
REPTILES OF THE ILES EPARSEES, INDIAN OCEAN: INVENTORY, DISTRIBUTION, AND CONSERVATION STATUS

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Abstract.—We surveyed the Iles Eparses (Europa, Juan de Nova, Iles Glorieuses and Tromelin) in the Western Indian Ocean for terrestrial reptiles. We reviewed the literature and data on museum specimens, then used data recorded from field surveys and International Union for Conservation of Nature (IUCN) criteria to analyze habitat occupation and to map the distribution of endemic species and subspecies for each island. Our field inventory revealed 11 species: four geckos are introduced or have uncertain status on these islands, while one gerrhosaurid and one gecko are considered native. Based on our new data and to obtain a national (French) conservation status, we propose IUCN categories for the following four skink taxa and one gecko species that are endemic for these islands: the Europa Snake-eyed Skink, *Cryptoblepharus bitaeniatus* (Near Threatened), the Juan de Nova Snake-eyed Skink, *Cryptoblepharus caudatus* (Critically Endangered), the Glorioso Snake-eyed Skink, *Cryptoblepharus gloriosus gloriosus* (Endangered), the Europa Speckle-lipped Skink, *Trachylepis maculilabris infralineata* (Vulnerable), and the Insular Dwarf Gecko, *Lygodactylus insularis* (Critically Endangered). We propose four of the endemic taxa for threatened status because they have a high extinction risk. The Valhalla Skink (*Flexiseps valhallae*), endemic to Iles Glorieuses, has not been rediscovered and we propose that its classification be Critically Endangered, possibly Extinct. Predation by invasive mammals poses a serious threat to the native herpetofauna, as does the degradation and destruction of habitats. We emphasize the need for the implementation of a conservation strategy with a biosecurity plan.

Key Words.—distribution; herpetofauna; invasive species; Red List; threatened taxa

Résumé.—Nous avons étudié les reptiles terrestres des Iles Eparses (Europa, Juan de Nova, les Iles Glorieuses et Tromelin) situées dans l’océan Indien occidental. Nous avons fait une synthèse de la littérature et des spécimens présents dans les muséums. À partir de données récoltées lors de missions de terrain et des critères de l’Union Internationale pour la Conservation de la Nature (UICN), nous avons analysé l’occupation des espèces par type d’habitat et réalisé des cartes de répartition pour les taxons endémiques. Notre inventaire de terrain a permis de détecter 11 espèces. Quatre espèces de geckos sont introduites ou ont un statut incertain sur ces îles. Un gerrhosaurid et un gecko sont considérés comme indigènes. À partir de nos nouvelles données, nous proposons des classements sur la liste rouge de l’UICN (France) pour quatre scinques et un gecko, tous endémiques pour ces îles: le Scinque aux Yeux de Serpent d’Europa, *Cryptoblepharus bitaeniatus* (Quasi Menacé), le Scinque aux Yeux de Serpent de Juan de Nova, *Cryptoblepharus caudatus* (En Danger Critique d’Extinction), le Scinque aux Yeux de Serpent des Glorieuses, *Cryptoblepharus gloriosus gloriosus* (En Danger), le Scinque aux Labiales Mouchetées d’Europa, *Trachylepis maculilabris infralineata* (Vulnérable), et le Gecko Nain Insulaire, *Lygodactylus insularis* (En Danger Critique d’Extinction). Le Scinque de Valhalla (*Flexiseps valhallae*), endémique des Glorieuses, n’a pas été retrouvé et nous proposons qu’il soit classé au statut En Danger Critique d’Extinction, peut-être éteint. La prédation par les mammifères introduits constitue une importante menace pour l’herpétofaune indigène, suivie par la transformation des habitats naturels. Nous insistons sur l’urgence de mettre en œuvre une stratégie de conservation, comprenant un plan de biosécurité.

Mots Clés.—espèces invasives; taxons menacés; herpétofaune; liste rouge; répartition

INTRODUCTION

The Iles Eparses are French overseas territories in the southwestern Indian Ocean managed by the Terres Australes et Antarctiques Françaises (TAAF). They include widely scattered islands or archipelagos. Europa (Eur), Bassas da India (a band of sand that emerges at

low tide), Juan de Nova (Jdn) and the Iles Glorieuses are located within the Mozambique Channel, whereas Tromelin (Tro) lies East of Madagascar (Fig. 1). Except for Jdn, all of the islands have been nature reserves due to French government decisions since 1975 and all of their fauna and flora species are protected.

Although the islands are considered to be among

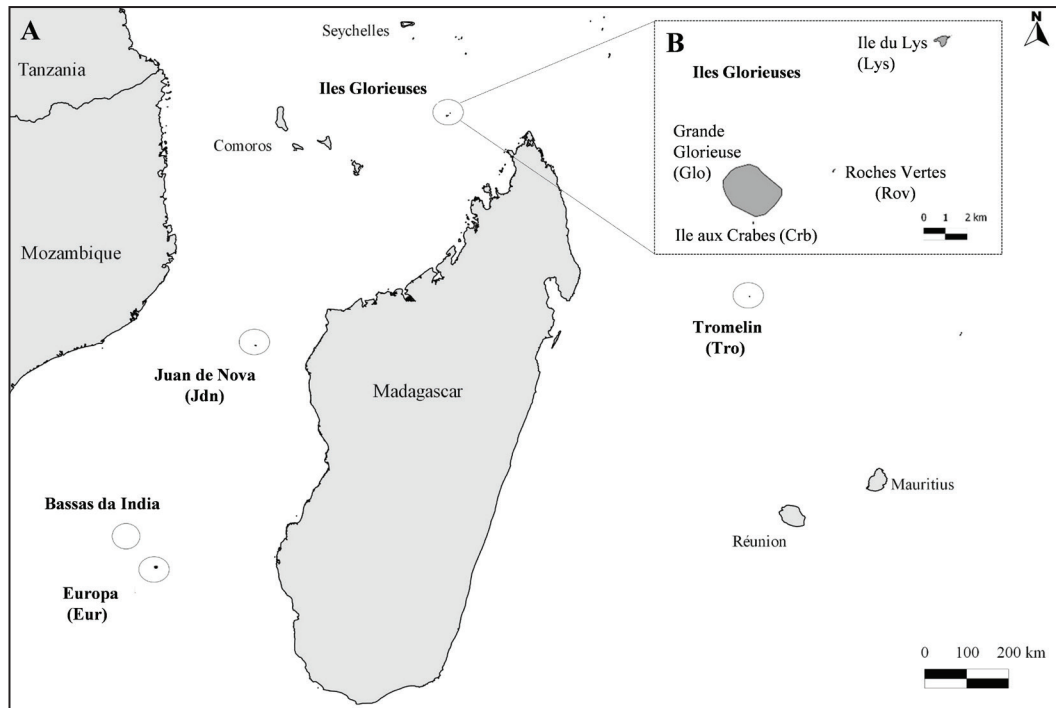


FIGURE 1. (A) The location of the Iles Eparses in the South-Western Indian Ocean and (B) details of Iles Glorieuses.

