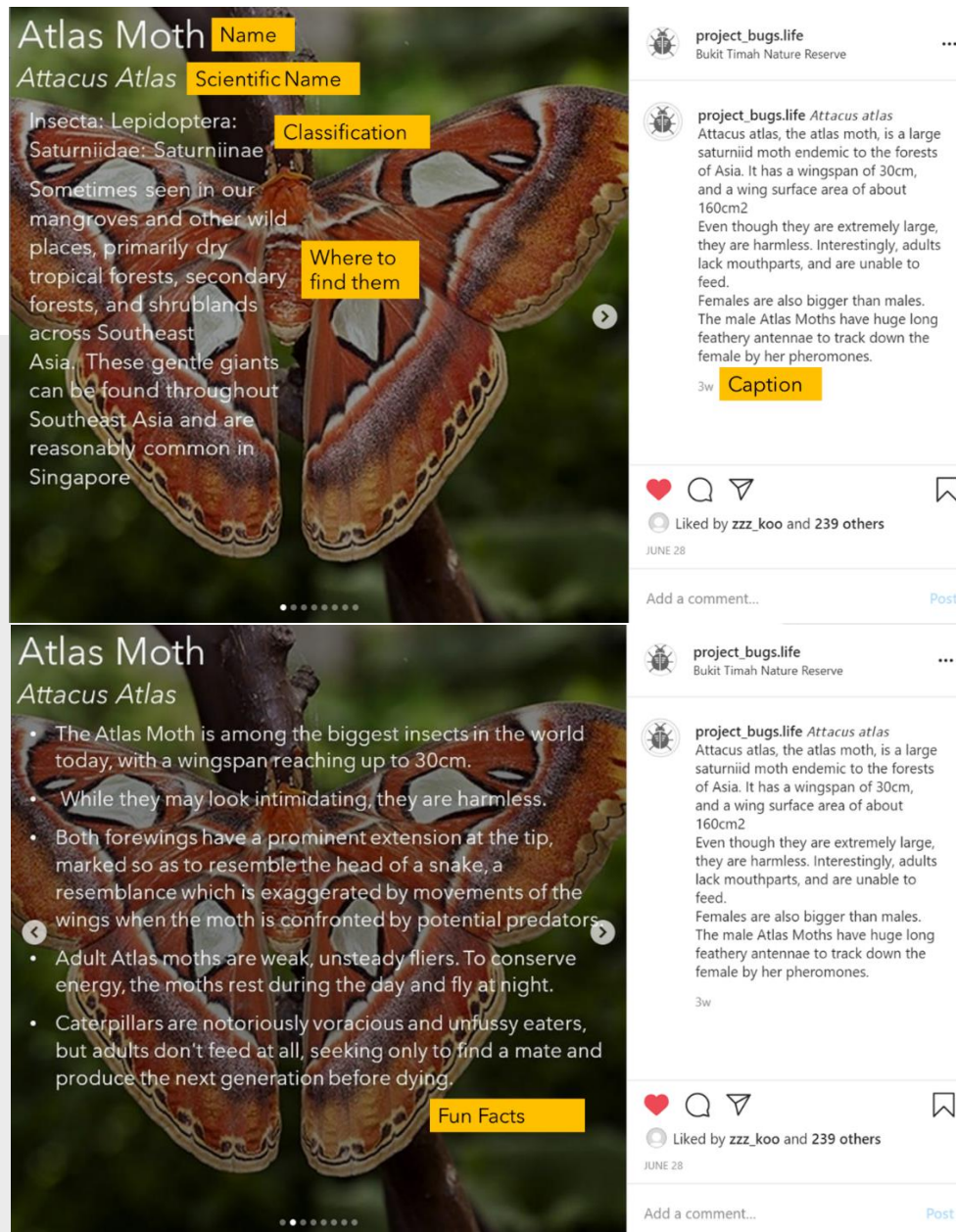
Instagram – Quizzes on insects



Instagram- National Moth Day and Raising awareness about diversity of moths

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Clear and interesting pictures of the insect



Instagram – Example of our post

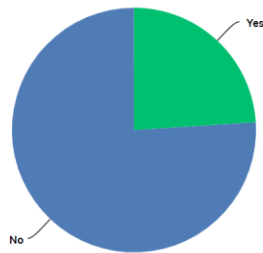
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3.1 Needs Analysis

Do you know that the population of bugs are declining?

