

Tuvalu Baseline Desktop Invasive Species and Biodiversity Study

In support of “Strengthening national and regional capacities to reduce the impact of Invasive Alien Species on globally significant biodiversity in the Pacific”

Shyama Pagad
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Tuvalu Baseline Desktop Invasive Species and Biodiversity Study

Tuvalu is the fourth smallest nation in the world with a population of 11,000. Tuvalu is made up of nine inhabited islands, five of which are coral atolls and four made of land rising from the seabed.

The environmental challenges Tuvalu faces include the impacts of a changing climate-increasing sea level rises and weather events, increasing salination. Dependence on rainwater as there are no rivers or streams and limited natural resources. The average elevation is 1.83m above sea level.

Shortage of skilled workers, high unemployment, infrastructure challenges, and high population density in urban areas constrains economic development¹.

Tuvalu is a participant country in the Global Environment Facility funded project "Strengthening National and Regional Capacities to Reduce the Impact of Invasive Alien Species on Globally Significant Biodiversity in the Pacific" which aims to reduce the threats from Invasive Alien Species to terrestrial, freshwater and marine biodiversity in the Pacific by developing and implementing comprehensive national and regional invasive species management frameworks.

The report below is the result of a comprehensive study compiling invasive alien species and biodiversity related information of Tuvalu, that will support the development of a National Invasive Alien Species Strategy and Action Plan (NISSAP)

The report is divided into sections

Section 1 briefly describes Tuvalu's national and global commitments to conservation of biodiversity and the management of invasive alien species.

Section 2 is a synthesis of data and information on the areas of biodiversity significance and protected areas of Tuvalu including any invasive alien species threats and pressures

Section 3 is a synthesis of data and information on the endemic and threatened species of Tuvalu including existing invasive alien species threats

Section 4 is a synthesis of data and information on the alien and known invasive species of Tuvalu, pathways of their introduction and spread, results of a horizon scanning exercise of potential invasive alien species that could be introduced to Tuvalu, and on-going and planned management action related to the management of biological invasions in Tuvalu.

¹ New Zealand Foreign Affairs and Trade
<https://www.mfat.govt.nz/en/countries-and-regions/pacific/tuvalu/>

Section 1A: Tuvalu's Multilateral Environmental Agreement commitments to the conservation of biodiversity and the management of invasive alien species

Tuvalu is signatory to several key Multilateral Environment Agreements including the Convention on Biological Diversity (CBD), the Convention on International Trade of Wild Fauna and Flora (CITES), Ramsar Convention on Wetlands, and others. See Table 1 for the list of MEAs that Tuvalu has ratified.

Several of the key conventions reference the issue of alien and invasive alien species, thus facilitating member states to implement action to prevent and manage the threat of invasive alien species.

Table 1: Tuvalu - Multilateral Environmental Agreements

Multilateral Environmental Agreement	Ratified
Convention on Biological Diversity (CBD)	√
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their utilization (Nagoya Protocol)	√
United Nations Convention on the Law of the Sea (UNCLOS)	√
United Nations Framework Convention on Climate Change (UNFCCC)	√
International Maritime Organisation (IMO)	√
International Maritime Organisation (IMO) Convention on Ballast Water Management (BWM)	√
International Civil Aviation Organisation (ICAO)	√

Source: (InforMEA, 2019)

Section 1B: Tuvalu's Environment legislation related to the conservation of biodiversity and the introduction of alien and invasive species

A brief overview of the environmental legislation in force in Tuvalu (Secretariat of the Pacific Regional Environment Programme (SPREP) and EDO NSW, 2018), was published in 2018.

Below is an extraction of legislation related to the conservation of biodiversity and biosecurity and quarantine measures to the prevention of the introduction, spread and impacts of alien and potentially invasive species in Tuvalu. Please refer the publication for more details

Environment Protection Act 2008

This Act passed in 2008 is the most comprehensive law that makes express provision concerning the responsibility for managing the environment. Some of the areas that the Act regulates are:

- the conduct of environment impact assessments;
- the regulation and control of pollution and wastes;
- all matters concerning the implementation of international environment related conventions;
- the protection of the biodiversity; and
- responses to climate change.

Quarantine Act 1929

The objective of this Act is to make comprehensive provisions in relation to quarantining vessels, persons and goods through the effective imposition of quarantine arrangements and requirements.