the last sanctuaries of terrestrial tropical biodiversity (Quétel et al. 2016), the herpetological study of the Iles Eparses is still in its infancy. The first specimen collections were conducted during oceanic expeditions between 1890 and 1910 (Coppinger 1885; Abbott 1893; Nicoll 1908; Gardiner 1909; Voeltzkow 1913). Since then, the literature has provided only a few naturalist observations (e.g., Paulian 1950; Le Corre 1993; Probst 2000a, b; Probst et al. 2001) and a few collections of specimens (see Brygoo 1966; Le Corre 1993). Due to this lack of data, the assessment of conservation issues and, therefore, the establishment of adequate policies for the conservation of the herpetofauna is difficult. This study, the first long-lasting field mission to survey the terrestrial herpetofauna of the Iles Eparses, was designed to assess the species richness, distribution, and ecology of the herpetofauna, and to propose an assessment of conservation status of species based on the Red List criteria of the International Union for Conservation of Nature (IUCN).

MATERIALS AND METHODS

Study sites.—Europa (22°21'10"S, 40°21'30"E; 3,000 ha; maximum 7 m above sea level [asl]) includes a large internal lagoon with several rocky or mangrove islets. The mainland is relatively undisturbed and can be characterized by nine main native habitat types (Figs. 2A, 3A). Juan de Nova (17°03'20"S, 42°43'22"E; 500 ha; maximum 12 m asl) includes five habitat types,

but the natural landscape is greatly disturbed by non-native Australian Pine (*Casuarina equisetifolia*) forest (Figs. 2B,C,D, 3B). The Iles Glorieuses (11°35'00"S, 47°18'20"E; Fig. 1B) is an archipelago that is comprised of the Grande Glorieuse (Glo), the Ile du Lys (Lys), the Ile aux Crabes (Crb), and the Roches Vertes (Rov). The very disturbed landscape on Glo (470 ha; maximum 14 m asl) includes eight habitat types (Figs. 2E, F, 3C), but half of the island has been invaded by Australian Pine forest and coconut plantation (Fig. 2G). The Lys island (15 ha; maximum 15 m asl; Figs. 2H, 3D) includes six natural habitat types. The small Crb islet (0.10 ha; maximum 3 m asl) is formed of a rocky coastline and a dense shrub habitat, while the three main rocky islets of Rov (four islets cumulating to 0.2 ha; maximum 2 m asl) are characterized by herbaceous vegetation. The well preserved Tro (15°53'30"S, 54°31'24"E; 75 ha; Fig. 3E) is largely dominated by herbaceous and shrub habitats. The habitat types and the habitat status (preserved or disturbed) varies for each island (Appendix Table 1).

Distributed along a climatic gradient ranging from sub-arid climate in Eur to a tropical dry climate in the Iles Glorieuses, all of the islands are coralline and of low elevation (< 20 m). The wet season (austral summer) lasts from December to April while the dry and cooler season (austral winter) lasts from April to October. Historically, Eur, Jdn, and the Iles Glorieuses have experienced human activities from the end of the 19th till the middle of the 20th centuries. Juan de Nova and Glo have been strongly affected by the exploitation of



FIGURE 2. Examples of surveyed habitats include: (A) herbaceous vegetation and shrubs on Europa; (B) coastal sand beach and shrubs on Juan de Nova; (C) inland shrubs and trees on a former phosphate mining area on Juan de Nova; (D) Australian Pine forest on Juan de Nova; (E) coastal sand beach and shrubs on Grande Glorieuse; (F) shrubs and trees on Grande Glorieuse; (G) dense coconut plantation on Grande Glorieuse, and (H) shrubs and trees near rocky area on Lys. (Photographed by Mickaël Sanchez).

phosphate (Figs. 2C, 3B) and copra (Figs. 2G, 3C). On Eur, Mauritius Hemp (*Furcraea foetida*) and Sisal Hemp (*Agave sisalana*) have been farmed for the production of vegetable fibers. There have also been introductions of important non-native animals such as Black Rats (*Rattus rattus*, on Eur, Jdn, Glo; eradicated on Lys in 2003), Norway Rats (*Rattus norvegicus*; eradicated on Tro in 2005), House Mice (*Mus musculus*, on Jdn and Tro), Domestic Cats (*Felis catus*, on Glo; eradicated on Jdn in 2016), Etruscan Shrews (*Suncus etruscus*, on Glo), and Goats (*Capra hircus*, on Eur). Although there are no permanent residents on these islands, Glo, Eur and Jdn have been inhabited year-round since 1973 by military detachments (15 people) that rotate every 45–

60 d. Consequently, a military camp has been installed on each island. This settlement requires the transport of materials and food supplies by air and sea from La Réunion and Mayotte (Comoros; Hoarau 2002; Quézel et al. 2016; Fig. 1). Wastes are picked up by a TAAF logistic vessel, which lands on each island consecutively every two to three years and which travels from Eur to Tro via the Mozambique Channel (David Ringler, pers. comm.).

Historical and museum records.—To determine the date at which each species was first mentioned, we conducted an extensive literature review of the herpetofauna from the Iles Eparses and looked for

