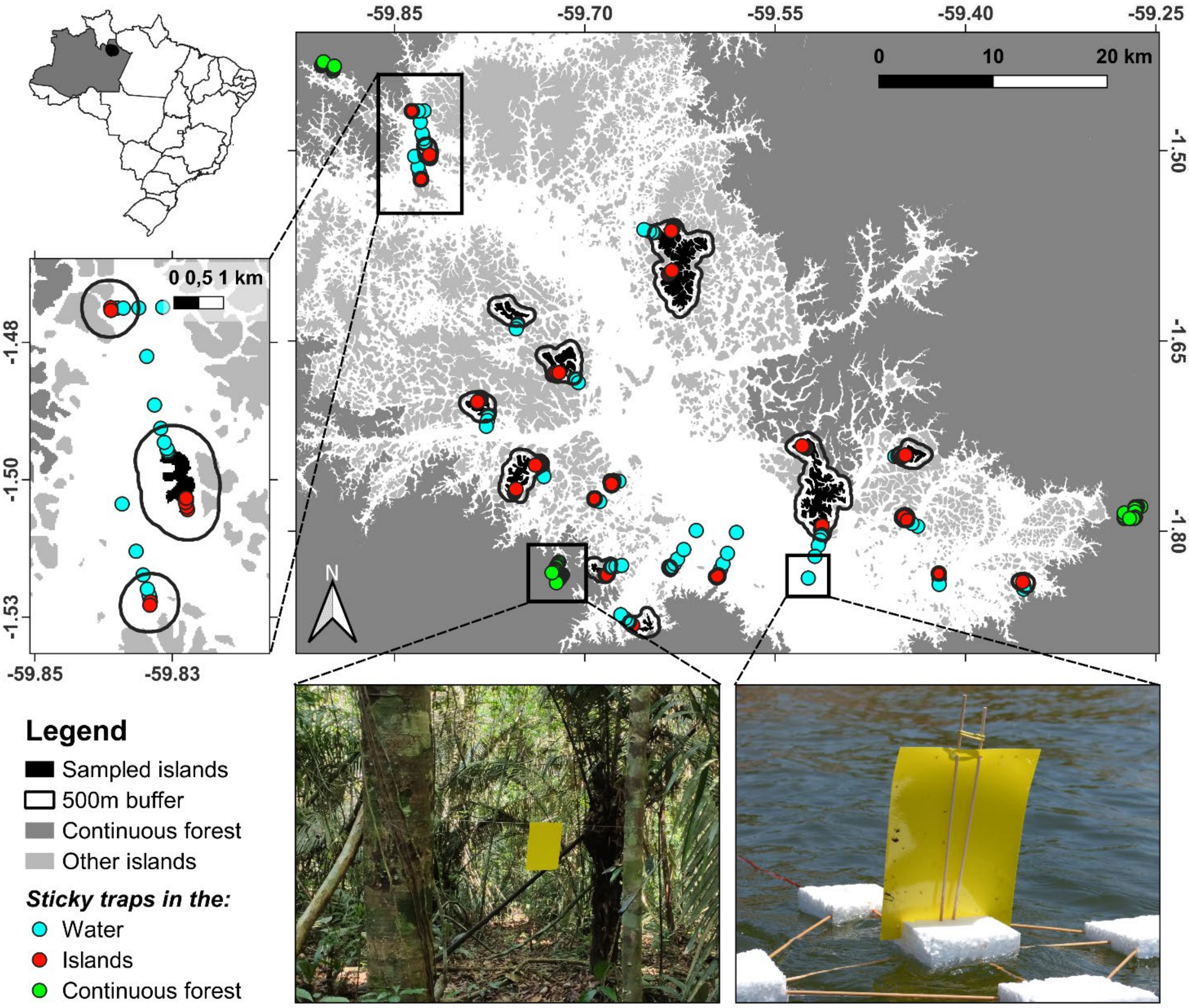
Project Update: July 2023

Since our last update, we have been working on the taxonomic identification and data analysis of the data collected in 2021 in the Balbina reservoir. The field campaign conducted in 2021 was relatively modest compared to the 2022 campaign (please refer to the project update from March 2023 for the specific differences). A total of 236 sticky traps were distributed across the landscape of the Balbina reservoir. The map below shows the locations of the 72, 119, and 45 sticky traps distributed in the islands, open-water matrix, and continuous forest areas, respectively.