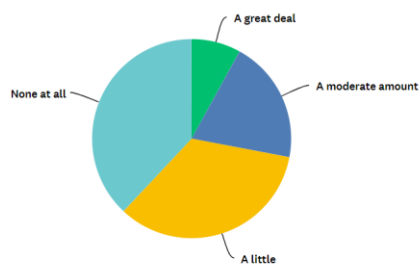
Answered: 50 Skipped: 0



Most people are oblivious about the insect population decline.

How much do you know about bugs?

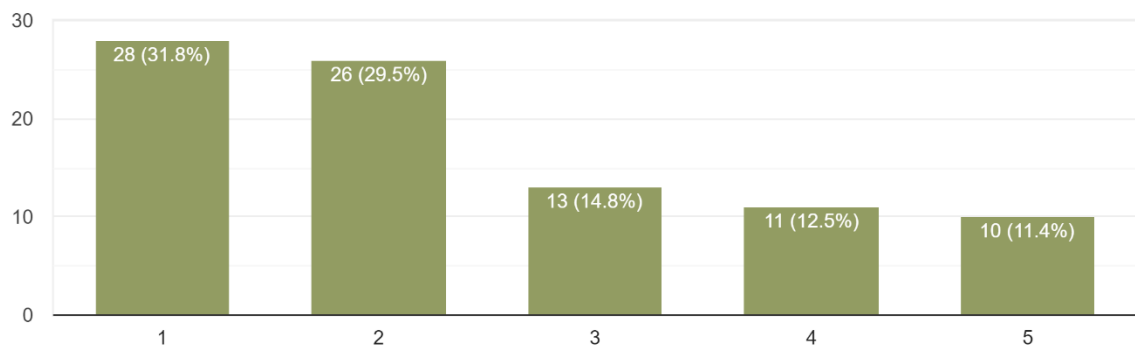
Answered: 50 Skipped: 0



The majority of the people do not know much about insects.

How much did you understand about insects?

88 responses

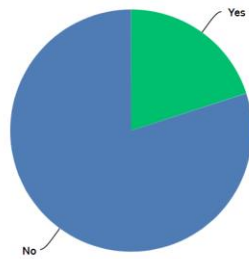


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Do you know any websites that provide information about bugs in Singapore?

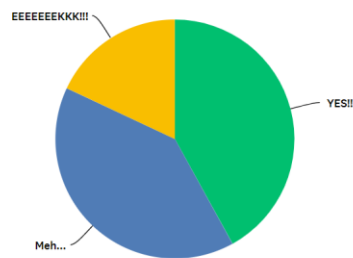
Answered: 50 Skipped: 0



Many are unable to find resources to learn more about insects.

Do you like bugs?

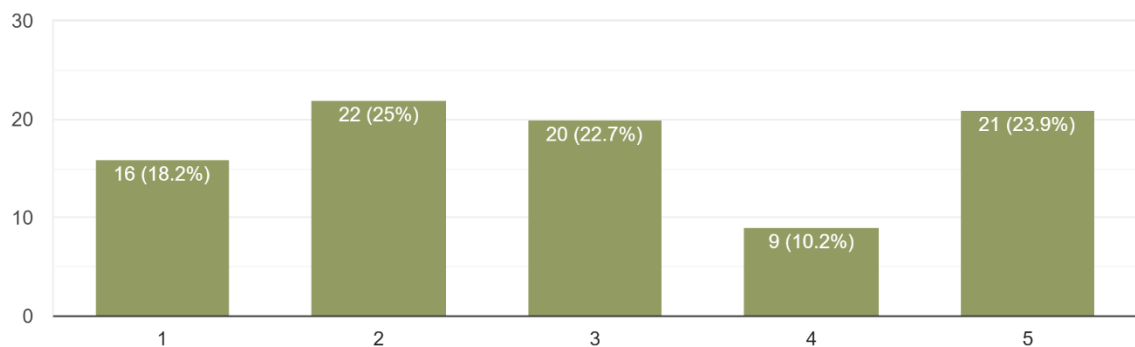
Answered: 50 Skipped: 0



58% of the respondents did not like bugs that much before seeing our resource possibly due to lack of understanding of these insects.

