

Preliminary report on research conducted from MY Arctic Sunrise in Saya de Malha Bank region, Indian Ocean, 2021

Field expedition date: 2nd – 30th March 2021

Summary

During early 2021, Greenpeace International conducted a research and investigation cruise with the vessel MY Arctic Sunrise in the Indian Ocean as part of the Protect the Oceans campaign. As part of this campaign, on March 2nd 2021, a research expedition departed from Victoria, Mahe Island, Seychelles to the Saya de Malha Bank region of the Mascarene Plateau. A total of four transits between Seychelles and Saya de Malha Bank took place in the course of the expedition, which ended on the 30th March 2021 (Fig. 1). The primary aim of the research was to contribute much needed data on marine megafauna distributions within the Western Indian Ocean region, and specifically to build knowledge on sperm whale populations.

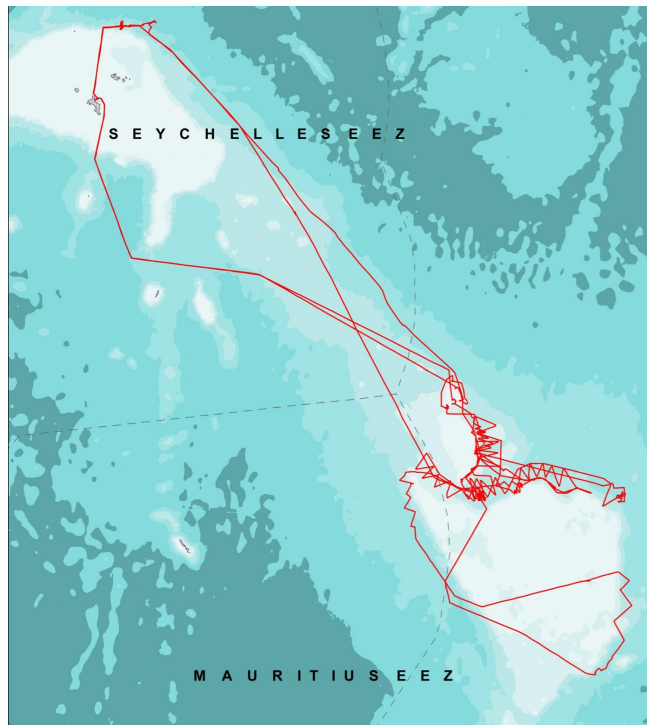


Figure 1. Map of tracks of the Arctic Sunrise during the Greenpeace International research expedition.

The initial findings from the Greenpeace International expedition to the Saya de Malha Bank in March 2021 have revealed a diverse array of wildlife. The research team used a combination of systematic (and opportunistic) visual surveys, passive acoustic monitoring, underwater video and photographic imaging as well as water sampling for subsequent environmental DNA (eDNA) monitoring.

The visual survey of marine megafauna, defined as birds, whales and dolphins, turtles and large fish, such as sharks or billfish, demonstrates the diversity of wildlife living on and around the Saya de Malha Bank region. Our survey included transits across the Saya de Malha Bank and Ritchie Bank, and regions of the shelf edge, particularly between the two (Fig. 1).

The water samples collected for environmental DNA monitoring will be sent to a laboratory in France, SPYGEN, for sequencing. These samples will provide a record of vertebrate species inhabiting the area based on eDNA monitoring detections from the DNA from biological material such as skin cells, mucus or feces that remain in the water after an animal has passed through. eDNA detection data can complement those from visual and acoustic surveys by providing evidence of species that are elusive, cryptic and difficult to observe.

The research team collected approximately 8 terabytes of acoustic data with a hydrophone towed from the stern of the ship which will provide more information on cetacean distributions at the Saya de Malha region.