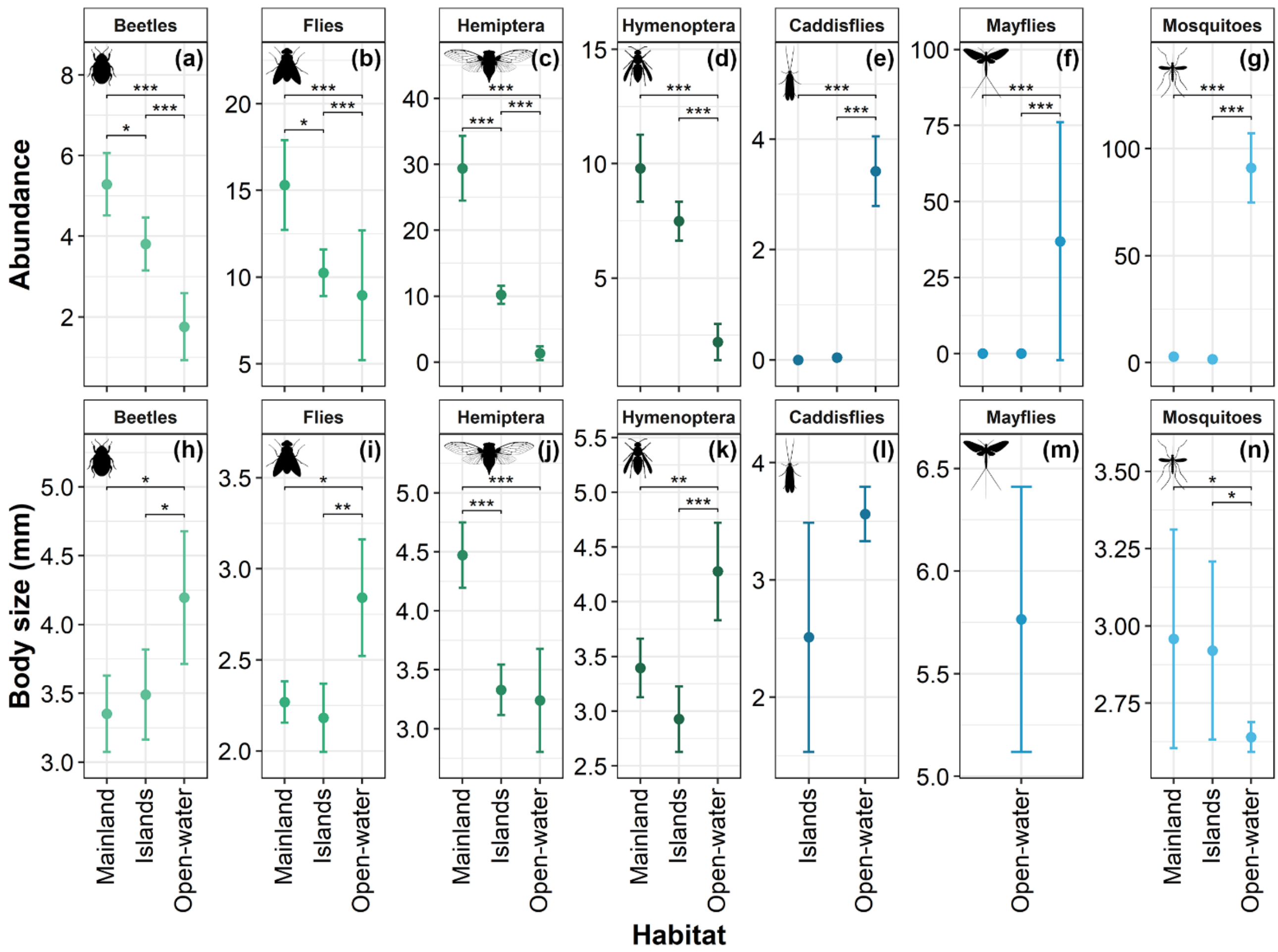
To perform the taxonomic identification of the insects, we utilised an object detection deep learning model, similar to the ones employed in self-driving cars. With this approach, we successfully identified 19,830 arthropod individuals belonging to 13 different taxonomic groups and automatically measured their body size. This automated identification process saved us several months of labour that would have otherwise been required to manually identify the arthropods from each trap. Consequently, what could have taken over 6 months for the taxonomic identification was accomplished in less than 1 month.

Our work stands out as one of the few studies that have applied these deep learning methods to biodiversity assessments. By demonstrating the feasibility of automatic biodiversity assessments, we provide evidence that such approaches can yield results in record time, which is crucial for conservationists engaged in the race against human impacts. Below, you can find some samples of this automated identification process.

After conducting the taxonomic identification, we were able to identify highly significant patterns among insects in response to habitat loss, which is the primary driver of species decline and extinction in our current era. In areas with low forest cover, such as islands and the open-water matrix, we observed a sharp decline in the abundance of terrestrial insects, including beetles, flies, cicadas, bees, wasps, and ants, when compared to continuous forest areas. Conversely, the impoundment of the Balbina reservoir had a positive impact on the abundance of certain aquatic insects (refer to the figure below). Mosquitos, caddisflies, and mayflies were particularly abundant in areas devoid of forest cover, specifically the open-water matrix. The increased abundance of mosquitoes is particularly concerning due to their role as vectors for several tropical diseases, such as malaria, dengue fever, yellow fever, and chikungunya.

Furthermore, we discovered that large terrestrial insects and small mosquitoes were the primary individuals capable of crossing the open-water matrix. This finding highlights the pivotal importance of different characteristics in determining an individual's response to habitat loss (refer to the figure below).

Our next steps involve publishing these results in high quality, peer-reviewed journals, a process we anticipate will be completed within the next 2 months. Following that, we will proceed with the taxonomic identification of the data collected in 2022 and investigate the influence of habitat fragmentation on biodiversity. The impact of habitat fragmentation on biodiversity is a highly debated topic in the literature, with some authors reporting no effects or even positive effects of fragmentation on biodiversity. So, we look forward to give some resolutions to this problematic in the next months.



Beetles
Flies
Hemiptera
Hymenoptera
Caddisflies
Mayflies
Mosquitoes
(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)
(k)
(l)
(m)
(n)
Abundance
Body size (mm)
Mainland
Islands
Open-water
Habitat