Plants Act 1977

The purpose of this Act is to provide for the protection of plants within Tuvalu through conferring powers on quarantine officers and imposing restrictions on the importation of plants to prevent the introduction and spread of plant diseases. For the purpose of protecting agriculture and livestock against the introduction of pests and plant diseases from outside Tuvalu, the Minister may, by order, prohibit the importation or introduction of any plants, whether generally or over specified places or species, and prohibit absolutely or subject to specified conditions or restrictions.

Regulations created under the Act cover shipping, prevention of disease and pests, quarantine disembarkation cards and spraying of aircrafts.

Importation of Animals Act 1919

The objective of this Act is to regulate the importation of animals into Tuvalu. Under this Act the Minister may make regulations in respect of a matters listed in regulation 3, such as:

- prescribing the ports and parts of ports at which imported animals may be landed;
- defining parts of ports;
- prohibiting or regulating the movement of imported animals into, in or out of a defined part of a port;
- prohibiting or regulating the landing of imported animals, or of any specified kind thereof, or of carcasses, fodder, litter, dung or other thing brought from any specified country or from any specified part thereof;
- prescribing and regulating the inspection and the examination and the mode, time and conditions of slaughter of imported animals in a defined part of a port; and
- prescribing and regulating the seizure, detention, quarantine, isolation or destruction of any imported animal, carcase, fodder, litter or dung.

Biosecurity Bill (Model Law) 2004

Draft legislation has been developed in Tuvalu in order to pursue biosecurity. Its objective is to protect the health, environment and agriculture of Tuvalu and to facilitate trade in its animal and plant products.

The draft law seeks to make comprehensive provision for biosecurity related issues and processes, and to harmonise these in the region.

The purposes of the law are to control the introduction and spread of new pests and diseases affecting plants and animals, control those pests that are already present in Tuvalu, provide for the safe import and export of animals and animal products and plants and plant

products, and facilitate cooperation in the prevention of the international movement of pests and diseases affecting plants and animals. However, the Bill does not require application of the **precautionary principle**².

Biosecurity Act 2017 (Act 24 of 2017)

The purposes of Biosecurity Act 2017 as stated in the document are –

(a) to protect Tuvalu against the entry of regulated pests and diseases affecting animals, plants, human beings and the environment;

(b) to carry out surveillance and monitoring of pests and diseases in Tuvalu and assess the status of regulated pests and diseases;

(c) to prevent the establishment and spread of regulated pests and diseases and the release of organisms that might adversely affect animals, plants, human beings and the environment in Tuvalu;

(d) to eradicate, contain or control the movement of regulated pests and diseases that are already present in Tuvalu;

(e) to prevent the introduction and spread of regulated pests and diseases not already present in Tuvalu;

(f) to facilitate the safe importation of animals and plants and their products, and related equipment and technology;

(g) to facilitate the export of animals and plants and their products in accordance with the biosecurity requirements of the receiving countries;

(h) to facilitate international cooperation to prevent the spread of pests and diseases affecting plants, animals, human beings and the environment.

National Ballast Water Management Strategy 2016-2020

Tuvalu is a signatory to the International Maritime Organisation (IMO) Convention on Ballast Water Management (BWM) (see Table 1). The National Ballast Water Management Strategy 2016-2020 was developed in 2015, in accordance with the GloBallast Guidelines³. The strategy also applies the requirements of Article 2(5) of the BWM "Parties undertake to encourage the continued development of Ballast Water Management and standards to prevent, minimize and ultimately eliminate the transfer of Harmful Aquatic Organisms and Pathogens through the control and management of ships' Ballast Water and Sediments" of the Ballast Water Management Convention.

² **Precautionary Approach to Species Introduction**- Because of the high probability that impacts of species introduction be of irreversible and unpredictable impacts, many species introductions are not precautionary. Therefore, a strictly precautionary approach would not permit deliberate introductions and would take strong measures to prevent unintentional introductions.