How much did you like insects?

88 responses

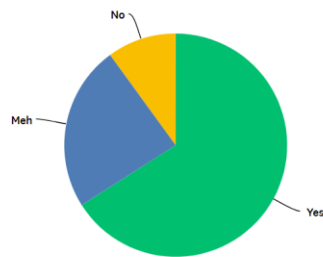


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Would you like to know more about bugs and where to find them?

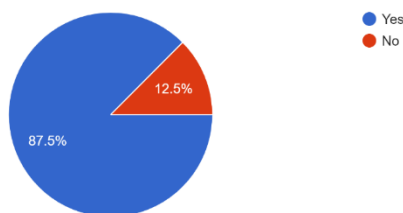
Answered: 50 Skipped: 0



Although many do not like insects, 66% of the respondents were willing to learn more about these insects and where to find them.

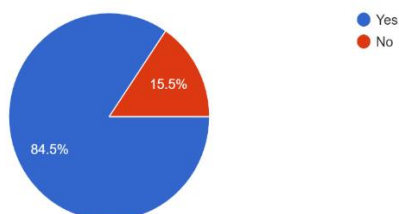
Have you been to Bukit Timah Nature Reserve or any other nature reserve?

88 responses



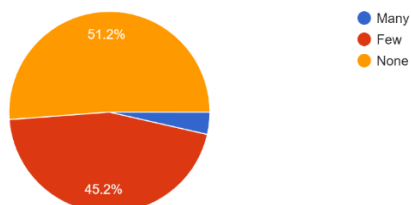
Have you spotted any insects there?

84 responses



Were there signs or boards about insects in the reserve?

84 responses



Many people go to reserves. However, they said they were unable to identify the insects. There were also few or no signs at the reserve with information about the insects. The public is unable to find resources to learn more about insects.

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3.2 Secondary Research

We have referred to many reliable websites for our secondary data, such as, <https://beetlesg.blogspot.com/>, <https://singapore.biodiversity.online/> and Lee Kong Chian Natural History Museum Resources along with research papers like those from Nparks.

3.3 Construction of Resources

We used wordpress to construct our website.

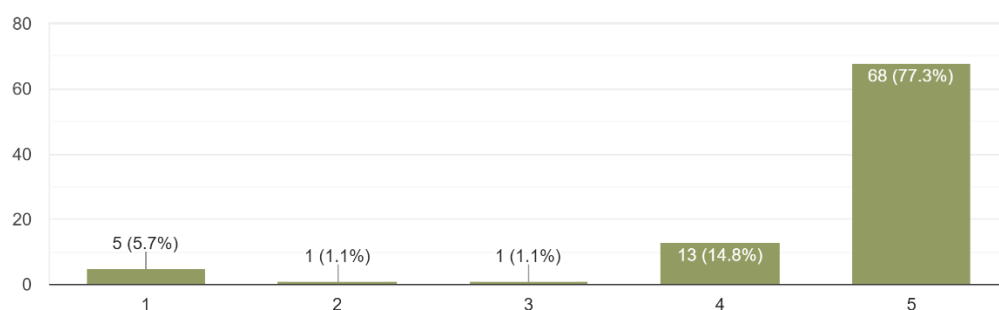
We have also created an instagram page, and posted information on the insects along with clear pictures. We have quizzes and information about each insect order.

3.4 Pilot Test & Expert Opinion

We have reached out to Dr Yeo (<https://sg.linkedin.com/in/darrenyeodr>) a PhD graduate from the NUS Evolutionary Biology Lab, whose research interests are focused on insect species diversity and ecology, to ask for his opinion and guidance on our project.

He commented that our website has an “[e]xcellent and eye-catching layout with beautiful pictures, highlights diversity of insects. Generally the pages are very well-done, with beautiful images and a nice write-up of the local species.” In particular, he said “[t]he bug-finder gives a pretty fun dimension for younger users to help them identify things.”