The team captured underwater footage of the seagrass and mixed coral shallow water ecosystem on Ritchie Bank in the Saya de Malha region. The Saya de Malha Bank region is known to support the world's largest seagrass meadow - and is, therefore, thought to be one of the largest carbon sinks by area in the ocean. By protecting seagrass meadows, such as the Saya de Malha region, we can keep carbon buried within the seabed and ensure carbon burial for the future. Seagrass meadows are also critical feeding and breeding grounds for many marine species and are known to be important habitats for candidate marine protected areas.

We hope the data collected on the Greenpeace Indian Ocean Expedition 2021, including the research expedition to the Saya de Malha Bank will contribute to understanding the role of the world's largest submerged bank as a key habitat and potential linkage areas for wildlife in the

heart of the Western Indian Ocean. Such data, through effective collaboration can help to support the design of effective conservation and management measures for the region as well as provide baseline information that enable future research.

Environmental DNA sampling

The science objectives for the Saya de Malha Expedition 2021 included environmental DNA sampling to provide detection data on marine vertebrates. We hope to help to fill significant knowledge gaps relating to species presence and more generally those relating to marine biodiversity in a rapidly changing marine ecosystem. eDNA monitoring is a novel tool in providing a rapid assessment of species presence within oceanic ecosystems and additional information on species community diversity. The technique is also extremely useful in detecting rare and elusive species that are often not recorded during other surveys. For the Saya de Malha Bank, this research is unprecedented and will provide baseline data on vertebrate species richness in this unique ecosystem.

The technique involved collecting water samples at the surface from the rigid hulled inflatable boats (RHIBs) using a peristaltic pump that then filters 30L seawater, collecting free-floating DNA on a membrane within a specialised filter. A total of 14 surface samples were collected on 9 transects. In addition, 6 samples were collected from depths between 20 - 160m using two 10L Niskin water samplers. The samples will be transported to a laboratory for DNA isolation and sequencing, resulting in a list of vertebrate species and raw sequence data with which to examine vertebrate community diversity. Further bioinformatic analyses and write up will result in a peer reviewed publication.

Underwater footage

We collected underwater footage using a remotely operated vehicle (ROV) in two deployments, resulting in 50 minutes of footage. ROV deployments were conducted on the 17th March (location: -8.857083, 60.210267): and 18th March 2021 (location: -8.853433, 60.2171). In addition, video and still photographs documented the seagrass meadows and corals. Preliminary assessment of the material indicates evidence of mixed seagrass and coral ecosystems: *Thalassodendron ciliatum*, *Acropora* spp., table corals and brain corals, as well as diverse fish species such as wrasse, trevally and grouper.

The images will provide an initial dataset with which to examine the seagrass ecosystem, fish and coral communities associated with it and its overall health and status. Images are to be shared with local experts to facilitate the visual identification of plant, algae and coral species as well as marine mammals, fish and other taxa.

Table 2. Date and location of photography.

Date	Latitude	Longitude	Image comments
06-Mar-21	-9.207	60.362	Seagrass, large table coral
18-Mar-21	-9.195	60.364	Coral
18-Mar-21	-9.195	60.364	Coral and seagrass mix
18-Mar-21	-9.196	60.364	Coral and seagrass mix
18-Mar-21	-9.208	60.365	Coral and seagrass mix
18-Mar-21	-9.471	60.394	Fish shoal, coral
20-Mar-21	-9.200	60.367	Corals, then mixed seagrass and coral

Systematic marine megafauna visual survey

More than 500 person hours of visual surveying recorded 201 marine megafauna sightings (28 cetaceans, 1 turtle, fish and 157 birds) associated with the Saya de Malha region (Table 2). This included two feeding groups of sperm whales (*Physeter macrocephalus*) as well as pilot whales, spinner dolphins, Blainville's beaked whales, Bryde's whales and a killer whale. The visual survey of birds revealed species such as petrels, shearwaters, boobies, terns, noddy and frigate birds.

Table 2. Cetaceans observed during visual surveys through Seychelles EEZ during four transits from Victoria, Mahe Island, and the Saya de Malha region of the Mascarene Plateau.