³ Tamelander J., Riddering L., Haag F., Matheickal J., 2010. Guidelines for Development of National Ballast Water Management Strategies. GEF-UNDP-IMO GloBallast, London, UK and IUCN, Gland, Switzerland. GloBallast Monographs <https://www.sprep.org/att/IRC/eCOPIES/Global/382.pdf>

Section 2: Areas of biodiversity significance and protected areas of Tuvalu

Tuvalu has nationally designated six Marine Protected areas: including five designated areas- two Conservation areas, two Marine managed areas, and a Fisheries reserve); and one proposed Conservation Area.

Table 2 below includes details related to these protected areas extracted from the World Database of Protected Areas (Protected Planet, 2019)

Table 2: Tuvalu- list of protected areas

Name	Original Name	Designation	Designation Status	Biome
Funafuti	Kogaa koga puipuigina o Funafuti	Conservation Area	Designated	Marine
Nukufetau	Koga tapu	Marine Managed Area	Designated	Marine
Nukulaelae	Koga koga sai ote fenua	Fisheries Reserve	Designated	Marine
Momea Tapu	Koga Tapu o Nanumea	Marine Managed Area	Designated	Marine
Nui	Terikiai	Conservation Area	Designated	Marine
Vaitupu	Koga tausi ote fenua	Conservation Area	Proposed	Coastal- Marine and Terrestrial

Source: (Protected Planet, 2019)

The Tuvalu Marine Life Project Report (CRISP, 2009) provides detailed documentation on Tuvalu's marine biodiversity. However, there is no mention of marine introduced species.

The two well known invasive species threats documented for the marine areas of Tuvalu include the occurrence of algal blooms and the occurrence of the Cryptogenic Crown-of-Thorns starfish COTs (*Acanthaster planci*).

Algal blooms have been recorded on the main atoll of Funafuti since 2011. A survey conducted in 2013 confirmed the presence of 19 species of macroalgae with the dominant one being the brown alga *Sargassum polycystum*. Nutrient levels of the water in the area of the blooms was found to be high (N'Yeurt. & Iese, 2015).

Section 3: Endemic and Threatened Species of Tuvalu

The IUCN Red List of Threatened Species was consulted to compile a database of native and endemic species of Tuvalu across all taxa that have been globally conservation assessed based on the IUC Red List standards. 1360 species have been listed for Tuvalu. **See Annexure 1 for the annotated dataset**

Taxonomic and Environment system breakdown

Of the 1360 species list for Tuvalu, 1342 species belong to Kingdom Animalia and 18 to Kingdom Plantae.

The environment/system in which these species occur include 2 species in Freshwater systems; 7 species in Freshwater | Marine systems; 1276 species in Marine systems; 16 species in Terrestrial systems; 12 species in Terrestrial | Freshwater systems and 47 in Terrestrial | Marine systems.

Of the **1342** species that belong to Kingdom Animalia

4 species are Arthropods (1 in the Terrestrial | Marine system and 3 in Marine systems);

862 species are Chordates (771 Actinopterygii (Ray-finned fish), 49 Aves (Bird), 14 Chondrichthyes (cartilaginous fishes), 22 Mammals all except one in the Marine system, 7 Reptiles (3 in the Terrestrial | Marine system, 3 in the Terrestrial system and 1 in the Marine system);

355 species belong to Cnidaria (353 Anthozoans and 2 Hydrozoans) all in the Marine system.

36 species are Echinoderms belonging to Holothuroidea (Sea cucumbers) all in the Marine system

85 species are Molluscs including 2 in the Terrestrial system, 1 in the Freshwater system and 82 in the Marine system

Of the **18 species** belonging to Kingdom Plantae are Tracheophytes, 8 species occur in the Terrestrial system, 5 species in the Terrestrial | Freshwater system, 4 species Terrestrial | Marine system and 1 species in the Freshwater system.

IUCN Red List category

Table 3 below provides a breakdown of the IUCN Red List categories of the 1360 species listed for Tuvalu

Critically Endangered (CR)- only 1 species is assessed as CR, this is the globally threatened Beck's Petrel (*Pseudobulweria becki*). Predation of eggs and juveniles by introduced mammals such as feral cats (*Felis catus*), Rats (*Rattus* spp.); habitat degradation by rooting Pigs (*Sus scrofa*) are an on-going threat to the survival of this species. **These impacts have been recorded in New Ireland (Papua New Guinea) but not in Tuvalu.**

Endangered (EN) -13 species have been assessed as EN. Including one marine mammal, 2 species of Ray-finned fish, 2 species of Aves (Bird), 2 species of Reptiles, 3 species of Cartilaginous fishes, 4 species of Echinoderms (Sea cucumbers).