Was the website easy to navigate?
88 responses



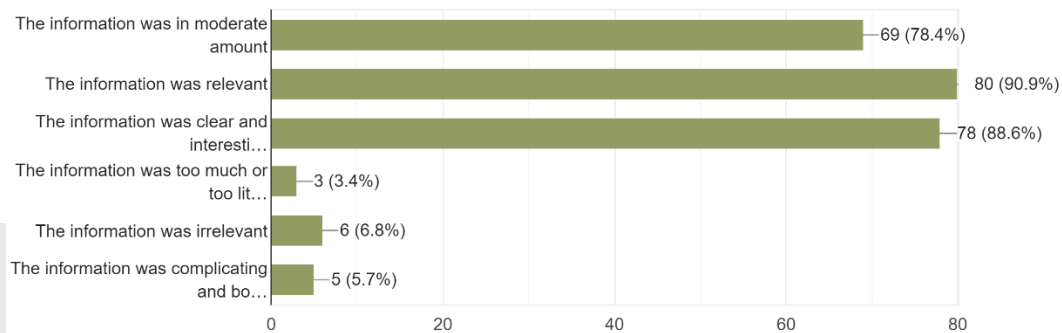
77.3% felt our website was very easy to navigate

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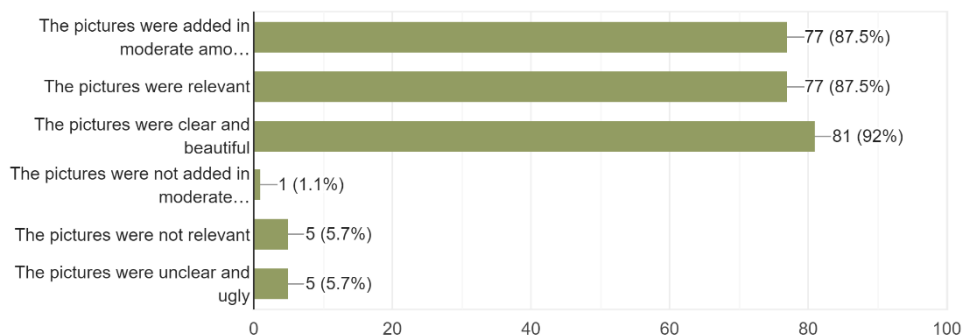
Were the information elaborate and educational?

88 responses



Were the pictures nice?

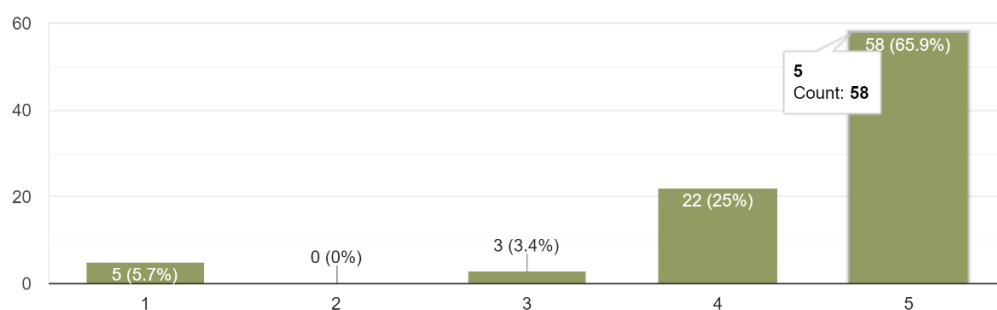
88 responses



More than 85% felt that the pictures and information were sufficient, relevant, clear and interesting.

How much have you learnt from the website?

88 responses



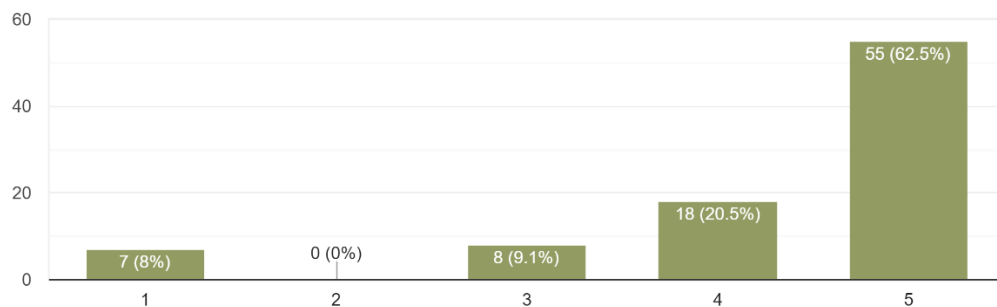
65.9% have learnt a lot from our website

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Have you developed an interest for insects after visiting the website?