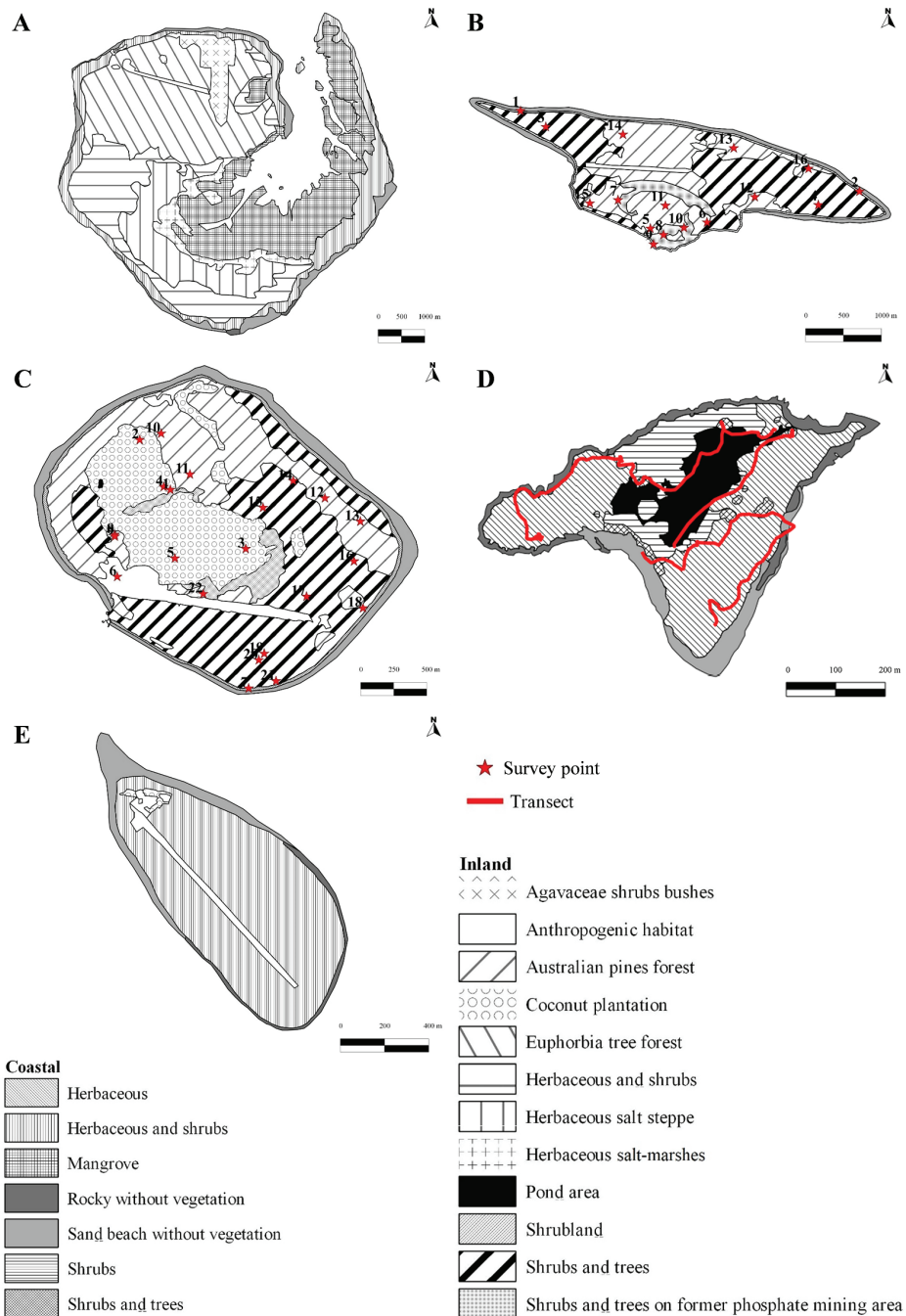


FIGURE 3. Natural habitats and location of survey points and transects on (A) Europa, (B) Juan de Nova, (C) Grande Glorieuse, (D) Lys, and (E) Tromelin.

preserved specimens from museum collections. We surveyed online databases of the Muséum National d’Histoire Naturelle, Paris, France (MNHN-RA), the Natural History Museum, London, UK (BMNH), and the National Museum of Natural History, Washington, USA (USNM). We also consulted with collection managers of the Senckenberg-Museum, Frankfurt, Germany (SMF), the Museum für Naturkunde, Berlin,

Germany (ZMB), and the Muséum d’Histoire Naturelle de La Réunion (MHNH).

Data collection.—Fieldwork was carried out by teams of one to three persons. We sampled Jdn from 30 March to 15 May 2015 (MS), the Iles Glorieuses from 30 March to 7 June 2017 (MS, AC, and Jean-Michel Probst), and Tro from 19 to 29 October 2017 (FB). In

Eur, we collected data between 16 March and 8 October 2017 (AL and FB) and added the data published in Sanchez and Probst (2015).

We sampled 16 points on Jdn (Fig. 3B), 22 on Glo (Fig. 3C), and one on Crb (Appendix Table 1). Due to limited access and the presence of seabird nesting colonies, we sampled both Lys and Rov using transects, with three transects on Lys (Fig. 3D) and one through the four islets of Rov. We sampled all points and transects during daytime (0700–1700), but also sampled at night in Glo (1745–2230; except points n°4, 9, and 19). We sampled points for 30–60 min/person and transects for 10–55 min/person. Our cumulative search effort was 11.5 h/person in Jdn, 31.5 h/person in Glo, 0.5 h/person in Crb, 0.92 h/person in Rov, and 3.1 h/person in Lys. During sampling, we searched for living individuals and signs of presence (i.e., eggs, molts, and feces) using a head lamp and binoculars (10×42). We systematically examined shelters and egg-laying sites by excavating stumps and dead wood, turning stones, opening tree bark, and crevices, etc. For each detection, we collected date, time, location (longitude/latitude, UTM 37S, 38S, and 40S system), species, sex, age, microhabitat (e.g., plant, rock, sand concrete), and activity (basking, movement, feeding, and agonistic interaction).

In addition to our formal surveys, we noted opportunistic observations during our journeys on the islands by collecting the same data as described above for survey points and transects. On Tro, we only obtained opportunistic observations. On Glo, we carried out additional surveys for burrowing skinks using active searches on survey points and transects as described above with 51 h/person through preserved shrub and tree habitats, and 9 h/person in coconut plantation and fence-pitfall lines using a 100 m and a 50 m trap line with traps spaced 10 m apart and a 50 cm plastic fence and installed inside suitable habitats (e.g., deep litter, dead wood, and scree). We checked once a day at 1630 on 31 consecutive days, representing a total of 8,235 h/trap.

Voucher specimens and conservation assessment.—We collected voucher specimens on Jdn, Glo, and Lys. Specimens were ethanol-preserved and deposited in the collections of the MNHN-RA and the MHNH. We evaluated all endemic species and subspecies using the IUCN Red List criteria (IUCN 2001). We calculated extent of occurrence (EOO) using a minimum convex polygon in which no internal angle exceeded 180° and which contained all the sites of occurrence. Based on the map of habitat classification (Fig. 3), we calculated area of occupancy (AOO, area in which a species lives) measured by the surfaces of suitable natural habitats. Because they were considered unsuitable for maintaining a viable population, we excluded some habitats from the AOO even if specimens were observed there (detection

only on the edge or very rarely).

RESULTS

Species composition.—Based on the literature review, specimen collection, and field study, we recorded six families (15 species) of reptiles on the Iles Eparses: one species of Chamaeleonidae, six Gekkonidae, one Gerrhosauridae, one Pelomedusidae, five Scincidae, and one Typhlopidae. We did not detect four species documented in the literature during our field research. Among the detected taxa of species or subspecies rank, four skinks and one Day Gecko are endemic to these islands, while one gerrhosaurid and one Day Gecko are considered native. Four species of night geckos are considered as introduced or with an uncertain status on these islands.

