



A multitaxa approach to biodiversity inventory in Matela protected area (Terceira, Azores, Portugal)

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Abstract

Background

This manuscript is the first contribution of the project, “Matela – uma ilha de biodiversidade” (“Matela - an island of biodiversity”), that aims to restore the native vegetation within the Azorean Protected Area of the Terceira Island Nature Park known as the “Protected Area for the Management of Habitats or Species of Matela” (TER08), situated on Terceira Island, the Azores Archipelago, Portugal. This small fragment of native forest, positioned at a low-medium altitude (300-400 m a.s.l.), is facing some conservation impacts as a consequence of the spread of different invasive exotic plant species, mainly *Pittosporum undulatum*, *Rubus ulmifolius* and *Hedychium gardnerianum*. The database we present encompasses diverse taxonomic groups, including bryophytes, vascular plants, arthropods, birds and mammals. It is derived from intensive sampling campaigns conducted in 2022, but some data from a previous vascular plant survey in 2015 were also included. The objective of this study was to provide an updated inventory of bryophytes, vascular plants, arthropods, birds and mammals within this protected area. In this way we

are providing the reference conditions necessary for the monitoring of the impacts of the current ongoing restoration efforts within the project “Matela - an island of biodiversity”. Whenever feasible, the present inventory is juxtaposed with historical data from previous surveys conducted in Matela.

New information

In the realm of bryophytes, our analysis revealed the presence of 75 taxa, comprising 44 mosses and 32 liverworts. Amongst these, 71 were indigenous, while three remained indeterminate and one, *Campylopus introflexus*, was identified as invasive. A comparison with previous historical data revealed a decrease in species richness, which was partially counterbalanced by the discovery of 23 new recorded species in the area.

Regarding vascular plants, we distinguished 54 species, comprising 28 indigenous and 26 introduced taxa. Almost 80% of the inventoried species ($n = 43$) were newly documented in Matela.

The study of arthropods encompassed a total of 103 taxa. Within the realm of soil arthropods, we documented eight indigenous and 25 introduced taxa, witnessing the disappearance of endemic species alongside a substantial increase in introduced ones between 2002 and 2022. Canopy arthropods, totalling 36 indigenous and 18 introduced taxa, exhibited few changes when compared with data from 2002. SLAM traps captured 24 indigenous and 15 introduced arthropod taxa and no historical data are available for comparison.

As for avian species, we noted 12 indigenous birds and one introduced species, confirming the presence of most of the historical recorded native species.

The mammalian census revealed eight introduced species, setting new precedents for Matela, alongside the identification of one endemic species: the Azorean endemic bat *Nyctalus azoreum*.

Keywords

bryophytes, vascular plants, arthropods, birds, mammals, endemic species, introduced species, historical data, protected areas, Azores

Introduction

The primary threats to biodiversity include biological invasions, climate change and habitat transformation and loss (e.g. Bellard et al. (2022)), all of which with dramatic impacts on native biota and ecosystems, profoundly altering ecological dynamics. The escalating magnitude of these threats has emerged as a paramount concern for scientists and

conservation organisations, as highlighted by some seminal works (e.g. Simberloff et al. (2013), Bellard et al. (2016)), particularly on islands (Hanski 2016).

Protected areas play a central role in global commitments to sustainability and biodiversity conservation (Mulongoy and Chape 2004, Gaston et al. 2008). These areas were established to conserve ecosystems of recognised value, encompassing both fauna and flora, including habitats of high rarity and integrity (Mulongoy and Chape 2004, Gaston et al. 2008), harbouring complex communities of native and endemic species, acting as natural buffers against climate change and functioning as genetic reservoirs, fulfilling numerous other roles (e.g. Mulongoy and Chape (2004)). In this sense, several studies have been developed to evaluate the best species distribution models, under current and future climate conditions and to assess the effectiveness of protected areas to represent biodiversity (e.g. Ferreira et al. (2016), Vergílio et al. (2016), Silva et al. (2017), Ferreira et al. (2019)).

There are recommendations from the scientific community and government entities to increase the surface area of protected areas worldwide from 10-12% of the total surface of the planet (Gaston et al. 2008), to close to 50% (Wilson 2016 - Half-Earth Project). For instance, the European Union's Biodiversity Strategy for 2030 aims to transform at least 30% of Europe's land and seas into effectively managed protected areas, complementing the Natura 2000 network areas (European-Commission 2021).

Conserving biodiversity poses distinct challenges in ecologically sensitive regions such as islands (Borges et al. 2018), where endemism rates are high and species often exhibit low abundance or occupy extremely restricted areas. For example, in the Azores Archipelago, native biodiversity is particularly vulnerable to the spread of invasive species (Hortal et al. 2010, Lourenço et al. 2011), habitat fragmentation (Vergílio et al. 2016) or climate change impacts (Ferreira et al. 2016, Patiño et al. 2016).

Since the 1980s, the Azorean government established protected areas for biodiversity conservation, encompassing terrestrial habitats, coastal zones and mountain areas, as well as a considerable number of protected habitats, such as coastal shrubland, heathlands and Laurissilva forests. The Azores Protected Areas Network includes nine Island Natural Parks (one for each island), with a total of 124 protected areas, comprising 19 Natural Reserves, 11 Natural Monuments, 48 Protected Areas for Habitat or Species Management, 16 Protected Landscape Areas and 30 Protected Areas for Resource Management (Regional-Directorate-for-the-Environment 2020). This accounts for a total of 180,374 hectares of protected areas, equivalent to approximately 21% of the terrestrial area of the Archipelago. Of this, 56,219 hectares are terrestrial, while 124,155 hectares are marine (Regional-Directorate-for-the-Environment 2020).

Specifically, on Terceira Island, the Natural Park currently comprises 20 protected areas, including three Natural Reserves, two Natural Monuments, seven Protected Areas for Habitat or Species Management, one Protected Landscape Area and seven Protected Areas for Resource Management (Regional Legislative Decree No. 11/2011/A; April 20). The protected terrestrial areas cover 8,561.11 hectares, representing 21.37% of the

territory (Regional-Directorate-for-the-Environment 2020). In 2011, Matela Forest, located on an ancient lava flow, was designated as a Protected Area for Habitat or Species Management given that its natural values, high biodiversity indices and representation in terms of flora (Regional Legislative Decree No. 11/2011/A; April 20). The vegetation of Matela can be classified as sub-montane forest, usually dominated by *Laurus azorica* (Azorean Laurel forests) that, in the past, probably covered more than two-thirds of the Azorean islands, from 300 m to 600 a.s.l. (Elias et al. 2016). For example, Matela Forest represents a "hotspot" of species, exhibiting a high specific richness for bryophytes, including globally threatened species, such as the moss *Echinodium renauldii* (Cardot) Broth. (Gabriel 1994) and could serve as a natural refuge to potentially aiding in the recolonisation of neighbouring areas (Gabriel 1994, Lloret and González-Mancebo 2011). On the leaves of laurel trees and fern fronds, it is possible to observe communities of small liverworts, including the species *Cololejeunea sintenisii* (Steph.) Pócs, equally threatened with extinction according to IUCN Criteria (González Mancebo et al. 2019). In Suppl. material 1, we list 88 species of bryophytes historically recorded for Matela.

For those visiting the area, it is impressive to observe the presence of large specimens of Azores juniper (*Juniperus brevifolia* (Hochst. ex Seub.) Antoine subsp. *brevifolia*), the only endemic gymnosperm species in the Azores and one of the most important in structuring native forests. A preliminary dendrochronological analysis (Elias, unpublished data) suggests that these trees are likely over 150 years old (see Suppl. material 2 for the listing of the 42 species of vascular plants already referenced for Matela).

Based on historical data (2002 sampling - see Pozsgai et al. (2024) - and other sources), it is worth highlighting the presence of a significant number of endemic arthropod species (about 23 species; Suppl. material 3), including eight species of spiders, which represent 60% of the known endemic species on Terceira Island (*Canariphantes acoreensis* (Wunderlich, 1992); *Savigniorrhhipis acoreensis* Wunderlich, 1992; *Emblyna acoreensis* Wunderlich, 1992; *Gibbaranea occidentalis* Wunderlich, 1989; *Lasaeola oceanica* Simon, 1883; *Leucognatha acoreensis* Wunderlich, 1992; *Pardosa acoreensis* Simon, 1883; *Rugathodes acoreensis* Wunderlich, 1992) with the first three being classified as vulnerable by IUCN Criteria. Amongst the beetles (Insecta, Coleoptera), four relatively rare endemic species mentioned in literature stand out, all classified as endangered by IUCN, namely: *Athous azoricus* Platia & Gudenzi, 2002; *Atlantocis gillerforsi* Israelson, 1986; *Drouetius borgesii borgesii* Machado, 2009; and *Pseudechinosoma nodosum* Hustache, 1936.

Amongst mammals, the endemic bat *Nyctalus azoreum* (Thomas, 1901) can be observed in Matela, a diurnal insectivorous species considered Vulnerable by the IUCN. Nine species of native birds are reported for the area, including the endemic subspecies of goldcrest, *Regulus regulus inermis* (Murphy & Chapin, 1929) and the Azores chaffinch, *Fringilla coelebs moreletti* (Pucheran, 1859) (see Suppl. material 4).