Invasive alien species have been recorded as a major threat to the two birds, **however these impacts have not been recorded in Tuvalu**. Mammal predators including *Rattus* spp. Feral cats, Feral dogs; Pigs causing habitat degradation and Yellow crazy ants (*Anoplolepis gracilipes*) potentially causing nest abandonment in the case of the Phoenix petrel (*Pterodroma alba*). Yellow crazy ants have also been identified as a cause of decline in populations of the Micronesian skink (*Emoia adspersa*), **however these impacts have been recorded in Samoa and in Tuvalu**

Vulnerable (VU)- 97 species have been assessed as VU, 10 species in the Terrestrial | Marine system and the remaining 77 species in the Marine system. The 97 species include one marine mammal, one Reptile in the Terrestrial | Marine system, 8 Ray-finned fish, 2 marine molluscs, 3 Cartilaginous fishes and 3 Echinoderms (Sea Cucumbers), 9 birds that occur in the Terrestrial | Marine system and 70 species of Cnidaria (all Anthozoans).

Invasive alien species have been recorded as a major threat to the listed 9 bird species including predation by introduced mammals (Rats, Cats etc.) and habitat degradation by Pigs). **These impacts have not been recorded in Tuvalu but in other areas of their range.**

Near Threatened (NT)- 122 species have been assessed as NT, one species in the Terrestrial system, one in the Terrestrial | Freshwater system, 4 in the Terrestrial | Marine system and 116 species in the Marine system. The VU listed species include 102 species of Cnidaria, 5 species of Cartilaginous fishes, 5 species of Aves (Bird), 5 species of Ray-finned fish, 4 species of molluscs (1 terrestrial and 3 marine), and one marine mammal.

Invasive alien species threats have been recorded for 3 species of Aves (Bird) including predation and habitat degradation by introduced mammals. The Terrestrial Mollusc *Omphalotropis zelriolata*, a ground-dwelling detritivore, recorded from lowland forests is impacted by several invasive alien species in its native Pacific range, **while Tuvalu is not specifically identified as one of these areas it is possible that similar impacts may be displayed**. Invasive alien species threats include the Giant African snail (*Lissachatina fulica*), Rosy Wolf Snail (*Euglandina rosea*), the Flatworm (*Platydemus manokwari*), introduced Tramp ants ((Forest Parrot Ant (*Paratrechina vaga*), Crazy Ant (*Paratrechina longicornis*), Ghost Ant (*Tapinoma melanocephalum*), Pennant Ant (*Tetramorium bicarinatum*), Yellow Crazy Ant (*Anoplolepis gracilipes*) and Little Fire Ant (*Wasmannia auropunctata*)); predation by introduced mammals (Pacific rat (*Rattus exulans*), Black rat (*Rattus rattus*)), habitat degradation by introduced Pigs, ungulates such as Goats (*Capra hircus*), Equines (*Equus caballus*), Cattle (*Bos taurus*) and the wild fowl (*Gallus gallus*).

Table 3: Tuvalu conservation assessed native and endemic species- Red List category

Red List category	Description	Species #
Critically Endangered (CR)	Critically Endangered (CR), a category containing those species that possess an extremely high risk of extinction as a result of rapid population declines of 80 to more than 90 percent over the previous 10 years (or three generations), a current population size of fewer than 50 individuals, or other factors	1
Endangered (EN)	Endangered (EN), a designation applied to species that possess a very high risk of extinction as a result of rapid population declines of 50 to more than 70 percent over the previous 10 years (or three generations), a current population size of fewer than 250 individuals, or other factors	13
Vulnerable (VU)	Vulnerable (VU), a category containing those species that possess a very high risk of extinction as a result of rapid population declines of 30 to more than 50 percent over the previous 10 years (or three generations), a current population size of fewer than 1,000 individuals, or other factors	97
Near Threatened (NT)	Near Threatened (NT), a designation applied to species that are close to becoming threatened or may meet the criteria for threatened status in the near future	122
Least Concern (LC)	Least Concern (LC), a category containing species that are <u>pervasive</u> and abundant after careful assessment	1075
Data Deficient (DD)	Data Deficient (DD), a condition applied to species in which the amount of available data related to its risk of extinction is lacking in some way. Consequently, a complete assessment cannot be performed. Thus, unlike the other categories in this list, this category does not describe the conservation status of a species	52

Source (IUCN, 2019)

Section 4: Alien and Invasive Species of Tuvalu

Databases, books, scientific literature and reports were consulted to develop a checklist of alien and invasive species in Tuvalu (see **Annexure 2 for Annotated dataset**).