REPTILIA: SQUAMATA: CHAMAELEONIDAE

***Furcifer polleni*, Pollen's Chameleon (Introduced and Extinct).**—This chameleon is mentioned as *Chamaeleo polleni* by Probst et al. (2000) and is documented in Glo based on three adults that were observed in coastal vegetation. It was not mentioned before the year 2000. This species was probably been introduced from Mayotte, its natural distribution area (Hawlitshchek et al. 2011). Because we did not observe it during our field work, we consider this species as extinct from Glo. We did not record any specimens in museum collections.

GEKKONIDAE

***Gehyra mutilata*, Stump-toed Gecko (Introduced).**—This is the first mention of this species in the Iles Eparses. This night gecko (Fig. 4A) was probably introduced to Glo from La Réunion over the past 20 y. A picture dated from 2008 from Matthieu Le Corre proved its presence at this date. We detected the species 10 times during our field work, and it seemed to be widespread on the island (Appendix Fig. 1). We observed this gecko in disturbed coconut plantations (dense and open) and in Australian Pine forest, but also in preserved habitats like shrubs and trees (Table 1), mainly on large trees (*C. equisetifolia*, *Ficus* sp., coconut tree) and inside tree stumps. We found eggs inside coconut cavities and in dead wood litter. We did not detect this species, previously described as a house dwelling gecko (Cole 2009; Rocha et al. 2009; Sanchez and Probst 2016), in anthropogenic habitats. We collected seven specimens (MNHN-RA-2017.25-31).

***Hemidactylus frenatus*, Common House Gecko (Introduced and Invasive).**—This species (Fig. 4B)



FIGURE 4. (A) The Stump-toed Gecko, *Gehyra mutilata* (MNHN-RA-2017.0026; Grande Glorieuse), (B) the Common House Gecko, *Hemidactylus frenatus* (MNHN-RA-2017.0068; Grande Glorieuse), (C) the Merchants Gecko, *Hemidactylus mercatorius* (MNHN-RA-2017.0038; Grande Glorieuse), (D) the Flathead Leaf-toed Gecko, *Hemidactylus platycephalus* (MHNR-2017.13.3; Grande Glorieuse), (E) the Insular Dwarf Gecko, *Lygodactylus insularis* (MNHN-RA-2017.0078; Juan de Nova) and (F) the Mocquard's Dwarf Gecko, *Lygodactylus verticillatus* (Europa). (Photographed by Mickaël Sanchez).

had not previously been detected in Glo, ours is the first mention of it in the Iles Eparses. As it was not mentioned by Probst et al. (2000), the species may have been introduced from Mayotte and/or La Réunion over the past 20 y. This invasive night gecko occupies both preserved and disturbed habitats and is widely distributed on the island (Appendix Table 2, Appendix Fig. 1). We observed it on the ground (litter, sand, concrete), in shrubs, on trees, and on buildings. It reaches a high density in and around the military camp, sharing anthropogenic habitats with *H. mercatorius*. Both the distribution data and the finding that its abundances decrease with increased distance from human-managed areas suggest a progressing colonization dynamic. We collected nine specimens (MNHN-RA-2017.62-70).

***Hemidactylus mercatorius*, Merchants Gecko (Uncertain status or Introduced).**—This night gecko (Fig. 4C) inhabits a large part of Eur, Jdn, Glo and Lys

(Appendix Figs. 1–4). The first collections for Iles Eparses were carried out by W.L. Abbott on what he called Gloriosa Island in 1892 (three specimens recorded as *H. mabouia*: USNM 20459-61; Abbott 1893), by A. Voeltzkow on Insel Juan de Nova (Jdn) in 1894 (six specimens recorded as *H. mabouia*: SMF 8503-08), and on Insel Europa in 1903 (16 specimens recorded as *H. mabouia*: ZMB 19511 (9), 19443 (5), 19174-75). Seventeen specimens collected by A. Voeltzkow in Eur (identified as *H. mabouia*: SMF 4122gg) were quoted by Boettger (1913) but are currently not cataloged in the Senckenberg-Museum collection. Nineteen other museum specimens are available for Eur (MHNR-1994.111, MNHN-RA-1964.71-78, -2014.32-41). We collected seven specimens in Jdn (MNHN-RA-2017.32-34 and 2017.44-47), 11 in Glo (MNHN-RA-2017.35-40, -2017.0059 and -2017.71-74), and three in Lys (MNHN-RA-2017.41-43). Based on morphometric and meristic analyses (Mickaël Sanchez,

TABLE 1. Proposition of International Union for Conservation of Nature Red List status for endemic species and subspecies of reptiles in the Iles Eparses. Abbreviations are NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR = Critically Endangered, PE = Possibly extinct, EOO = Extent of occurrence (km²), AOO = Area of occupancy (km²), NL = Number of locations, D2 = population very small or restricted with AOO < 20 km² or a number of location fewer than or equal to 5, B1abiii (CR status) = EOO < 100 km² (B1) and exist at only a single location (a) and continuing decline (b) of the quality of habitat (iii), B2abiii (CR status) = AOO < 10 km² (B2) and exist at only a single location (a) and continuing decline (b) of the quality of habitat (iii), B1abiii (EN status) = EOO < 5,000 km² (B1) and exist at no more than five locations (a) and continuing decline (b) of the quality of habitat (iii), B2abiii (EN status) = AOO < 500 km² (B2) and exist at no more than five locations (a) and continuing decline (b) of the quality of habitat (iii).

Species	Location	EOO	AOO	NL	Status
Europa Snake-eyed Skink <i>Cryptoblepharus bitaeniatus</i>	Europa	36.00	21.06	1	NT near D2
Juan de Nova Snake-eyed Skink <i>C. caudatus</i>	Juan de Nova	4.87	2.81	1	CR B1abiii + B2abiii
Glorioso Snake-eyed Skink <i>C. gloriosus gloriosus</i>	Iles Glorieuses	4.11	4.20	4	EN B1abiii + B2abiii
Valhalla Skink <i>Flexiseps valhallae</i>	Grande Glorieuse, Ile du Lys	–	–	–	CR (PE)
Insular Dwarf Gecko <i>Lygodactylus insularis</i>	Juan de Nova	4.48	4.68	1	CR B1abiii + B2abiii
Europa Speckle-lipped Skink <i>Trachylepis maculilabris infralineata</i>	Europa	29.14	17.77	1	VU D2

unpubl. data), we assigned specimens collected after 1994 to *H. mercatorius*. Specimens collected before 1994 need examination for classification. As all of these islands were visited or inhabited before the first collections were made, and that species distribution patterns in the southwestern Indian Ocean is frequently driven by anthropogenic factors (Rocha et al. 2010a; Sanchez et al. 2012), we cannot exclude an introduction scenario. The species was recently detected on Tro based on pictures dated from 2013 from Jean Hivert and shows a restricted distribution around human installations (Appendix Fig. 4), suggesting that it was probably introduced. On the Iles Eparses, this gecko inhabits most natural habitats except the most simplified ones, such as herbaceous salt steppes and salt marshes on Eur (Appendix Table 2). We detected this arboreal species on shrubs, trees, and buildings, but also found it on the grass and on the ground (in litter, rock, sand, and concrete). Females lay eggs on the ground (under rocks, trees and litter) and inside cavities of trees and shrubs (Mickaël Sanchez, pers. obs). Communal laying sites are frequent (range of number of eggs, 4–30; Mickaël Sanchez, unpubl. data).