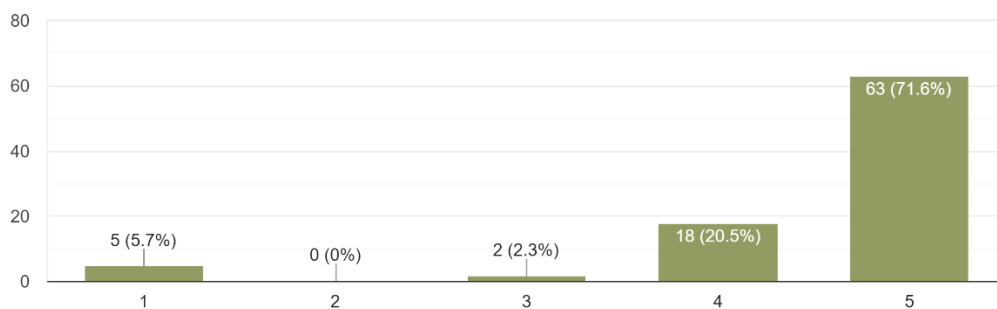
88 responses



62.5% have developed a great interest in insects

How would you rate our website in general

88 responses



71.6% gave a 5/5 for our website and many shared it to others.

Comments:

- Favorite feature was the bug identifier- helps me identify bugs
- Great pictures and interesting information. Found a green bug and now I know its a shield bug after reading your website!
- Extremely well made with interesting information
- Just found out about your website from my friend! Thanks for the beautiful info!!

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4. Outcome & Discussion

4.1 Changes Made/Final Outcome

Dr Yeo reminded us that some ants and termites have wings, so we made changes to our bug finder to make it more accurate. Photographers reminded us to use multiple sources to cross reference the pictures and have done so.

4.2 Limitations

There are more species that we have not covered. The literature in a country like Singapore, with a rich biodiversity, is not extensive and not complete.

4.3 Possible Further Works

We could collaborate with NParks to make a resource that visitors can use when they visit the different reserves, like QR codes on signboards. We could expand on the number of insect species we have or even work on the spider species of the reserve.

5. Conclusion

Bukit Timah Nature Reserve is home to many rare forest-dwelling insects. Although there are thousands of species in the reserve, many people do not appreciate or notice them. We hope that through our project, people will be aware about the declining population of insects, gain a better understanding of insects in Singapore and have greater interest and appreciation in them.

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<https://www.nickybay.com/>

Baharudin, H. (2019, May 25). NParks discovers 40 potentially new species of animals in Bukit Timah Nature Reserve. Retrieved from

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<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809>

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Bay, N. (2020). Macro Photography in Singapore. Retrieved from

<https://www.nickybay.com/>

Baharudin, H. (2019, May 25). NParks discovers 40 potentially new species of animals in Bukit Timah Nature Reserve. Retrieved from

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Bukit Timah Nature Reserve - Nature's Gift to Singapore. (n.d.). Retrieved from

<https://www.locomole.com/stories/bukit-timah-nature-reserve-natures-gift-singapore/>

Hallmann, C. A., Jongejans, E., Siepel, H., Hofland, N., Schwan, H., Stenmans, W., ... Martin Sorg. (2017.). More than 75 percent decline over 27 years in total

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flying insect biomass in protected areas. Retrieved from

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0185809>

Ho, J., Foo, M., Yeo, D., & Meier, R. (2019). The other 99%: exploring the arthropod species diversity of Bukit Timah Nature Reserve, Singapore. Gardens' Bulletin Singapore, 71(suppl.1), 391-417. doi: 10.26492/gbs71(suppl.1).2019-17 (2019, February 14). Why insect populations are plummeting-and why it matters. Retrieved from <https://www.nationalgeographic.com/animals/2019/02/why-insect-populations-are-plummeting-and-why-it-matters/>

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