Common name	Scientific name	Number of encounters	Comments
Sperm whale	<i>Physeter macrocephalus</i>	3	Two feeding groups, photoidentification of seven individuals at Saya de Malha.
Bryde's whale	<i>Balaenoptera edeni</i>	4	
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	1	
Killer whale	<i>Orcinus orca</i>	1	
Blainville's beaked whale	<i>Mesoplodon densirostris</i>	1	Two animals verified by photograph
Spinner dolphin	<i>Stenella longirostris</i>	6	
Unidentified balaenopterid	-	3	
Unidentified dolphin	-	7	Likely spotted or spinner dolphins but not close enough to the ship to verify.
Unidentified large whale	-	2	
	Total	28	

Spotted dolphins were sighted in Mauritian waters to the west of Saya de Malha Bank during transit to survey locations. At the Saya de Malha Bank, the visual survey also recorded fish, sharks and rays such as: whale shark (*Rhincodon typus*), oceanic manta ray (*Mobula birostris*), sunfish (*Mola mola*) and mahi mahi (*Coryphaena hippurus*) as well as many tuna and unidentified shark that were not noted in the survey.

In addition to documenting cetaceans and fish, the survey also noted all bird sightings to species level, where possible, resulting in 157 observations in international waters. Two observers were experienced bird biologists and were able to confirm species identity with high confidence, either by visual observation or by subsequent inspection on photographs. All other sightings were confirmed to the best of the observers ability and are noted as low or medium confidence unless specifically common and easy to identify. A total of 70 bird encounters were noted within the high seas area of the visual survey at high confidence. Species included: masked booby (*Sula dactylatra*), red-footed booby (*Sula sula*), lesser noddy (*Anous tenuirostris*), bridled tern (*Onychoprion anaethetus*), fairy tern (*Sternula nereis*), wedge-tailed shearwater (*Puffinus pacificus*), Bulwer's petrel (*Bulweria bulwerii*), white tern (*Gygis alba*), brown booby (*Sula leucogaster*). A further 87 bird sightings were noted where the species' identity was deemed to be of medium or low confidence.

On encountering a sperm whale group they were, wherever practical, tracked acoustically to identify group composition and behaviour. Photoidentification images were gathered for seven individuals encountered at the Saya de Malha region (Table 3). Vocalisations were also recorded where possible and additional images were collected with the use of drones.

Table 3. Sperm whale groups were encountered at the following locations in the Saya de Malha region.

Date	Latitude	Longitude	Group size	Identified individuals
21st March 2021	-9.698983	60.93675	6	PmaSaya01; PmaSaya02; PmaSaya03; PmaSaya04; PmaSaya05
24th March 2021	-9.867222	61.498888	>2	PmaSaya06; PmaSaya07
25th March 2021	-9.215383	60.44777	1	-

Sperm whale individuals identified as part of the Greenpeace Expedition within the Saya de Malha region: Please note that some photoidentification images are extracted from drone footage or are taken from a distance and, therefore, are of low quality.





Greenpeace PmaSaya03_2021



Greenpeace PmaSaya03_2021



Greenpeace PmaSaya04_2021

Note: The above image is extracted from drone video when the animal is underwater, so it is of poor quality but does show a highly marked individual.



Greenpeace PmaSaya05_2021



Greenpeace PmaSaya06_2021



Greenpeace PmaSaya07_2021



Passive acoustic monitoring

An approximately 350 m long towed passive acoustic monitoring hydrophone array was deployed from the vessel. Continuous recordings were made constituting approximately 8 Terabytes of data that can be processed through the open source Pamguard¹ software. Downstream analyses will provide a map of acoustic detections resulting in further cetacean detections.