***Hemidactylus platycephalus*, Flathead Leaf-toed Gecko (Uncertain status or Introduced).**—This night gecko (Fig. 4D) is widespread on Jdn (Appendix Fig. 3). If we accept the assumption that specimens collected by A. Voeltzkow in Jdn (six specimens recorded as *H. mabouia*: SMF 8503-08) were actually *H. mercatorius*, then no specimen has been recorded in museum collections to date. Probst (2001) was the first author to document this species on Jdn. Because an introduction scenario cannot be excluded, we consider its native

status as uncertain on Jdn. Herein, we report it for the first time in the Iles Glorieuses. Because this species is absent from museum collections and the literature and shows a patchy distribution near anthropogenic areas (Appendix Fig. 1), it may have been introduced to Glo (probably from Mayotte). On Jdn, it inhabits all natural habitats; however, it can only be found in certain disturbed habitats in Glo (Appendix Table 2). It can be abundant in anthropogenic environments and large trees. We observed it on the ground (sand and concrete), in trees, shrubs and vines. Females lay two eggs (glued together), deposited or glued under dead trees, and in tree cavities (Mickaël Sanchez, pers. obs). We have found a communal egg-laying site containing 23 eggs in a large tree on Jdn. We collected five specimens in Jdn (MNHN-RA-2017.48-50 and 2017.60-61) and 11 in Glo (MNHN-RA-2017.51-58, -2017.75-76, and MHN-2017.13.3).

***Lygodactylus insularis*, Insular Dwarf Gecko (Endemic).**—This species (Fig. 4E) is poorly known (Puente et al. 2009) and is endemic to Jdn (Boettger 1913). They are only represented by two specimens in the Senckenberg-Museum collection (SMF 8946-47), which were collected by A. Voeltzkow in 1894. No observation has been reported in the literature since the species description. We collected nine specimens (MNHN-RA-2017.77-85). This tiny arboreal day gecko inhabits preserved coastal shrubs and inland shrub/tree habitats, but also inhabits disturbed shrubs and trees in former phosphate mining areas (Appendix Table 2). It is rare in disturbed Australian Pine forest (Appendix Fig. 3). Observations were made on trees, shrubs (frequently on the native *Heliotropium foertherianum*), sand,



Figure 5. (A) The Madagascar Girdled Lizard, *Zonosaurus madagascariensis insulanus*, with red ventral coloration (MNHN-RA-2017.0092; Grande Glorieuse), and (B) with pale ventral coloration, (C) the Europa Snake-eyed Skink, *Cryptoblepharus bitaeniatus*, boldly striped morph (Europa, mainland), (D) intermediate morph (Europa, mainland), (E) brown morph (Europa, biggest islet of the lagoon), (F) the Juan de Nova Snake-eyed Skink, *Cryptoblepharus caudatus* (MNHN-RA 2016.0020; Juan de Nova), (G) the Glorioso Snake-eyed Skink, *Cryptoblepharus gloriosus gloriosus* (MNHN-RA-2017.0019; Grande Glorieuse) and (H) the Europa Speckle-lipped Skink, *Trachylepis maculilabris infralineata* (Europa). (Photographed by Mickaël Sanchez).

ground, and occasionally on the walls of the military camp. Females lay two eggs (glued together) under tree bark or inside dead *C. equisetifolia* trees (Mickaël Sanchez, pers. obs). We discovered a communal egg-laying site containing 10 eggs in a dead tree. Boettger (1913) reported it as very rare on the island, but its cryptic coloration and small size may result in a very low detection rate.

***Lygodactylus verticillatus*, Mocquard's Dwarf Gecko (Native).**—This species (Fig. 4F) is considered

as native of Madagascar and Eur (Probst 1998, 1999; Glaw and Vences 2007); however, it is impossible to exclude the possibility of its accidental introduction from Madagascar if natural overseas dispersal is unlikely (Pasteur 1964; Sanchez and Probst 2015). The first specimens were collected by A. Voeltzkow in 1903 [nine specimens: ZMB 19185 (4), 19459 (5)]. Sixteen other specimens collected by A. Voeltzkow are quoted by Boettger (1913), but without museum identification numbers. We recorded eight other museum specimens (MNHN-RA-1964.79-82, -1982.208, -1984.422 and

-2017.86-87). The occurrence of this day gecko depends on the availability of shelters in vegetation (shrubs and/or trees) or in human constructions. It occurs in most natural habitats, except for herbaceous salt steppes and salt marshes (Appendix Table 2, Appendix Fig. 2). It can be observed on rocks, litter, sand, shrubs, trees, and the emerged part of mangrove trees. Sometimes found in communal eggs-laying sites (range of number of eggs, 5–12), the eggs (glued together) are laid on the ground, under rocks, or hidden in tree or shrub cavities (Sanchez and Probst 2015).

GERRHOSAURIDAE

Zonosaurus madagascariensis insulanus, **Madagascar Girdled Lizard (Native)**.—This subspecies (Fig. 5A,B) is endemic to Cosmoledo (Seychelles) and the Iles Glorieuses (Brygoo 1985). Collected in Glo by R.W. Coppinger in 1882 (two specimens, BMNH 1883.1.22.12-13; Coppinger 1885), by W.L. Abbott in 1892 (one specimen, USNM 20462), by J. Frazier in 1972 (two specimens, USNM 231630-31), and by R. Bour in 1990 (one specimen, MNHN RA-1990.5069), it was also collected in Lys by J.S. Gardiner in 1905 (one specimen, BMNH 1906.8.15.2). We collected 10 specimens (MNHN-RA-2017.89-96 and MHNR-2017.13.1-2.) in Glo. We detected this lizard in a large geographical range in Glo (Appendix Fig. 1). It is now extinct in Lys, probably because of the historical occurrence of rats and the scarcity of retreat sites for protection. It inhabits both preserved and disturbed habitats and is common inside dense tree habitats such as dense coconut plantation and preserved inland and coastal shrubs and trees (Appendix Table 2). This terrestrial lizard is less common in open habitats and is mainly associated with large trees, such as those found in coastal preserved shrub areas or in anthropogenic habitats. It is absent in shrubland. In dense Australian Pine forest, we mainly observed it on the edge or near native vegetation remains near potential retreat sites (e.g., coconut litter, cavities in the roots of trees, cavities between rocks). We observed aggressive behavior (pursuits of other individuals) in adults. This species forages on the ground, on rocky areas and in litter, where it feeds on *Ficus* sp. fruits, termites, woodworms, religious moths, crickets, *Cryptoblepharus* skinks, and human food (Mickaël Sanchez, pers. obs). Some lizards (males and females) show an orange-red coloration on the ventral scales (Fig. 5A), while others have a light color (Fig. 5B). Moreover, as mentioned by Brygoo (1985), this lizard exhibits a variable dorsal color pattern: the typical pale dorso-lateral lines can be replaced by few pale spots, or even be absent.