Unfortunately, in recent years, Matela has been invaded by a high number of introduced species, possibly due to its low-altitude location, proximity to pasturelands and being a small fragment of natural vegetation with a high perimeter/area ratio, intersected by

communication routes (Borges et al. 2006). These conditions may have severe consequences at the local scale, as well as for Azorean biodiversity conservation (Borges et al. 2005).

General description

Purpose: The main objectives of this study were: (i) provide an updated inventory of bryophytes, vascular plants, arthropods, birds and mammals within this protected area; ii) when possible, to provide some comparisons with historical data on surveys of Matela.

Project description

Title: Multitaxa Inventory of Matela (Terceira, Azores, Portugal) - Protected Area for the Management of Habitats or Species.

Personnel: Fieldwork (site selection and experimental setting): Rosalina Gabriel (Bryophytes); Rui B. Elias (Vascular Plants); Paulo A. V. Borges (Arthropods) & Mariana Sousa (Vertebrates).

Fieldwork (authorisation): Azorean Minister of Environment (Lic 46/2022/DRAAC) and Azorean Minister of Science and Technology (CCPI 28/2022/DRCT).

Fieldwork (sample collection): Bryophytes (Mariana Sousa, Bruna Martins & Rosalina Gabriel); Vascular Plants (Mariana Sousa, Joana Romão, Joana Roxo, Bruna Martins & Rui B. Elias); Arthropods (Mariana Sousa & Paulo A.V. Borges); Vertebrates (Mariana Sousa, Bruna Martins & Lucas Lamelas-López).

Parataxonomists: Bryophytes (Mariana Sousa); Vascular Plants (Joana Romão, Joana Roxo & Mariana Sousa); Arthropods (Mariana Sousa & Abrão Leite); Vertebrates (Bruna Martins & Mariana Sousa).

Taxonomist: Rosalina Gabriel (Bryophytes); Rui B. Elias (Vascular Plants); Paulo A. V. Borges (Arthropods) & Mariana Sousa (Vertebrates).

Voucher specimen management: Bryophytes (Mariana Sousa & Rosalina Gabriel); Arthropods (Mariana Sousa & Abrão Leite).

Database management: Mariana Sousa, Rosalina Gabriel, Paulo A. V. Borges & Rui B. Elias.

Darwin Core databases management: Lucas Lamelas-López, Rosalina Gabriel & Paulo A. V. Borges.

Study area description: Matela (Latitude: 38°41'59"N, Longitude: 27°15'40"W) is located at low-medium altitude (300-400 m a.s.l.) inland of Terceira Island (Fig. 1), the third largest island of the Azorean Archipelago (about 400 km²). Matela is included in the Natural Park

of Terceira Island and is considered a Protected Area for the Management of Habitats or Species (Regional Legislative Decree nº 11/2011/A, of 20 April 2011). It has a total area of 220,530 m² and, although the main habitat comprises natural forests, mainly dominated by *Erica azorica* Hochst. ex Seub. or *Laurus azorica* (Seub.) Franco, it also includes small patches of *Eucalyptus globulus* Labill. and Japanese cedar (*Cryptomeria japonica* D.Don) plantations and semi-natural pastures (Elias et al. 2016).

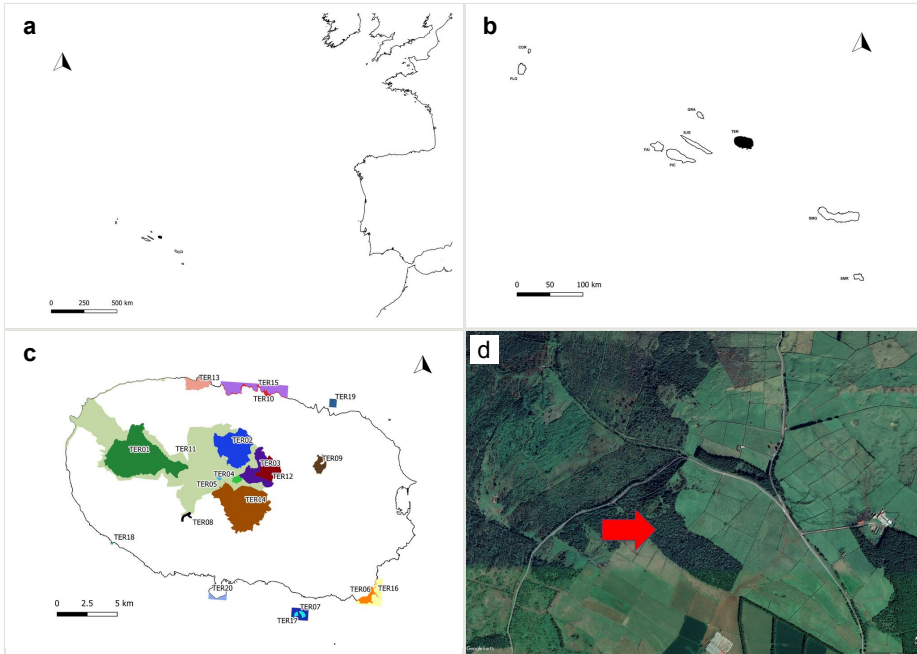


Figure 1.

Location of Matela (Credit: Enésima Pereira).

a: Location of Azores in North Atlantic. [doi](#)

b: The nine Azorean Islands (COR -Corvo; FLO - Flores; FAI - Faial; PIC - Pico; SJG - São Jorge; GRA - Graciosa; TER -Terceira; SMG - São Miguel; SMR - Santa Maria). Terceira is marked in black. [doi](#)

c: The Island of Terceira with all the protected areas and location of Matela protected area (TER08). [doi](#)

d: The location of Matela with an arrow locating the main sampling area. [doi](#)

Design description: The sampling protocol was carried out in 2022 and it is based on GIMS - A Global Island Monitoring Scheme protocols (Borges et al. 2018) (see more details below).

The historical data were obtained from herbarium and other unpublished data and through a bibliographic revision (from 1970 to date) (see list of main sources in Suppl. material 5). Particularly for the bryophytes, data come from the study of Gabriel and Bates (2005). More detailed data from arthropods sampled in 2020 can be consulted in Pozsgai et al. (2024).

Funding: FCT-UIDB/00329/2020-2024 (<https://doi.org/10.54499/UIDB/00329/2020>); Azores DRCT Pluriannual Funding (M1.1.A/FUNC.UI&D/010/2021-2024); Viridia – Conservation In Action Contract “Matela – uma ilha de biodiversidade”.

Sampling methods

Description: Most sampling was performed in 2022 on the “Protected Area for the Management of Habitats or Species of Matela”, located on Terceira Island (Azores, Portugal). This area is the unique available small fragment of native forest located at a low-medium altitude (300-400 m a.s.l.). Unfortunately, this small fragment was recently invaded by exotic invasive plant species.

Sampling description: The sampling protocol is based on GIMS - A Global Island Monitoring Scheme protocols (Borges et al. 2018).

For bryophytes, in the summer of 2022, three quadrats of 2 m × 2 m were sampled in three habitats: native forest, grassland and a former eucalyptus plantation; in each quadrat, three samples (microplots) of 10 cm × 5 cm were collected per substrate type, totalling 71 samples with bryophytes. For vascular plants, inventories were made in 72 sub-plots measuring 5 m × 5 m, in addition to a list of all observed species. Sampling mostly occurred in the autumn of 2022, but some data from a previous vascular plant survey in spring 2015 were also included.

For sampling arthropods, in the summer of 2022, the BALA methodology was used (Borges et al. 2005, Borges et al. 2018): 30 pitfall traps were set to sample soil arthropods and the canopy of the dominant tree species (*Juniperus beryifolia*, *Erica azorica*, *Laurus azorica*, *Pittosporum undulatum*) was beaten to collect plant-associated arthropods (10 samples per tree species); in addition to this protocol, one flight interception trap (SLAM - Sea, Land, Air, Malaise traps) (Fig. 2) was also used to sample flying arthropods or arthropods with great dispersal capacity. This SLAM trap has been operating since 2019 (see Borges et al. (2022a)), but the sample used for the current study was the sample from the summer of 2022.

The bird census was carried out at 25 observation points, always between 07:00 and 11:00 am during the summer and autumn 2022, applying the listening point method and other observations. The mammal inventory was carried out using camera traps at 30 sampling points also during the summer and autumn 2022. All the details of the sites can be consulted in the event table in GBIF (Sousa et al. 2024).

Quality control: All collected specimens were identified or revised by a taxonomical expert.

Step description: For Bryophytes, the final validation was made by Rosalina Gabriel. For Vascular Plants, the final validation was made by Rui B. Elias. For arthropods, the final validation was made by Paulo A. V. Borges. For Birds and Mammals, the identification was made by Mariana Sousa.



Figure 2. [doi](#)

SLAM trap (Sea, Land, Air, Malaise trap) (Credit: Paulo A. V. Borges).

The nomenclature and colonisation status of species follows the most updated information available in the AZORESBIOPORTAL (<https://azoresbioportal.uac.pt/>). For arthropods, this information is also available in the last published checklist (Borges et al. 2022b).

Geographic coverage

Description: The study was conducted on the Protected Area for the Management of Habitats or Species of Matela, Terceira Island, Azores, (Portugal).

Coordinates: 38.700538 and 38.69533 Latitude; -27.26478 and -2725338 Longitude.