Data processing and sharing

The research team on board was led by marine scientist Dr Kirsten Thompson, Greenpeace Research Laboratories and University of Exeter, and assisted by Dr Tim Lewis, independent research scientist. The participation of Sheena Talma from Seychelles and Shaama Sandooyea from Mauritius was essential in providing insights into the region's biodiversity and environment as well as research networks. Dr Thompson and Dr Lewis designed the visual survey with assistance from specialists from the Harry Butler Institute at Murdoch University (Perth, Australia) with support from GLOBICE and the Indian Ocean Cetacean Research Network on whales and dolphins in the Mascarene Plateau and additional guidance from Seychelles Bird Records Committee on seabird observations.

¹ <https://www.pamguard.org>

Through this expedition report and on publication of peer reviewed articles we hope to help fill a gap in global knowledge on the distribution marine megafauna in the western Indian Ocean region, adding to available open access data through OBIS Seemap². By sharing our data, online at the earliest opportunity, we can provide a baseline for monitoring change in unsurveyed regions.

The megafauna observations can be viewed on an interactive map online at:

http://maps.greenpeace.org/maps/su/indian_ocean_2021/

Please note that the above map was designed for real time communication and the data on which it was based has been checked and cleaned to make survey data available for subsequent scientific analyses.

The recordings from the acoustic monitoring will be analysed in collaboration with University of St Andrews, UK. On completing the more detailed acoustic analyses, we will make the results available on publication of the peer reviewed article that will be shared with the Joint Commission for the Joint Management Area and uploaded to OBIS Seemap repository.

All photoidentification images of sperm whales will be shared with the Réunion-based organisation GLOBICE in order to contribute to the database of marine mammals in the Western Indian Ocean region maintained by GLOBICE and the Indian Ocean Network for Cetacean Research IndoCet. We also hope that researchers and organisations in Seychelles, Mauritius and the Western Indian Ocean region can use these images in building knowledge of sperm whales in the region.

5.1. Environmental DNA

All environmental DNA data will contribute to the World Biodiversity Observatory through DNA (ALIVe) and sequence data will be uploaded to online repositories such as GenBank on publication of peer reviewed articles.

² <http://seamap.env.duke.edu>

5.2. Underwater images

Underwater footage will be made available for scientific purposes, including further species identification and analyses.

Aerial footage can be obtained through the [Greenpeace Media Library](#).

5.3. Systematic marine megafauna visual survey

Through this expedition, we hope to help fill a gap in global knowledge on the distribution marine megafauna in the Western Indian Ocean region, adding to available open access data through OBIS Seamap³. By sharing our data, online and with the JMA at the earliest opportunity, we can provide a baseline for monitoring change in unsurveyed regions.

5.4. Photo identification

We will share all photo ID images with the Réunion-based organisation GLOBICE in order to contribute to the database of marine mammals in the Western Indian Ocean region maintained by GLOBICE and the Indian Ocean Network for Cetacean Research IndoCet. Through this report we are also making these images available to researchers and organisations in Seychelles and Mauritius to provide a basis for a Saya de Malha sperm whale photoidentification catalogue.

5.5. Passive acoustic monitoring

The recordings from the acoustic monitoring will be analysed in collaboration with University of St Andrews, UK. On completing a peer reviewed journal article detailing the acoustic analyses, we will provide a copy to the JMA and any interested research organisation in Seychelles and Mauritius.

Acknowledgements

We thank the Joint Commission of the Joint Management Area, Governments of Seychelles and Mauritius for welcoming the research as well as advice during the Greenpeace 2021 research expedition to the Saya de Malha Bank.

³ <http://seamap.env.duke.edu>

Contact details

Scientific research: Kirsten Thompson

Greenpeace Research Laboratories, University of Exeter

Email: k.f.thompson@exeter.ac.uk

Mob: +44 7841695569

Ship operations: Manuel Pinto

Operations Manager - Marine

Greenpeace International

The Netherlands

Email: manuel.pinto@greenpeace.org

Email: operations.ships@greenpeace.org

Mob: +31 6 2900 1147

Campaign: Laura Meller

Ocean Policy Advisor, Greenpeace Nordic

Based in Finland

Email: laura.meller@greenpeace.org

Mob: +358 40 180 3322