SCINCIDAE

Taxonomic note.—The specific status of some *Cryptoblepharus* skinks from the Indian Ocean is still under debate (Brygoo 1986; Rocha et al. 2006; Horner 2007). In this study, we followed the systematic revision of *Cryptoblepharus* species proposed by Horner (2007).

Cryptoblepharus bitaeniatus, **Europa Snake-eyed Skink (Endemic)**.—This species (Fig. 5C-E) was collected for the first time by A. Voeltzkow in 1903 (15 specimens, SMF 15601-3, ZMB 19209, 19454, 19520, 25611, 57121-27, 57180). We recorded 20 other specimens in collections (MNHN-RA-1964.56-67, -1983.896, -1982.203-207, -1992.5256 and MHNR-1994.109). Several specimens collected by A. Voeltzkow in Eur (SMF 6347,4a) were quoted by Boettger (1913), but are currently not cataloged in the Senckenberg-Museum collection. This species is endemic to Eur, and is widespread on this island, as well as on the little islets in the internal lagoon (Appendix Fig. 2). This heliotropic lizard inhabits most of the natural habitats. Density is high in *Euphorbia* forest and extremely low in herbaceous salt steppes. It can live on the edges of mangrove and salt marshes (Mickaël Sanchez, pers. obs). This herbaceous habitat may be used as foraging area (Appendix Table 2). It occurs in direct syntopy with *T. maculilabris infralineata* in several inland habitats. This skink has diurnal and terrestrial habits, although we observed it on the lower branches of trees. It is very active a few hours after sunrise and feeds on arthropods hunted on the ground or on trees. It can also forage on human food (Sanchez and Probst 2015).

This lizard exhibits a polymorphic dorsal color pattern. Based on the width and color of the dorsolateral strips, three color morphs are described in the literature: the boldly striped morph (Horner 2007), the intermediate morph (Brygoo 1966), and the brown morph (Probst 1997). From the analysis of photographs and of previously collected specimens, these forms vary in their distributions on the island. During a field mission in 2014, the boldly striped form (Fig. 5C) was distributed across the entire island. The intermediate morph (Fig. 5D) was present at least in the northeastern tip, the southwest center, the south, and in the two northern rocky islets of the internal lagoon. The brown morph (Fig. 5E) had a distribution limited to the biggest rocky islet of the lagoon. Both the intermediate and brown morphs seemed to be associated with rocky areas that are devoid of tree vegetation (Mickaël Sanchez, unpubl. data). According to Brygoo (1966), the intermediate form was also present in the southeast. *Cryptoblepharus* lizards are known to exhibit pronounced intra-specific color variations (Horner

2007; Horner and Adams 2007). Such variability is also observed in several Australian clades (Mozes Blom, pers. comm.). In 2014 (Sanchez and Probst 2015), we collected two specimens showing the boldly striped morph (MNHN-RA 2016.0013, -2016.0017), two with the intermediate morph (MNHN-RA 2016.0012, 2016.0015), and three with the brown morph (MNHN-RA 2016.0014, -2016.0016, -2016.0018).

***Cryptoblepharus caudatus*, Juan de Nova Snake-eyed Skink (Endemic).**—Endemic to Jdn (Horner 2007), this lizard (Fig. 5F) was first collected by A. Voeltzkow in 1894 (eight specimens, SMF 15592-97, SMF 15600, BMNH 1946.8.15.76). During our study, we collected 10 specimens (MNHN-RA-2016.19-28). This heliophilous lizard was common in littoral shrubs, in the former phosphate mining area, and in the military camp (Appendix Table 2, Appendix Fig. 3). Rare in inland shrub and tree habitats (mainly associated with edges), it occupied only the edge (e.g., paths) of the Australian Pine forest. This skink shows terrestrial and diurnal habits. It feeds on arthropods and microcrustaceans on rocky, sandy, or muddy areas, but also on leaf litter and trees (Mickaël Sanchez, pers. obs). Inland mudflats and rocky coastal zones seemed to be important feeding areas because we observed high lizard abundance at low tide (354 lizards/h/person on rocky coastal zone). Adult lizards can show aggressive behavior (attacks and pursuits). We found four eggs inside a piece of dead wood, and several communal egg-laying sites (range of number of eggs, 5–32) deposited in the sand under dead woods on the beach. Eggs were oblong shaped with a maximum diameter around 15 mm.

***Cryptoblepharus gloriosus gloriosus*, Glorioso Snake-eyed Skink (Endemic).**—A subspecies (Fig. 5G) endemic to the Iles Glorieuses, this skink inhabits a large part of Glo, Lys, Crb and the tiny Rov (Appendix Fig. 1, 5). It was first collected by W.L. Abbott in 1892 (USNM 20463-66) in Glorioso Islands (unspecified island), and we recorded 11 other specimens in collections (BMNH 1953.1.12.23, MNHN-RA-1990.370-72, -1990.5070-72, -1992.5248-50, and USNM 231634). We collected nine specimens in Glo (MNHN-RA-2017.12-20) and four in Lys (MNHN-RA-2017.21-24). We observed that this heliotropic lizard inhabited most of the natural habitats (preserved and disturbed; Appendix Table 2). It avoided shaded environments like dense coconut plantation and shrubland and we only observed it on habitat edges. It is diurnal and mainly terrestrial but can be detected on lower branches of trees and coconut trees. This skink was very active a few hours after sunrise, as well as at the hottest hours of the day. It feeds on insects (butterflies, termites, ants and ant eggs), hunted on the ground, trees, leaf litter, rocks

and in pond areas (Mickaël Sanchez, pers. obs). We observed numerous lizards feeding inside dry ponds. It may also feed on carcasses of the Madagascar Girdled Lizard (*Z. madagascariensis insulanus*) and on the remnants of sooty tern eggs (Jean-Michel Probst, pers. comm.). Adults commonly demonstrate territorial behavior (pursuits) (Mickaël Sanchez, pers. obs). We detected pairs of eggs laid inside tree crevices or inside calcarenite rock cracks and we found communal egg-laying sites on the sand under a rock (6 eggs) and in a stump (42 eggs).