Taxonomic coverage

Description: We have covered several taxonomic groups, namely mosses and liverworts (Bryophyta, Marchantiophyta), vascular plants (Magnoliophyta, Lycopodiophyta, Pteridophyta, Pinophyta), arthropods (Arthropoda) and vertebrates (Chordata).

Taxa included:

Rank	Scientific Name	Common Name
phylum	Bryophyta	Mosses
phylum	Marchantiophyta	Liverworts

phylum	Lycopodiophyta	Ferns and alies
phylum	Pteridophyta	Ferns
phylum	Pinophyta	Conifers
phylum	Magnoliophyta	Flowering plants
phylum	Arthropoda	Arthropods
phylum	Chordata	Birds and mammals

Temporal coverage

Notes: 01-07-2015 - 15-11-2022

Collection data

Collection name: AZU_Section Bryophytes; AZU_Section Vascular Plants; Dalberto Teixeira Pombo (Arthropods)

Collection identifier: AZU (Bryophytes and Vascular Plants); DTP (Arthropods)

Specimen preservation method: Dry (Bryophytes and Vascular Plants); Ethanol 96% (Arthropods).

Curatorial unit: Curator: Rosalina Gabriel (Bryophytes); Rui B. Elias (Vascular Plants); Paulo A. V. Borges (Arthropods).

Usage licence

Usage licence: Creative Commons Public Domain Waiver (CC-Zero)

Data resources

Data package title: Biodiversity inventory of the Protected Area for the Management of Habitats or Species of Matela (Terceira, Azores, Portugal)

Resource link: <https://doi.org/10.15468/qbj3rd>

Alternative identifiers: http://ipt.gbif.pt/ipt/resource?r=matela_project; <https://www.gbif.org/dataset/30ff08cc-4913-4564-a84c-734b040b9380>

Number of data sets: 2

Data set name: Event Table

Character set: UTF-8

Download URL: http://ipt.gbif.pt/ipt/resource?r=matela_project

Data format: Darwin Core Archive format

Data format version: 1.5

Description: The dataset was published in the Global Biodiversity Information Facility platform, GBIF (Sousa et al. 2024). The following data table includes all the records for which a taxonomic identification of the species was possible. The dataset submitted to GBIF is structured as a sample event dataset that has been published as a Darwin Core Archive (DwCA), which is a standardised format for sharing biodiversity data as a set of one or more data tables. The core data file contains 269 records (eventID). This GBIF IPT (Integrated Publishing Toolkit, Version 2.5.6) archives the data and, thus, serves as the data repository. The data and resource metadata are available for download in the Portuguese GBIF Portal IPT (Sousa et al. 2024).

Column label	Column description
eventID	Identifier of the events, unique for the dataset.
locationID	Identifier of the location.
stateProvince	Name of the region of the sampling site (Azores).
islandGroup	Name of archipelago (Azores).
island	Name of the island (Terceira).
country	Country of the sampling site (Portugal).
countryCode	ISO code of the country of the sampling site (PT).
municipality	Municipality of the sampling sites (Angra do Heroísmo).
minimumElevationInMetres	The lower limit of the range of elevation (altitude, usually above sea level), in metres.
decimalLongitude	Approximate centre point decimal longitude of the field site in GPS coordinates.
decimalLatitude	Approximate centre point decimal latitude of the field site in GPS coordinates.
geodeticDatum	The ellipsoid, geodetic datum or spatial reference system (SRS), upon which the geographic coordinates given in decimalLatitude and decimalLongitude are based.
coordinateUncertaintyInMetres	Uncertainty of the coordinates of the centre of the sampling plot.
coordinatePrecision	Precision of the coordinates.
georeferenceSources	A list (concatenated and separated) of maps, gazetteers or other resources used to georeference the Location, described specifically enough to allow anyone in the future to use the same resources.
locality	Name of the locality.
habitat	The habitat of the sample.

day	Day of the event.
month	Month of the event.
year	Year of the event.
eventDate	Date or date range the record was collected.
sampleSizeValue	The numeric amount of time spent in each sampling.
sampleSizeUnit	The unit of the sample size value.
verbatimEventDate	The verbatim original representation of the date and time information for an Event. In this case, we use the season and year.
samplingProtocol	The sampling protocol used to capture the species.

Data set name: Occurrence Table

Character set: UTF-8

Download URL: http://ipt.gbif.pt/ipt/resource?r=matela_project

Data format: Darwin Core Archive format

Data format version: 1.5

Description: The dataset was published in the Global Biodiversity Information Facility platform, GBIF (Sousa et al. 2024). The following data table includes all the records for which a taxonomic identification of the species was possible. The dataset submitted to GBIF is structured as an occurrence table that has been published as a Darwin Core Archive (DwCA), which is a standardised format for sharing biodiversity data as a set of one or more data tables. The core data file contains 1801 records (occurrenceID). This GBIF IPT (Integrated Publishing Toolkit, Version 2.5.6) archives the data and, thus, serves as the data repository. The data and resource metadata are available for download in the Portuguese GBIF Portal IPT (Sousa et al. 2024).

Column label	Column description
eventID	Identifier of the events, unique for the dataset.
type	Type of the record, as defined by the Public Core standard.
licence	Reference to the licence under which the record is published.
institutionID	The identity of the institution publishing the data.
collectionID	The identity of the collection publishing the data.
institutionCode	The code of the institution publishing the data.
collectionCode	The code of the collection where the specimens are conserved.
basisOfRecord	The nature of the data record.

occurrenceID	Identifier of the record, coded as a global unique identifier.
organismQuantity	A number or enumeration value for the quantity of organisms.
organismQuantityType	The type of quantification system used for the quantity of organisms. For bryophytes, we used the Braun Blanquet Scale.
sex	The sex and quantity of the individuals captured.
lifeStage	The life stage of the organisms captured.
establishmentMeans	The process of establishment of the species in the location, using a controlled vocabulary: 'native', 'introduced', 'endemic', "indeterminate".
dynamicProperties	Additional information about the process of the establishment of the species.
recordedBy	A list (concatenated and separated) of names of people, groups or organisations who performed the sampling in the field.
identifiedBy	A list (concatenated and separated) of names of people, groups or organisations who assigned the Taxon to the subject.
dateIdentified	The date on which the subject was determined as representing the Taxon.
kingdom	Kingdom name.
phylum	Phylum name.
class	Class name.
order	Order name.
family	Family name.
genus	Genus name.
scientificName	Species name.
specificEpithet	Specific epithet.
infraspecificEpithet	Infraspecific epithet.
scientificNameAuthorship	Name of the author of the lowest taxon rank included in the record.
taxonRank	Lowest taxonomic rank of the record.
identificationRemarks	Information about arthropod morphospecies identification (code in Dalberto Teixeira Pombo Collection).

Additional information

Results

Overall two kingdoms, six phyla, 14 classes, 58 orders and 254 taxa are listed. A total of 46 species are endemic distributed as follows: bryophytes - 4; vascular plants - 15; arthropods - 17; vertebrates - 10.

In the community of bryophytes, we recorded a total of 75 taxa, comprising 43 mosses and 32 liverworts. Amongst these, 71 were indigenous, while three remained indeterminate and one, *Campylopus introflexus*, was identified as invasive (Table 1). The most frequent species in the plots were the liverworts *Frullania acicularis* Hentschel & von Konrat (n = 26) and *Heteroscyphus denticulatus* (Mitt.) Schiffn. (n = 26). A temporal comparison with previous data (Suppl. material 1) unveiled a decrease in richness, offset by the addition of 23 new species to the area.

Table 1.

Inventory of bryophytes collected in 2022 on the Protected Area for the Management of Habitats or Species of Matela, (Natural Park of Terceira Island, Azores), including taxonomical information (Phylum, Class, Order and Species names), colonisation status (C.S.) (END - endemic from Azores; NAT - native non-endemic; INT - introduced species; IND - indeterminate origin) and number of plots where the species occurs (Plots). (Note: In the Occurrence Table, we used the Braun Blanquet Scale to determine the species abundance).