A most recent key source for data and information on alien and invasive species of plants was the article in the Atoll Bulletin 2017 (Thaman, 2016). A summary from the publication states "*The resultant total number of terrestrial vascular plants reported present at some time in Tuvalu is about 362 species or distinct varieties, of which only about 59 (16%) are possibly indigenous. The remaining 303 species (84% of the flora) are non-indigenous species that have been introduced by humans, some of which (about 12 or more) may have been at one time or another early aboriginal introductions by Pacific Islanders into some of the atolls of Tuvalu. The total recorded flora of Funafuti is about 356, with 7 additional indigenous species having been reported from the other atolls*".

The journal article was consulted, and all relevant data and information was extracted to an Excel file (**See Worksheet Thaman-2016 in Annexure 2**). Of the 290+ alien species recorded in Thaman 2016, only 79 species described as 'weed' species growing in the wild with some aspect of spread described were included in the Tuvalu checklist- Annexure 2. Over 200 species a majority of which have been intentionally introduced into Tuvalu for ornamental purposes, landscaping, as a food resource. Additional plant species have also been recorded from various governmental reports such as the NBSAP etc. and databases.

Of the 79 plant species included in the Tuvalu checklist, 7 plant species have been described as weedy and found in ruderal areas and disturbed sites. Two species *Sphagneticola trilobata* and *Commelina diffusa* are described as invasive and spreading aggressively.

The Hawaii-Pacific Weed Risk Assessment (HPWRA) system (The Hawaii-Pacific Weed Risk Assessment (HPWRA) , 2019) provides information about the invasive potential of plants in Hawaii and other Pacific islands. It is a screening tool to ask "background questions" about a plant before it is imported or widely planted in the Pacific. Weed Risk assessments have been prepared for 44 of the 79 plant species listed in the Tuvalu checklist. 26 species are assessed as 'high risk' (documented to cause significant ecological and economic damage), 11 as 'reject' (species that are highly likely to be a pest and need to be rejected for introduction or spread); 4 species have been listed as 'evaluate' (no assessment of risk can be provided because of missing information and the species possesses a combination of traits and characteristics that make it difficult to be assessed)), 3 as 'low risk' (Not currently recognised as being invasive or likely to have major ecological or economic impacts based on the screening).

21 Animalia are listed as Alien and Invasive Species in the Tuvalu checklist. Of these 11 are Arthropods- 4 species of tramp ants including the well-known invasive species in Tuvalu- yellow crazy ant (*Anoplolepis gracilipes*), two mosquito species (*Aedes aegypti* and *Culex quinquefasciatus*) and five insect pests of Agriculture and other plants - including the Coconut Rhinoceros beetle (*Oryctes rhinoceros*), Coconut scale (*Aspidiotus destructor*), kou leafworm (*Ethmia nigroapicella*). the pink Hibiscus mealybug- *Maconellicoccus hirsutus* and fruitfly (*Bactrocera* sp.). Additionally, 9 are Chordates (one Aves the wild fowl (*Gallus gallus*);

one Amphibian - the cane toad (*Rhinella marina*), one Ray-finned fish - Tilapia (*Oreochromis mossambicus*) and six mammals predators including the three *Rattus* sp. (*Rattus rattus*, *R. exulans*, *R. norvegicus*), the House mouse (*Mus musculus*), Feral pig and cattle (*Sus scrofa* and *Bos taurus*).

The two 'alien' species in the marine biome that cause harm include the Crown of Thorns Starfish (*Acanthaster planci*) and the Algae *Sargassum polycystum*

Pathways of introduction

The predominant pathways of introduction of alien and invasive plant species are intentional introductions for ornamental purposes and for food purposes. In the past decade alien plant seeds have been introduced as soil contaminants – in the movement of soil from Fiji for the purposes of building a sport field/ centre. These introduced species have been documented in areas surrounding the sports site.