***Flexiseps valhallae*, Valhalla Skink (Endemic).**—This poorly known skink is endemic to the Iles Glorieuses. The species is only known from three specimens, one collected in Glorioso Island (probably Glo) by J.S. Gardiner and H.H.W. Pearson in 1905 (BMNH 1907.10.15.85) and two collected in Isle de Lix by M.J. Nicoll in 1906 (BMNH 1946.8.2.51-52; Boulenger 1909; Brygoo 1983). After several taxonomic shifts (assignments to the genus *Sepsina*, then *Scelotes*, then *Amphiglossus*; see Boulenger 1909; Blanc 1971; Brygoo 1983), Erens et al. (2017) assigned it to the genus *Flexiseps*. In the species description, Boulenger (1909) wrote that it is “very closely allied to *Sepsina* [*Flexiseps*] *melanurus* (Günther, 1877) from Madagascar,” and Brygoo (1983) indicated that it is morphologically close to *Sepsina* (*Flexiseps*) *ardouini* (Mocquard 1897). Most species of this skink group are associated with non-disturbed humid forest habitats, where they burrow and thus are inconspicuous (Andreone and Greer 2002; Glaw and Vences 2007). Due to the absence of detection during our field study, historical presence of rats on Lys, abundance of other invasive mammals (cats and shrews), and high level of habitat disturbance in Glo, we consider this species as close to extinction or extinct.

***Trachylepis maculilabris infralineata*, Europa Speckle-lipped Skink (Endemic).**—This subspecies (Fig. 5H) is endemic to Eur and was collected for the first time by A. Voeltzkow in 1903 (nine specimens, SMF 14080-84, ZMB 25613, 86366-68). We recorded six other specimens in museum collections (MNHN-RA-1924.84, -1964.68-70, -2017.88, MHN-1994.110). Ten specimens collected by A. Voeltzkow (SMF 6163, 1a) were quoted by Boettger (1913), but are currently not catalogued in the Senckenberg-Museum collection. Brygoo (1981), Mausfeld-Lafdihiya et al. (2004), and The Reptile Database (available from www.reptile-database.org [Accessed 15 November 2017]) attributed it a species rank but, according to Rocha et al. (2010b) and B. Hedges (pers. comm.), it must be considered as a subspecies. Avoiding open habitats, it inhabits preserved and disturbed habitats inland, such as herbaceous vegetation and shrubs, *Euphorbia* forest and

Agavaceae shrubs and is uncommon in anthropogenic habitats (Sanchez and Probst 2015; Appendix Table 2, Appendix Fig. 2). This diurnal and terrestrial skink eats arthropods on the ground and was observed basking on lower branches of trees at the beginning and the end of the day (Sanchez and Probst 2015).

TYPHLOPIDAE

***Indotyphlops braminus*, Brahminy Blindsnake (Introduced?).**—Quoted by Probst (1998) in Eur based on a testimony from a service agent of Météo France (1994: “observation in a flower pot removed from La Réunion”), it has not been detected during a recent field mission (see Sanchez and Probst 2015) and no specimen has been recorded in museum collections. Given the poor reliability of the single observation and the low detection rate, we consider its occurrence as doubtful on Eur.

TESTUDINES: PELOMEDUSIDAE

***Pelusios subniger*, East African Black Mud Turtle (Introduced and Extinct?).**—Although it was mentioned by Blanc (1971) as present in Glo, we did not record any specimens in museum collections. We have not observed this turtle during our field mission and none of the available habitats seems suitable; however, we cannot exclude an ancient introduction (from Seychelles and/or Madagascar) followed by an extinction.

Conservation assessments.—Based on IUCN (2001) criteria, with an AOO near 20 km² and a number of location ≤ 5 (criteria D2), *C. bitaeniatus* is likely to qualify for a threatened category in the near future, and thus we propose the status of Near Threatened (Table 1). We propose the status of Vulnerable for *Trachylepis maculilabris infralineata* due to limited AOO (< 20 km²) and a single location (criteria D2). We suggest the status Endangered for *Cryptoblepharus gloriosus gloriosus* due to limited area [EOO < 100 km² (B1) and AOO < 10 km² (B2)], number of locations ≤ 5 and a decline of the quality of habitat (iii). We propose the status Critically Endangered for both *C. caudatus* and *L. insularis* as a result of their having a restricted geographic range (B1 and B2), a single location (b), and a decline in the quality of their habitat (iii). Based on our survey, there is small chance that the *F. valhallae* skink may still be extant and thus we propose the status of Critically Endangered, possibly extinct.

DISCUSSION

This study provides a comprehensive overview of the terrestrial reptiles of the Iles Eparses. We give an updated list of 11 species present in this territory, along

with information on their distribution and the first ecological information for poorly known species. This herpetofauna is currently composed by five endemic taxa proposed for IUCN status (NT, VU, EN or CR) and two native taxa. Species biogeographic affinities, native status, threats and conservation perspectives are discussed below.

Biogeographic affinities and native status.—Samples of the *Cryptoblepharus* skinks (Rocha et al. 2006), *L. insularis*, *L. verticillatus* (Puente et al. 2005; Röhl et al. 2010; Castiglia and Annesi 2011; Mezzasalma et al. 2016), and *Z. madagascariensis insulanus* (Raselimanana et al. 2009; Recknagel et al. 2013) from the Iles Eparses have not been included in published molecular studies. Phylogenetic affinities are unknown and native status uncertain for several species. For examples, African affinities of *L. insularis* (Blanc 1971; Röhl et al. 2010) and native status of *L. verticillatus* (Probst 1998, 1999; Glaw and Vences 2007; Sanchez and Probst 2015) are suspected, but without strong evidence. Also, the status and identification of *Hemidactylus* species in the south-western Indian Ocean region has been a source of confusion (Vences et al. 2004; Sanchez et al. 2012). In the Iles Eparses, our data suggests the non-exclusive assumptions of natural over-sea dispersal and/or accidental introduction of *H. mercatorius* in Eur, Jdn, Glo and Lys, and of *H. platycephalus* in Jdn. Because the results may have an impact on the future herpetofauna management, the status and phylogenetic affinities of species on the Iles Eparses need clarification with molecular analyses using DNA material from the Iles Eparses.