Phylum	Class	Order	Species	C.S.	Plots
Bryophyta	Bryopsida	Bryales	<i>Bryum ruderale</i> Crundw. & Nyholm	NAT	1
Bryophyta	Bryopsida	Bryales	<i>Ptychostomum bornholmense</i> (Wink. & R.Ruthe) Holyoak & N.Pedersen	IND	1
Bryophyta	Bryopsida	Bryales	<i>Plagiomnium undulatum</i> (Hedw.) T.J.Kop.	NAT	1
Bryophyta	Bryopsida	Dicranales	<i>Dicranum flagellare</i> Hedw.	NAT	1
Bryophyta	Bryopsida	Dicranales	<i>Dicranum scottianum</i> Turner	NAT	1
Bryophyta	Bryopsida	Dicranales	<i>Ceratodon purpureus</i> (Hedw.) Brid. subsp. <i>purpureus</i>	NAT	2
Bryophyta	Bryopsida	Dicranales	<i>Fissidens asplenioides</i> Hedw.	NAT	5
Bryophyta	Bryopsida	Dicranales	<i>Fissidens serrulatus</i> Brid.	NAT	1
Bryophyta	Bryopsida	Dicranales	<i>Fissidens taxifolius</i> Hedw.	NAT	4
Bryophyta	Bryopsida	Dicranales	<i>Campylopus flexuosus</i> (Hedw.) Brid.	NAT	17
Bryophyta	Bryopsida	Dicranales	<i>Campylopus introflexus</i> (Hedw.) Brid.	INT	3
Bryophyta	Bryopsida	Dicranales	<i>Campylopus pilifer</i> Brid.	NAT	1
Bryophyta	Bryopsida	Dicranales	<i>Campylopus pyriformis</i> (Schultz) Brid.	NAT	4
Bryophyta	Bryopsida	Dicranales	<i>Leucobryum glaucum</i> (Hedw.) Ångstr.	NAT	1
Bryophyta	Bryopsida	Dicranales	<i>Leucobryum juniperoideum</i> (Brid.) Müll.Hal.	NAT	12
Bryophyta	Bryopsida	Grimmiales	<i>Grimmia lisae</i> De Not.	NAT	6

Phylum	Class	Order	Species	C.S.	Plots
Bryophyta	Bryopsida	Grimmiales	<i>Ptychomitrium nigrescens</i> (Kunze) Wijk & Margad.	NAT	1
Bryophyta	Bryopsida	Grimmiales	<i>Ptychomitrium polyphyllum</i> (Dicks. ex Sw.) Bruch & Schimp.	NAT	3
Bryophyta	Bryopsida	Hookeriales	<i>Tetrastichium virens</i> (Cardot) S.P.Churchill	NAT	11
Bryophyta	Bryopsida	Hypnales	<i>Isoetecium prolixum</i> (Mitt.) M.Stech, Sim-Sim, Tangney & D.Quandt	NAT	12
Bryophyta	Bryopsida	Hypnales	<i>Pseudotaxiphyllum laetevirens</i> (Dixon & Luisier ex F.Koppe & Düll) Hedenäs	NAT	2
Bryophyta	Bryopsida	Hypnales	<i>Brachytheciastrum velutinum</i> (Hedw.) Ignatov & Huttunen	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Brachythecium</i> sp.	IND	1
Bryophyta	Bryopsida	Hypnales	<i>Brachythecium rutabulum</i> (Hedw.) Schimp.	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Brachythecium salebrosum</i> (Hoffm. ex F.Weber & D.Mohr) Schimp.	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Kindbergia praelonga</i> (Hedw.) Ochyra	NAT	20
Bryophyta	Bryopsida	Hypnales	<i>Pseudoscleropodium purum</i> (Hedw.) M.Fleisch.	NAT	5
Bryophyta	Bryopsida	Hypnales	<i>Rhynchostegiella azorica</i> Hedenäs & Vanderp.	END	2
Bryophyta	Bryopsida	Hypnales	<i>Rhynchostegium confertum</i> (Dicks.) Schimp.	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Sciuro-hypnum populeum</i> (Hedw.) Ignatov & Huttunen	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Echinodium renauldii</i> (Cardot) Broth.	END	2
Bryophyta	Bryopsida	Hypnales	<i>Hypnum cupressiforme</i> Hedw. var <i>cupressiforme</i>	NAT	18
Bryophyta	Bryopsida	Hypnales	<i>Hypnum uncinulatum</i> Jur.	NAT	18
Bryophyta	Bryopsida	Hypnales	<i>Heterocladium flaccidum</i> (Schimp.) A.J.E.Sm.	NAT	7
Bryophyta	Bryopsida	Hypnales	<i>Andoa berthelotiana</i> (Mont.) Ochyra	NAT	13
Bryophyta	Bryopsida	Hypnales	<i>Myurium hochstetteri</i> (Schimp.) Kindb.	NAT	2

Phylum	Class	Order	Species	C.S.	Plots
Bryophyta	Bryopsida	Hypnales	<i>Exsertotheca intermedia</i> (Brid.) S.Olsson, Enroth & D.Quandt	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Thamnobryum alopecurum</i> (Hedw.) Gangulee	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Thamnobryum maderense</i> (Kindb.) Hedenäs	NAT	1
Bryophyta	Bryopsida	Hypnales	<i>Thamnobryum rudolphianum</i> Mastracci	END	1
Bryophyta	Bryopsida	Hypnales	<i>Thuidium tamariscinum</i> (Hedw.) Schimp.	NAT	10
Bryophyta	Polytrichopsida	Polytrichales	<i>Atrichum undulatum</i> (Hedw.) P.Beauv.	NAT	3
Bryophyta	Polytrichopsida	Polytrichales	<i>Polytrichum commune</i> Hedw.	NAT	2
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Fuscocephaloziopsis crassifolia</i> (Lindenb. & Gottsche) Váña & L.Söderstr.	NAT	1
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Odontoschisma sphagni</i> (Dicks.) Dumort.	NAT	4
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Geocalyx graveolens</i> (Schrad.) Nees	NAT	1
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Telaranea europaea</i> J.J.Engel & G.L.Merr.	NAT	4
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Heteroscyphus denticulatus</i> (Mitt.) Schiffn.	NAT	26
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Lophocolea</i> sp.	IND	2
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Lophocolea fragrans</i> (Moris & De Not.) Gottsche, Lindenb. & Nees	NAT	8
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Lophocolea heterophylla</i> (Schrad.) Dumort.	NAT	2
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Plagiochila bifaria</i> (Sw.) Lindenb.	NAT	3
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Plagiochila exigua</i> (Taylor) Taylor	NAT	3
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Saccogyna viticulosa</i> (L.) Dumort.	NAT	21
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Scapania gracilis</i> Lindb.	NAT	3
Marchantiophyta	Jungermannioptida	Jungermanniales	<i>Scapania nemorea</i> (L.) Grolle	NAT	6
Marchantiophyta	Jungermannioptida	Jungermannioptida	<i>Acrobolbus azoricus</i> (Grolle & Perss.) Briscoe	END	3
Marchantiophyta	Jungermannioptida	Metzgeriales	<i>Metzgeria furcata</i> (L.) Corda	NAT	1

Phylum	Class	Order	Species	C.S.	Plots
Marchantiophyta	Jungermanniopsida	Porellales	<i>Frullania acicularis</i> Hentschel & von Konrat	NAT	26
Marchantiophyta	Jungermanniopsida	Porellales	<i>Frullania microphylla</i> (Gottsche) Pearson	NAT	7
Marchantiophyta	Jungermanniopsida	Porellales	<i>Frullania teneriffae</i> (F.Weber) Nees	NAT	1
Marchantiophyta	Jungermanniopsida	Porellales	<i>Cololejeunea sintenisii</i> (Steph.) Pócs	NAT	6
Marchantiophyta	Jungermanniopsida	Porellales	<i>Harpalejeunea molleri</i> (Steph.) Grolle	NAT	8
Marchantiophyta	Jungermanniopsida	Porellales	<i>Lejeunea cavifolia</i> (Ehrh.) Lindb.	NAT	8
Marchantiophyta	Jungermanniopsida	Porellales	<i>Lejeunea eckloniana</i> Lindenb.	NAT	5
Marchantiophyta	Jungermanniopsida	Porellales	<i>Lejeunea flava</i> subsp. <i>moorei</i> (Lindb.) R.M.Schust.	NAT	1
Marchantiophyta	Jungermanniopsida	Porellales	<i>Lejeunea hibernica</i> Bischl., H.A.Mill. & Bonner ex Grolle	NAT	1
Marchantiophyta	Jungermanniopsida	Porellales	<i>Lejeunea lamacerina</i> (Steph.) Schiffn.	NAT	18
Marchantiophyta	Jungermanniopsida	Porellales	<i>Lejeunea patens</i> Lindb.	NAT	1
Marchantiophyta	Jungermanniopsida	Porellales	<i>Marchesinia mackaii</i> (Hook.) Gray	NAT	9
Marchantiophyta	Jungermanniopsida	Porellales	<i>Myriocoleopsis minutissima</i> (Sm.) R.L.Zhu, Y.Yu & Pócs	NAT	1
Marchantiophyta	Jungermanniopsida	Porellales	<i>Porella canariensis</i> (F.Weber) Underw.	NAT	2
Marchantiophyta	Jungermanniopsida	Porellales	<i>Porella obtusata</i> (Taylor) Trevis.	NAT	3
Marchantiophyta	Jungermanniopsida	Porellales	<i>Radula carringtonii</i> J.B.Jack	NAT	11
Marchantiophyta	Jungermanniopsida	Porellales	<i>Radula wichurae</i> Steph.	NAT	3

Concerning vascular plants, we identified 54 species, with 28 being indigenous and 26 introduced (Table 2). The most frequent species in plots were the endemic fern *Dryopteris azorica* (Christ) Alston (n = 64) and the endemic tree *Laurus azorica* (Seub.) Franco (n = 63). However, several exotic invasive species are also very frequent, namely *Pittosporum undulatum* Vent. (n = 54), *Rubus ulmifolius* Schott (n = 49) and *Hedychium gardnerianum* Sheppard ex Ker-Gawl. (n = 43). Of the 54, a remarkable 43 were newly recorded for Matela (see historical records in Suppl. material 2).