Mammal introductions into Tuvalu has taken place when the islands were being colonised.

Insect species including Ants and others have been introduced as hitchhikers in the Nursery trade or in the transport of commodities.

Horizon scanning

The CABI Invasive Species Compendium offers access to use the free version of their Horizon scanning tool (CABI, 2019)- a decision support tool that helps identify and categorise species that may enter a country from another. A preliminary Horizon scanning exercise was carried out for Tuvalu using the following criteria

Area at risk: Tuvalu; Source Countries: Fiji

Pathways: Container or bulk, Containers and packaging -non-wood, Containers and packaging -wood , Debris and waste associated with human activities, Floating vegetation and debris, Hitchhikers in or on plane, Hitchhikers on land vehicles, Hitchhikers on ship or boat , Machinery and equipment, Mail, Mulch, straw, baskets and sod, People and their luggage's/equipment, Ship bilge water, Ship ballast water and sediment, Ship hull fouling, Soil, sand, gravel, Contaminated aquaculture stock, Contaminated bait, Food contaminant, Germplasm , Hides, trophies and feathers, Host and vector organisms, Livestock, Pets and aquarium species, Plants or parts of plants (Including datasheets with no pathways data)

The result was a list of 301 Plants, 170 Invertebrates, 110 Fungi, 28 Vertebrates, 26 Viruses and 15 Bacteria- species that occur in Fiji and could potentially be introduced unintentionally to Tuvalu. No pathways were listed in the final outcome. **The result is available as Annexure 3.**

Section 5- invasive species prevention, management/control related projects undertaken in Tuvalu and on-going initiatives

The major areas of invasive species management action in Tuvalu are focused on the prevention of the spread, and management/ control of existing populations of the Yellow crazy ant and the incursions of the fruit fly.

Yellow crazy ants have severe impacts on populations of both the coconut crab and other land crabs. Yellow crazy ant and fruit fly surveys were carried out in 2014 (Vaqalo, Lonalona, & Panapa, 2014). The surveys were carried out on Fongafale islet (Funafuti atoll), Niulakita Island, and five islets in the Nukulaelae atoll by the Secretariat of the Pacific Community (SPC), through its Biosecurity and Trade Services (BATS) section of the Land Resources Division (LRD), and Tuvalu government. 18 ant species were documented, and presence confirmed on different islands and regions. Yellow crazy ant was confirmed on Fongafale Islet (Funafuti atoll), only some parts of Niulakita Island and some islets of Nukulaelae atoll. Three of the islets in the Nukulaelae atoll were confirmed to be infested. Anecdotal reports from the locals suggested two other islets in the Nukulaelae atoll that were not visited due to time constraint also had Yellow crazy ant infestations. Eradication on selected sites and management/control using Antbait was recommended. A complete report can be read through the following link [Vaqalo et al 2014](#).

Fruit fly surveys, including setting of fruit fly traps was also undertaken. The results obtained from fruit fly trap showed that Fongafale (Funafuti) had the lighter form of *Bactrocera passiflorae*, while Niulakita had *Bactrocera xanthodes*. No fruit flies were found in the traps in the Nukulailai atoll. These fruit fly species have been previously recorded in these localities.

A Management plan for Tuvalu to manage Yellow crazy ant populations was compiled in 2017 (Pacific Biosecurity, 2017), with an aim of managing ant incursions in both conservation areas as well as human inhabited areas. Based on the results of the surveys carried out in 2014, the action was aimed at Yellow crazy ant infestations on Funafuti atoll (specifically Fongafale and Fualopa islets) and Nukulaelae atoll (specifically Fangaua, Motala and Tumiloto islets) and some parts of Niulakita Island. A very detailed action plan is available from this link [Pacific Biosecurity 2017](#).

Following the 2017 Ant management plan, the Ant management teams continue to control and carry out ant management upon request from outer islands. Some of the outer island treated using Antoff baits are Nui Island, Nukufetau, Nanumaga and Niutao. The plan is to attempt other islands under the new project under the GEF 6 for invasive species (Update from Matio Lonalona pers.comm).

Biosecurity department in Tuvalu have continue carrying out monitoring of fruit flies fortnightly and also installing other traps to identify if there any new species are present (Update from Matio Lonalona pers.comm).

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