The study of arthropods encompassed a total of 103 taxa (Table 3). The most abundant species were the introduced *Stelidota geminata* (Say, 1825) (Insecta, Coleoptera; n = 935) and the native *Lasius grandis* Forel, 1909 (Insecta, Hymenoptera; n = 263). Within the community of soil arthropods, we documented eight indigenous and 25 introduced taxa, witnessing the disappearance of endemic species alongside a substantial increase in introduced ones between 2002 and 2022 (see Suppl. material 3). Canopy arthropods, totalling 36 indigenous and 18 introduced taxa, exhibited a similar trend in the increase of

introduced species but not in the loss of endemic species. SLAM traps captured 24 indigenous and 15 introduced arthropod taxa.

Table 2.

Inventory of vascular plants collected between 2015 and 2022, on the Protected Area for the Management of Habitats or Species of Matela, (Natural Park of Terceira Island, Azores), including taxonomical information (Kingdom, Phylum, Class, Order and Species names), colonisation status (END - endemic from Azores; NAT - native non-endemic; INT - introduced species; IND - indeterminate origin) and number of plots where the species occurs (Plots). (Note: In the Occurrence Table, we used the Braun Blanquet Scale to determine the species abundance).

Phylum	Class	Order	Species	C.E.	N
Lycopodiophyta	Selaginellopsida	Selaginellales	<i>Selaginella kraussiana</i> (Kunze) A.Braun	NAT	28
Magnoliophyta	Liliopsida	Alismatales	<i>Zantedeschia aethiopica</i> Spreng.	INT	1
Magnoliophyta	Liliopsida	Asparagales	<i>Ruscus aculeatus</i> L.	INT	9
Magnoliophyta	Liliopsida	Liliales	<i>Smilax aspera</i> L.	INT	1
Magnoliophyta	Liliopsida	Zingiberales	<i>Hedychium gardnerianum</i> Sheppard ex Ker-Gawl.	INT	43
Magnoliophyta	Magnoliopsida	Apiales	<i>Hedera azorica</i> Carrière	END	6
Magnoliophyta	Magnoliopsida	Apiales	<i>Pittosporum undulatum</i> Vent.	INT	54
Magnoliophyta	Magnoliopsida	Aquifoliales	<i>Ilex azorica</i> Gand.	END	3
Magnoliophyta	Magnoliopsida	Asterales	<i>Erigeron canadensis</i> L.	INT	3
Magnoliophyta	Magnoliopsida	Asterales	<i>Roldana petasitis</i> (Sims) H.Rob. & Brettell	INT	1
Magnoliophyta	Magnoliopsida	Caryophyllales	<i>Persicaria capitata</i> (Buch.-Ham. Ex D.Don) H.Gross	INT	4
Magnoliophyta	Magnoliopsida	Caryophyllales	<i>Phytolacca americana</i> L.	INT	4
Magnoliophyta	Magnoliopsida	Ericales	<i>Calluna vulgaris</i> (L.) Hull	NAT	1
Magnoliophyta	Magnoliopsida	Ericales	<i>Erica azorica</i> Hochst. ex Seub.	END	46
Magnoliophyta	Magnoliopsida	Ericales	<i>Lysimachia arvensis</i> (L.) U.Manns & Anderb. subsp. <i>arvensis</i>	INT	2
Magnoliophyta	Magnoliopsida	Ericales	<i>Lysimachia azorica</i> Hornem. ex Hook.	END	30
Magnoliophyta	Magnoliopsida	Ericales	<i>Myrsine retusa</i> Aiton	END	5
Magnoliophyta	Magnoliopsida	Ericales	<i>Vaccinium cylindraceum</i> Sm.	END	1
Magnoliophyta	Magnoliopsida	Fabales	<i>Lotus pedunculatus</i> Cav.	INT	2
Magnoliophyta	Magnoliopsida	Fabales	<i>Morella faya</i> (Aiton) Wilbur	NAT	1
Magnoliophyta	Magnoliopsida	Fabales	<i>Quercus robur</i> L.	INT	1
Magnoliophyta	Magnoliopsida	Fabales	<i>Trifolium repens</i> L.	INT	1

Phylum	Class	Order	Species	C.E.	N
Magnoliophyta	Magnoliopsida	Gentianales	<i>Rubia agostinhoi</i> Dansereau & P.Silva	END	2
Magnoliophyta	Magnoliopsida	Gentianales	<i>Vinca difformis</i> Pourr.	INT	2
Magnoliophyta	Magnoliopsida	Lamiales	<i>Digitalis purpurea</i> L.	INT	4
Magnoliophyta	Magnoliopsida	Lamiales	<i>Halleria lucida</i> L.	INT	12
Magnoliophyta	Magnoliopsida	Lamiales	<i>Marrubium vulgare</i> L.	INT	2
Magnoliophyta	Magnoliopsida	Lamiales	<i>Mentha suaveolens</i> Ehrh.	INT	5
Magnoliophyta	Magnoliopsida	Lamiales	<i>Picconia azorica</i> (Tutin) Knobl.	END	9
Magnoliophyta	Magnoliopsida	Lamiales	<i>Plantago lanceolata</i> L.	INT	2
Magnoliophyta	Magnoliopsida	Laurales	<i>Laurus azorica</i> (Seub.) Franco	END	63
Magnoliophyta	Magnoliopsida	Myrtales	<i>Eucalyptus globulus</i> Labill.	INT	4
Magnoliophyta	Magnoliopsida	Myrtales	<i>Psidium cattleianum</i> Sabine	INT	1
Magnoliophyta	Magnoliopsida	Rosales	<i>Fragaria vesca</i> L.	NAT	3
Magnoliophyta	Magnoliopsida	Rosales	<i>Frangula azorica</i> Grubov	END	4
Magnoliophyta	Magnoliopsida	Rosales	<i>Rubus ulmifolius</i> Schott	INT	49
Magnoliophyta	Magnoliopsida	Saxifragales	<i>Umbilicus rupestris</i> (Salisb.) Dandy	NAT	4
Magnoliophyta	Magnoliopsida	Solanales	<i>Solanum mauritanium</i> Scop.	INT	2
Pinophyta	Pinopsida	Pinales	<i>Cryptomeria japonica</i> D.Don	INT	6
Pinophyta	Pinopsida	Pinales	<i>Juniperus brevifolia</i> (Hochst. ex Seub.) Antoine subsp. <i>brevifolia</i>	END	2
Pteridophyta	Polypodiopsida	Cyatheales	<i>Sphaeropteris cooperi</i> (F. Muell.) R.M.Tryon	INT	4
Pteridophyta	Polypodiopsida	Hymenophyllales	<i>Hymenophyllum tunbrigense</i> (L.) Sm.	NAT	11
Pteridophyta	Polypodiopsida	Hymenophyllales	<i>Vandenboschia speciosa</i> (Willd.) G.Kunkel	NAT	1
Pteridophyta	Polypodiopsida	Polypodiales	<i>Asplenium azoricum</i> (Milde) Lovis, Rasbach & Reichst.	END	7
Pteridophyta	Polypodiopsida	Polypodiales	<i>Asplenium scolopendrium</i> L.	NAT	25
Pteridophyta	Polypodiopsida	Polypodiales	<i>Doodia caudata</i> (Cav.) R.Br.	INT	2
Pteridophyta	Polypodiopsida	Polypodiales	<i>Dryopteris aemula</i> (Aiton) Kuntze	NAT	14
Pteridophyta	Polypodiopsida	Polypodiales	<i>Dryopteris affinis</i> (Lowe) Fraser-Jenk.	NAT	10
Pteridophyta	Polypodiopsida	Polypodiales	<i>Dryopteris azorica</i> (Christ) Alston	END	64
Pteridophyta	Polypodiopsida	Polypodiales	<i>Dryopteris crispifolia</i> Rasbach, Reichst. & Vida	END	2

Phylum	Class	Order	Species	C.E.	N
Pteridophyta	Polypodiopsida	Polypodiales	<i>Polypodium macaronesicum</i> subsp. <i>azoricum</i> (Vasc.) Rumsey, Carine & Robba	END	16
Pteridophyta	Polypodiopsida	Polypodiales	<i>Pteridium aquilinum</i> (L.) Kuhn	NAT	23
Pteridophyta	Polypodiopsida	Polypodiales	<i>Pteris incompleta</i> Cav.	NAT	11
Pteridophyta	Polypodiopsida	Polypodiales	<i>Struthiopteris spicant</i> (L.) Weis	NAT	6

Table 3.

Arthropod inventory collected in 2022, on the Protected Area for the Management of Habitats or Species of Matela, (Natural Park of Terceira Island, Azores), including taxonomical information (Kingdom, Phylum, Class, Order and Species names), colonisation status (C.S.) (END - endemic from Azores; NAT - native non-endemic; INT - introduced species; IND - indeterminate origin) and overall abundance data (N) (Note: only taxa identified at species level are included).

Phylum	Class	Order	Species	C.S.	N
Arthropoda	Arachnida	Araneae	<i>Cheiracanthium erraticum</i> (Walckenaer, 1802)	INT	58
Arthropoda	Arachnida	Araneae	<i>Clubiona terrestris</i> Westring, 1851	INT	4
Arthropoda	Arachnida	Araneae	<i>Cryptachaea blattea</i> (Urquhart, 1886)	INT	2
Arthropoda	Arachnida	Araneae	<i>Dysdera crocata</i> C.L.Koch, 1838	INT	1
Arthropoda	Arachnida	Araneae	<i>Emblyna açorensis</i> Wunderlich, 1992	END	65
Arthropoda	Arachnida	Araneae	<i>Entelecara schmitzi</i> Kulczynski, 1905	NAT	6
Arthropoda	Arachnida	Araneae	<i>Erigone atra</i> Blackwall, 1833	INT	1
Arthropoda	Arachnida	Araneae	<i>Gibbaranea occidentalis</i> Wunderlich, 1989	END	18
Arthropoda	Arachnida	Araneae	<i>Lathys dentichelis</i> (Simon, 1883)	NAT	177
Arthropoda	Arachnida	Araneae	<i>Leucognatha açorensis</i> Wunderlich, 1992	END	1
Arthropoda	Arachnida	Araneae	<i>Macaroeris cata</i> (Blackwall, 1867)	NAT	32
Arthropoda	Arachnida	Araneae	<i>Macaroeris diligens</i> (Blackwall, 1867)	NAT	13
Arthropoda	Arachnida	Araneae	<i>Mangora acalypha</i> (Walckenaer, 1802)	INT	2
Arthropoda	Arachnida	Araneae	<i>Metellina merianae</i> (Scopoli, 1763)	INT	1
Arthropoda	Arachnida	Araneae	<i>Nigma puella</i> (Simon, 1870)	INT	2
Arthropoda	Arachnida	Araneae	<i>Palliduphantes schmitzi</i> (Kulczynski, 1899)	NAT	50
Arthropoda	Arachnida	Araneae	<i>Pelecopsis parallela</i> (Wider, 1834)	INT	18
Arthropoda	Arachnida	Araneae	<i>Porrhoclubiona decora</i> (Blackwall, 1859)	NAT	61
Arthropoda	Arachnida	Araneae	<i>Rugathodes açorensis</i> Wunderlich, 1992	END	3

Phylum	Class	Order	Species	C.S.	N
Arthropoda	Arachnida	Araneae	<i>Savigniorrhipis acorensis</i> Wunderlich, 1992	END	17
Arthropoda	Arachnida	Araneae	<i>Steatoda nobilis</i> (Thorell, 1875)	NAT	1
Arthropoda	Arachnida	Araneae	<i>Tenuiphantes miguelensis</i> (Wunderlich, 1992)	NAT	5
Arthropoda	Arachnida	Araneae	<i>Tenuiphantes tenuis</i> (Blackwall, 1852)	INT	29
Arthropoda	Arachnida	Araneae	<i>Theridion musivivum</i> Schmidt, 1956	NAT	1
Arthropoda	Arachnida	Araneae	<i>Xysticus cor</i> Canestrini, 1873	NAT	1
Arthropoda	Arachnida	Araneae	<i>Zygiella x-notata</i> (Clerck, 1757)	INT	2
Arthropoda	Arachnida	Opiliones	<i>Homalenotus coriaceus</i> (Simon, 1879)	NAT	1
Arthropoda	Arachnida	Opiliones	<i>Leiobunum blackwalli</i> Meade, 1861	NAT	41
Arthropoda	Arachnida	Pseudoscorpiones	<i>Chthonius ischnocheles</i> (Hermann, 1804)	INT	1
Arthropoda	Arachnida	Pseudoscorpiones	<i>Ephippiochthonius tetrachelatus</i> (Preysler, 1790)	INT	2
Arthropoda	Chilopoda	Lithobiomorpha	<i>Lithobius pilicornis pilicornis</i> Newport, 1844	NAT	1
Arthropoda	Diplopoda	Julida	<i>Blaniulus guttulatus</i> (Fabricius, 1798)	INT	161
Arthropoda	Diplopoda	Julida	<i>Brachyiulus pusillus</i> (Leach, 1814)	INT	2
Arthropoda	Diplopoda	Julida	<i>Cylindroiulus propinquus</i> (Porat, 1870)	INT	15
Arthropoda	Diplopoda	Julida	<i>Nopoiulus kochii</i> (Gervais, 1847)	INT	79
Arthropoda	Diplopoda	Julida	<i>Ommatoiulus moreleti</i> (Lucas, 1860)	INT	7
Arthropoda	Diplopoda	Polydesmida	<i>Oxidus gracilis</i> (C.L. Koch, 1847)	INT	260
Arthropoda	Diplopoda	Polydesmida	<i>Polydesmus coriaceus</i> Porat, 1870	INT	94
Arthropoda	Insecta	Archaeognatha	<i>Dilta saxicola</i> (Womersley, 1930)	NAT	4
Arthropoda	Insecta	Blattodea	<i>Zetha simonyi</i> (Krauss, 1892)	NAT	71
Arthropoda	Insecta	Coleoptera	<i>Aleochara bipustulata</i> (Linnaeus, 1760)	IND	2
Arthropoda	Insecta	Coleoptera	<i>Anaspis proteus</i> Wollaston, 1854	NAT	1
Arthropoda	Insecta	Coleoptera	<i>Anotylus nitidifrons</i> (Wollaston, 1871)	IND	11
Arthropoda	Insecta	Coleoptera	<i>Atheta aeneicollis</i> (Sharp, 1869)	IND	1
Arthropoda	Insecta	Coleoptera	<i>Brachypeplus maui</i> Gardner & Classey, 1962	INT	2
Arthropoda	Insecta	Coleoptera	<i>Calacalles subcarinatus</i> (Israelson, 1984)	END	3
Arthropoda	Insecta	Coleoptera	<i>Catops coracinus</i> Kellner, 1846	NAT	4
Arthropoda	Insecta	Coleoptera	<i>Cercyon haemorrhoidalis</i> (Fabricius, 1775)	INT	2
Arthropoda	Insecta	Coleoptera	<i>Coccotrypes carpophagus</i> (Hornung, 1842)	INT	1

Phylum	Class	Order	Species	C.S.	N
Arthropoda	Insecta	Coleoptera	<i>Cryptamorpha desjardinsii</i> (Guérin-Méneville, 1844)	INT	2
Arthropoda	Insecta	Coleoptera	<i>Dryops algericus</i> (Lucas, 1846)	NAT	1
Arthropoda	Insecta	Coleoptera	<i>Epitrix hirtipennis</i> (Melsheimer, 1847)	INT	1
Arthropoda	Insecta	Coleoptera	<i>Eपुरaea biguttata</i> (Thunberg, 1784)	INT	4
Arthropoda	Insecta	Coleoptera	<i>Longitarsus kutscherai</i> (Rye, 1872)	INT	1
Arthropoda	Insecta	Coleoptera	<i>Ocyus aethiops</i> (Waltl, 1835)	IND	1
Arthropoda	Insecta	Coleoptera	<i>Ocys harpaloides</i> (Audinet-Serville, 1821)	NAT	2
Arthropoda	Insecta	Coleoptera	<i>Phenolia limbata tibialis</i> (Boheman, 1851)	INT	5
Arthropoda	Insecta	Coleoptera	<i>Phloeonomus punctipennis</i> C.G.Thomson, 1867	IND	2
Arthropoda	Insecta	Coleoptera	<i>Popillia japonica</i> Newman, 1838	INT	1
Arthropoda	Insecta	Coleoptera	<i>Pseudophloeophagus tenax borgesii</i> Stüben, 2022	END	31
Arthropoda	Insecta	Coleoptera	<i>Rugilus orbiculatus</i> (Paykull, 1789)	IND	1
Arthropoda	Insecta	Coleoptera	<i>Sericoderus lateralis</i> (Gyllenhal, 1827)	INT	1
Arthropoda	Insecta	Coleoptera	<i>Stelidota geminata</i> (Say, 1825)	INT	935
Arthropoda	Insecta	Coleoptera	<i>Tachyporus nitidulus</i> (Fabricius, 1781)	IND	2
Arthropoda	Insecta	Dermoptera	<i>Forficula auricularia</i> Linnaeus, 1758	INT	3
Arthropoda	Insecta	Hemiptera	<i>Campyloneura virgula</i> (Herrich-Schaeffer, 1835)	NAT	1
Arthropoda	Insecta	Hemiptera	<i>Cinara juniperi</i> (De Geer, 1773)	NAT	7
Arthropoda	Insecta	Hemiptera	<i>Cixius azoterceirae</i> Remane & Asche, 1979	END	23
Arthropoda	Insecta	Hemiptera	<i>Cyphopterum adscendens</i> (Herrich-Schäffer, 1835)	NAT	2
Arthropoda	Insecta	Hemiptera	<i>Kleidocerys ericae</i> (Horváth, 1909)	NAT	9
Arthropoda	Insecta	Hemiptera	<i>Megamelodes quadrimaculatus</i> (Signoret, 1865)	NAT	1
Arthropoda	Insecta	Hemiptera	<i>Piezodorus lituratus</i> (Fabricius, 1794)	NAT	6
Arthropoda	Insecta	Hemiptera	<i>Pinalitus oromii</i> J. Ribes, 1992	END	1
Arthropoda	Insecta	Hemiptera	<i>Saldula palustris</i> (Douglas, 1874)	NAT	1
Arthropoda	Insecta	Hemiptera	<i>Siphanta acuta</i> (Walker, 1851)	INT	3
Arthropoda	Insecta	Hemiptera	<i>Strophingia harteni</i> Hodkinson, 1981	END	1
Arthropoda	Insecta	Hemiptera	<i>Trioza laurissilvae</i> Hodkinson, 1990	NAT	9
Arthropoda	Insecta	Hymenoptera	<i>Bombus terrestris</i> (Linnaeus, 1758)	NAT	2
Arthropoda	Insecta	Hymenoptera	<i>Lasius grandis</i> Forel, 1909	NAT	263

Phylum	Class	Order	Species	C.S.	N
Arthropoda	Insecta	Hymenoptera	<i>Tetramorium caldarium</i> (Roger, 1857)	INT	7
Arthropoda	Insecta	Lepidoptera	<i>Argyresthia atlanticella</i> Rebel, 1940	END	26
Arthropoda	Insecta	Lepidoptera	<i>Ascotis fortunata azorica</i> Pinker, 1971	END	4
Arthropoda	Insecta	Lepidoptera	<i>Autographa gamma</i> (Linnaeus, 1758)	NAT	1
Arthropoda	Insecta	Lepidoptera	<i>Cyclophora azorensis</i> (Prout, 1920)	END	20
Arthropoda	Insecta	Lepidoptera	<i>Scoparia coecimaculalis</i> Warren, 1905	END	1
Arthropoda	Insecta	Neuroptera	<i>Hemerobius azoricus</i> Tjeder, 1948	END	1
Arthropoda	Insecta	Phasmida	<i>Carausius morosus</i> (Sinéty, 1901)	INT	1
Arthropoda	Insecta	Psocodea	<i>Atlantopsocus adustus</i> (Hagen, 1865)	NAT	5
Arthropoda	Insecta	Psocodea	<i>Ectopsocus briggsi</i> McLachlan, 1899	INT	17
Arthropoda	Insecta	Psocodea	<i>Ectopsocus strauchii</i> Enderlein, 1906	NAT	6
Arthropoda	Insecta	Psocodea	<i>Elipsocus azoricus</i> Meinander, 1975	END	1
Arthropoda	Insecta	Psocodea	<i>Elipsocus brincki</i> Badonnel, 1963	END	1
Arthropoda	Insecta	Psocodea	<i>Trichopsocus clarus</i> (Banks, 1908)	NAT	1
Arthropoda	Insecta	Psocodea	<i>Valenzuela flavidus</i> (Stephens, 1836)	NAT	1
Arthropoda	Insecta	Thysanoptera	<i>Heliothrips haemorrhoidalis</i> (Bouché, 1833)	INT	5

In relation to Chordata, avian species totalled 12 indigenous and one introduced bird, indicating an increase in the overall taxa count for the area (Table 4 and Suppl. material 4). The most abundant bird species were the endemic Passeriformes *Turdus merula azorensis* Hartert, E, 1905 (n = 134) and *Fringilla coelebs moreletti* Pucheran, 1859 (n = 128). Finally, the mammalian species included eight introduced species, marking new records for Matela, the most abundant being *Rattus rattus* (Linnaeus, 1758) (n = 223) and one endemic species, the Azorean endemic bat *Nyctalus azoreum* (n = 3).

Table 4.

Inventory of birds and mammals collected in 2022 on the Protected Area for the Management of Habitats or Species of Matela, (Natural Park of Terceira Island, Azores), including taxonomical information (Kingdom, Phylum, Class, Order and Species names), colonisation status (C.S.) (END - endemic from Azores; NAT - native non-endemic; INT - introduced species; IND - indeterminate origin) and overall abundance data (N).

Phylum	Class	Order	Species	C.S.	N
Chordata	Aves	Accipitriformes	<i>Buteo buteo rothschildi</i> Swann, 1919	END	6
Chordata	Aves	Charadriiformes	<i>Larus michahellis atlantis</i> Dwight, 1922	END	4
Chordata	Aves	Columbiformes	<i>Columba palumbus azorica</i> Hartert, E, 1905	END	92

Phylum	Class	Order	Species	C.S.	N
Chordata	Aves	Passeriformes	<i>Erithacus rubecula</i> (Linnaeus, 1758)	NAT	17
Chordata	Aves	Passeriformes	<i>Fringilla coelebs moreletti</i> Pucheran, 1859	END	128
Chordata	Aves	Passeriformes	<i>Motacilla cinerea patriciae</i> Vaurie, 1957	END	24
Chordata	Aves	Passeriformes	<i>Oenanthe oenanthe leucorhoa</i> (Gmelin, JF, 1789)	NAT	19
Chordata	Aves	Passeriformes	<i>Passer domesticus</i> (Linnaeus, 1758)	INT	16
Chordata	Aves	Passeriformes	<i>Regulus regulus inermis</i> Murphy & Chapin, 1929	END	6
Chordata	Aves	Passeriformes	<i>Serinus canaria</i> (Linnaeus, 1758)	NAT	13
Chordata	Aves	Passeriformes	<i>Sturnus vulgaris granti</i> Hartert, E, 1903	END	12
Chordata	Aves	Passeriformes	<i>Sylvia atricapilla gularis</i> Alexander, 1898	END	14
Chordata	Aves	Passeriformes	<i>Turdus merula azorensis</i> Hartert, E, 1905	END	134
Chordata	Mammalia	Artiodactyla	<i>Bos taurus</i> Linnaeus, 1758	INT	2
Chordata	Mammalia	Carnivora	<i>Canis lupus familiaris</i> (Linnaeus, 1758)	INT	4
Chordata	Mammalia	Carnivora	<i>Felis catus</i> (Linnaeus, 1758)	INT	1
Chordata	Mammalia	Carnivora	<i>Mustela furo</i> Linnaeus, 1758	INT	3
Chordata	Mammalia	Carnivora	<i>Mustela nivalis</i> Linnaeus, 1766	INT	15
Chordata	Mammalia	Chiroptera	<i>Nyctalus azoreum</i> (Thomas, 1901)	END	3
Chordata	Mammalia	Lagomorpha	<i>Oryctolagus cuniculus</i> (Linnaeus, 1758)	INT	6
Chordata	Mammalia	Rodentia	<i>Mus musculus</i> Linnaeus, 1758	INT	32
Chordata	Mammalia	Rodentia	<i>Rattus rattus</i> (Linnaeus, 1758)	INT	223

Despite Matela harbouring numerous native and endemic species, thereby maintaining a highly notable natural heritage, it has recently fallen object to the invasion of introduced exotic species, some of them also invasive. Of high concern is the spread of *Pittosporum undulatum* Vent. (n = 54), *Rubus ulmifolius* Schott (n = 49) and *Hedychium gardnerianum* Sheppard ex Ker-Gawl.

The number of recorded species has substantially increased across almost all groups for which historical data allow comparisons. However, we were not able to confirm the presence of some epigeal endemic arthropods that were sampled in 2002, namely three spider species (*Canariphantes açorensis* (Wunderlich, 1992); *Lasaeola oceanica* Simon, 1883; *Pardosa açorensis* Simon, 1883) and several beetle species, namely *Athous azoricus* Platia & Gudenzi, 2002; *Atlantocis gillerforsi* Israelson, 1986; *Drouetius borgesii* Machado, 2009; and *Pseudechinosa nodosum* Hustache, 1936.

The genuine impact of the exotic potentially invasive species on native communities remains not fully clarified; nevertheless, the imperative to address this pressing issue for

nature conservation in the Azores is unequivocal. Within the project “Matela – uma ilha de biodiversidade” (“Matela - an island of biodiversity”), we aim to contribute to the restoration of this important fragment of native forest and we will maintain the monitoring of the several taxonomic groups during the next years using the same protocols.

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Author contributions

MAS: Research (field and laboratory work); Data Curation; Darwin Core dataset preparation; Formal analysis and interpretation; Manuscript writing.

LLL: Darwin Core dataset preparation; Manuscript writing.

RBE: Conceptualisation; Methodology; Research (fieldwork).

RG: Conceptualisation; Methodology; Research (field and laboratory work); Resources.

PAVB: Conceptualisation; Methodology; Research (field and laboratory work); Resources; Darwin Core dataset revision, GBIF IPT management.

All the authors participated in data interpretation and manuscript revision.

References

- Bellard C, Cassey P, Blackburn T (2016) Alien species as a driver of recent extinctions. *Biology Letters* 12 (2). <https://doi.org/10.1098/rsbl.2015.0623>
- Bellard C, Marino C, Courchamp F (2022) Ranking threats to biodiversity and why it doesn't matter. *Nature Communications* 13 (1). <https://doi.org/10.1038/s41467-022-30339-y>
- Borges PAV, Aguiar C, Amaral J, Amorim IR, André G, Arraiol A, Baz A, Dinis F, Enghoff H, Gaspar C, Ilharco F, Mahnert V, Melo C, Pereira F, Quartau JA, Ribeiro SP, Ribes J, Serrano AR, Sousa AB, Strassen RZ, Vieira L, Vieira V, Vitorino A, Wunderlich J (2005) Ranking protected areas in the Azores using standardised sampling of soil epigeal arthropods. *Biodiversity and Conservation* 14 (9): 2029-2060. <https://doi.org/10.1007/s10531-004-4283-y>
- Borges PAV, Lobo J, de Azevedo E, Gaspar C, Melo C, Nunes L (2006) Invasibility and species richness of island endemic arthropods: a general model of endemic vs. exotic

- species. *Journal of Biogeography* 33 (1): 169-187. <https://doi.org/10.1111/j.1365-2699.2005.01324.x>
- Borges PAV, Cardoso P, Kreft H, Whittaker R, Fattorini S, Emerson B, Gil A, Gillespie R, Matthews T, Santos AC, Steinbauer M, Thébaud C, Ah-Peng C, Amorim I, Aranda SC, Arroz AM, Azevedo J, Boieiro M, Borda-de-Água L, Carvalho JC, Elias R, Fernández-Palacios JM, Florencio M, González-Mancebo J, Heaney L, Hortal J, Kueffer C, Lequette B, Martín-Esquivel JL, López H, Lamelas-López L, Marcelino J, Nunes R, Oromí P, Patiño J, Pérez A, Rego C, Ribeiro S, Rigal F, Rodrigues P, Rominger A, Santos-Reis M, Schaefer H, Sérgio C, Serrano AM, Sim-Sim M, Stephenson PJ, Soares A, Strasberg D, Vanderporten A, Vieira V, Gabriel R (2018) Global Island Monitoring Scheme (GIMS): a proposal for the long-term coordinated survey and monitoring of native island forest biota. *Biodiversity and Conservation* 27 (10): 2567-2586. <https://doi.org/10.1007/s10531-018-1553-7>
 - Borges PAV, Lamelas-Lopez L, Stüben P, Ros-Prieto A, Gabriel R, Boieiro M, Tsafack N, Ferreira MT (2022a) SLAM Project - Long Term Ecological Study of the Impacts of Climate Change in the Natural Forest of Azores: II - A survey of exotic arthropods in disturbed forest habitats. *Biodiversity Data Journal* 10: e81410. <https://doi.org/10.3897/bdj.10.e81410>
 - Borges PAV, Lamelas-Lopez L, Andrade R, Lhoumeau S, Vieira V, Soares AO, Borges I, Boieiro M, Cardoso P, Crespo LC, Karsholt O, Schülke M, Serrano ARM, Quartau JA, Assing V (2022b) An updated checklist of Azorean arthropods (Arthropoda). *Biodiversity Data Journal* 10: e97682. <https://doi.org/10.3897/bdj.10.e97682>
 - Elias R, Gil A, Silva L, Fernández-Palacios J, Azevedo E, Reis F (2016) Natural zonal vegetation of the Azores Islands: characterization and potential distribution. *Phytocoenologia* 46 (2): 107-123. <https://doi.org/10.1127/phyto/2016/0132>
 - European-Commission (2021) Directorate-General for Environment, EU biodiversity strategy for 2030 - Bringing nature back into our lives. Publications Office of the European Union URL: <https://data.europa.eu/doi/10.2779/677548>
 - Ferreira MT, Cardoso P, Borges PAV, Gabriel R, de Azevedo EB, Reis F, Araújo M, Elias RB (2016) Effects of climate change on the distribution of indigenous species in oceanic islands (Azores). *Climatic Change* 138: 603-615. <https://doi.org/10.1007/s10584-016-1754-6>
 - Ferreira MT, Cardoso P, Borges PAV, Gabriel R, de Azevedo EB, Elias RB (2019) Implications of climate change to the design of protected areas: The case study of small islands (Azores). *PLOS One* 14 (6): e0218168. <https://doi.org/10.1371/journal.pone.0218168>
 - Gabriel R (1994) Briófitos da Ilha Terceira (Açores) - Ecologia, distribuição e vulnerabilidade de espécies seleccionadas. APCC – Provas de Aptidão Pedagógica e Capacidade Científica. Departamento de Ciências Agrárias. Universidade dos Açores. Angra do Heroísmo.
 - Gabriel R, Bates JW (2005) Bryophyte community composition and habitat specificity in the natural forests of Terceira, Azores. *Plant Ecology* 177: 125-144. <https://doi.org/10.1007/s11258-005-2243-6>
 - Gaston K, Jackson S, Cantú-Salazar L, Cruz-Piñón G (2008) The ecological performance of protected areas. *Annual Review of Ecology, Evolution, and Systematics* 39 (1): 93-113. <https://doi.org/10.1146/annurev.ecolsys.39.110707.173529>

- González Mancebo J, Sim-Sim M, Gabriel R, Hodgetts N, Martins A (2019) *Cololejeunea sintensis* (Europe assessment). The IUCN Red List of Threatened Species 2019: e.T88150678A88382508. <https://www.iucnredlist.org/species/88150678/88382508>. Accessed on: 2024-3-19.
- Hanski I (2016) Messages from islands: a global biodiversity tour. University of Chicago Press, Chicago, 272 pp. <https://doi.org/10.7208/chicago/9780226406589.001.0001>
- Hortal J, Borges PAV, Jiménez-Valverde A, de Azevedo E, Silva L (2010) Assessing the areas under risk of invasion within islands through potential distribution modelling: The case of *Pittosporum undulatum* in São Miguel, Azores. *Journal for Nature Conservation* 18 (4): 247-257. <https://doi.org/10.1016/j.jnc.2009.11.002>
- Lloret F, González-Mancebo JM (2011) Altitudinal distribution patterns of bryophytes in the Canary Islands and vulnerability to climate change. *Flora - Morphology, Distribution, Functional Ecology of Plants* 206 (9): 769-781. <https://doi.org/10.1016/j.flora.2011.04.007>
- Lourenço P, Medeiros V, Gil A, Silva L (2011) Distribution, habitat and biomass of *Pittosporum undulatum*, the most important woody plant invader in the Azores Archipelago. *Forest Ecology and Management* 262 (2): 178-187. <https://doi.org/10.1016/j.foreco.2011.03.021>
- Mulongoy K, Chape S (2004) Protected areas and biodiversity: an overview of key issues. IUCN, Cambridge, UK, 52 pp. [ISBN 92-807-2404-5]
- Patiño J, Mateo R, Zanatta F, Marquet A, Aranda S, Borges P,V, Dirkse G, Gabriel R, Gonzalez-Mancebo J, Guisan A, Muñoz J, Sim-Sim M, Vanderpoorten A (2016) Climate threat on the Macaronesian endemic bryophyte flora. *Scientific Reports* 6 (1). <https://doi.org/10.1038/srep29156>
- Pozsgai G, Lhoumeau S, Amorim IR, Boieiro M, Cardoso P, Ferreira MT, Leite A, Malumbres-Olarte J, Oyarzabal G, Rigal F, Ros-Prieto A, Santos AMC, Gabriel R, Borges PAV (2024) Long-term monitoring of Azorean forest arthropods: the BALA Project (1997-2022). Version 1.0. Universidade dos Açores. Samplingevent dataset. http://ipt.gbif.pt/ipt/resource?r=bala_arthropods&v=1.0. Accessed on: 2024-2-07.
- Regional-Directorate-for-the-Environment (2020) Conservação da Natureza e Biodiversidade – Áreas classificadas. Região Autónoma dos Açores. URL: <https://rea.azores.gov.pt/reaa/11/conservacao-da-natureza-e-biodiversidade/734/areas-classificadas>
- Silva L, Brito de Azevedo E, Elias R, Silva L (2017) Species distribution modeling: comparison of fixed and mixed effects models using INLA. *ISPRS International Journal of Geo-Information* 6 (12). <https://doi.org/10.3390/ijgi6120391>
- Simberloff D, Martin J, Genovesi P, Maris V, Wardle D, Aronson J, Courchamp F, Galil B, García-Berthou E, Pascal M, Pyšek P, Sousa R, Tabacchi E, Vilà M (2013) Impacts of biological invasions: what's what and the way forward. *Trends in Ecology & Evolution* 28 (1): 58-66. <https://doi.org/10.1016/j.tree.2012.07.013>
- Sousa M, Lamelas-López L, Martins BS, Romão J, Roxo J, Elias RB, Gabriel R, Borges PAV (2024) Biodiversity inventory of the Protected Area for the Management of Habitats or Species of Matela (Terceira, Azores, Portugal). Version 1.5. Universidade dos Açores. Samplingevent dataset. <https://doi.org/10.15468/qbj3rd>. Accessed on: 2024-3-19.
- Vergílio MH, Fonseca C, Calado H, Borges PAV, Elias RB, Gabriel R, Martins A, Azevedo EB, Cardoso P (2016) Avaliar a eficiência das áreas protegidas para

representar a biodiversidade: o caso de estudo de uma pequena ilha. Açoriano Oriental 26-27. URL: <http://hdl.handle.net/10400.3/5573>

- Wilson EO (2016) Half-earth: our planet's fight for life. WW Norton & Company

Supplementary materials

Suppl. material 1: List of bryophytes historically documented in Matela (Bryophyta, Marchantiophyta and Anthocerotophyta) [doi](#)

Authors: Mariana Sousa & Rosalina Gabriel

Data type: Occurrences

Brief description: Detailed list of bryophytes found in Matela, based on a revision of historical literature, including grey literature.

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Suppl. material 2: List of Vascular Plants historically recorded in Matela (Lycopodiophyta, Pteridophyta, Pinophyta and Magnoliophyta) [doi](#)

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Data type: Occurrences

Brief description: Detailed list of vascular plants found in Matela, based on a revision of historical literature, including grey literature.

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Suppl. material 3: List of arthropods historically documented in Matela (Arthropoda) [doi](#)

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Suppl. material 4: List of vertebrates historically documented in Matela [doi](#)

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Suppl. material 5: List of historical literature sources mentioning Matela [doi](#)

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Data type: Literature list

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