Threats and conservation.—In a short-term, the main threat to native reptiles of the Iles Eparses is invasive alien species. Introduced mammals such as rats, cats, mice, and shrews induce predation pressure and pose serious threats. Although some data has been provided about cat predation in Glo (Ringler 2009) and in Jdn (Peck et al. 2008), no comprehensive study has yet been conducted to assess the impact of these mammals on the reptile community on the Iles Eparses. Due to their small size, reptiles rarely represent a significant percentage of cat prey biomass, but this predation can have a high impact (Bonnaud et al. 2010; Palmas et al. 2017). Examples of cat (Campbell et al. 2011) and rat eradication (Townsend 1991; Thorsen et al. 2000; Parrish 2005; Harper et al. 2011) have been shown to cause positive responses in several reptile species. Therefore, we strongly encourage the eradication of rats and cats in the Iles Eparses, coupled with reptile monitoring and subsequent biosecurity control measures.

In addition, a potential threat to the herpetofauna may be the competition with invasive species. On Jdn, we cannot exclude competition (and predation) by

both *H. mercatorius* and *H. platycephalus* on the tiny endemic *L. insularis*. Focused studies are necessary to assess if these night geckos are direct competitors and might lead to the extinction of the endemic *L. insularis*. Several studies have already suggested or demonstrated the impact of *Hemidactylus* geckos on native geckos (Cole et al. 2005; Newbery and Jones 2007; Cole and Harris 2011; Hoskin 2011; Sanchez et al. 2012). This is one more argument to encourage molecular studies on *H. mercatorius* and *H. platycephalus* because their native status is still doubtful.

On the other hand, the logistic management of these islands (i.e., the importation of materials and food supplies and waste management) induces a high risk of invasive species introduction (mainly mammals, reptiles, and arthropods). Our results suggest that at least four night geckos have probably been introduced in the Iles Eparses in this manner (*H. mercatorius* on Tro, *H. platycephalus*, *H. frenatus*, and *G. mutilata* on Glo). Boat and airplane traffic is an important source of small animal introduction (Gill et al. 2001; Dobbs and Brodel 2004; Causton et al. 2006; Kenis et al. 2007; Hawlitschek et al. 2016). Dramatic cases of drastic decline of native reptiles related to invasive predators or competitors have already been reported in the southwestern Indian Ocean (Arnold 1980; Cole et al. 2005; Cheke and Hume 2008; Austin et al. 2009; Buckland et al. 2014) and elsewhere in the world (Case et al. 1992; Towns and Daugherty 1994; Rodda et al. 1997; Feare 1999; Fisher and Ineich 2012). Some species that have already been introduced to La Réunion and Mayotte have the potential to cause major damage if introduced to the Iles Eparses. These include ants (the Yellow Crazy Ant, *Anoplolepis gracilipes*, the Big-headed Ant, *Pheidole megacephala*, and the Fire Ant, *Solenopsis geminata*), reptiles (the Rainbow Lizard, *Agama agama*, the Bloodsucker, *Calotes versicolor*, the Indian Wolf Snake, *Lycodon aulicus*, the Zanzibar Day Gecko, *Phelsuma dubia*, the Madagascar Day Gecko, *Phelsuma grandis*, and the Gold Dust Day Gecko, *Phelsuma laticauda*), and mammals (the House Mouse, *Mus musculus*, the Asian Musk Shrew, *Suncus murinus*, and the Small Indian Civet, *Viverricula indica*). To prevent further damage, a complete biosecurity strategy is needed, including robust methods of control (post-entry control, quarantine and inspection system, early detection, rapid-response measures).

Furthermore, on the Iles Glorieuses and Jdn, *Cryptoblepharus* skinks, *Z. madagascariensis insulanus*, and *L. insularis* are uncommon or absent in the Australian Pine forest and are therefore probably sensitive to this habitat disturbance. This disturbed habitat is structurally poor (few retreat sites for terrestrial lizards) and sometimes very shady with reduced basking area. Additionally, on Jdn the thick

litter of *C. equisetifolia* trees hosts a high abundance of *Scolopendra* sp. centipedes, which preys on lizards. In India, Subramanean and Vikram Reddy (2010) reported a significant negative correlation between *C. equisetifolia* density and the abundance of the skink *Eutropis bibronii*, which may be directly linked to the availability of basking places (reduced after *C. equisetifolia* plantation). Therefore, the conversion of native habitats to homogenous Australian Pine forest might cause an important decline of native species.

Finally, the future of the herpetofauna of the Iles Eparses may not be secured because few populations live on low elevation coralline islands that are threatened by climate change effects such as sea-level rise and the intensification of tropical cyclones (Quétel et al. 2016). Although Glo and Lys reach a maximum elevation of 14–15 m, most habitats of the Iles Eparses are restricted to 1–5 m above sea-level and are threatened by rising sea levels.

IUCN Red List assessment.—Most endemic reptiles from the Iles Eparses were previously evaluated by IUCN France and MNHN (2015), based on limited information, and were given the status Data Deficient (*F. valhallae*), Near Threatened (*C. bitaeniatus* near D2) or Vulnerable (*C. caudatus* D2, *C. gloriosus gloriosus* D2 and *T. maculilabris infralineata* D2). Based on our data, we propose changing the Red List entries to better reflect the degree of threat faced by these species. Currently, the threatened *C. gloriosus gloriosus*, *C. caudatus*, *F. valhallae*, and *L. insularis* are under a high risk of extinction and need a relevant management strategy such as a recovery plan in connection with the identified threats (invasive alien species, degradation and destruction of natural habitats, climate change effects). The skink *F. valhallae* has the proposed classification of Critically Endangered, possibly extinct. The gap of knowledge on this species is extremely important as data is restricted to the species description (Boulenger 1909) and some comments about morphology, taxonomic position, and biogeographic origin (Brygoo 1983). According to the IUCN (2001) guideline, “a taxon is extinct when there is no reasonable doubt that the last individual has died... when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.” Despite our fieldwork on the Iles Glorieuses, our survey must be completed by intensive specific research, including pitfall trapping and foot print detection.

Usually, taxonomic units below species level do not receive an IUCN Red List status. Therefore, we did not assess *Z. madagascariensis insulanus*. Due to its very restricted distribution range on Cosmoledo and Iles Glorieuses, and its vulnerability to sea-level rise, Gerlach

(2006) proposed the Vulnerable status (D2 criteria) for this subspecies. In the future, according to the evolution in knowledge and taxonomy, a re-assessment of this subspecies could be conducted using our data.

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Herpetological Conservation and Biology



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ALEXANDRE LAUBIN graduated with a B.S. in Wildlife Management from the Université de Paris XI, France. He worked in France for both National Natural Reserves and for the non-governmental organization Ligue pour la Protection des Oiseaux, as well as for the non-governmental organization Groupe d'Études et de Protection des Oiseaux de Mayotte (GEPOMAY) in the Mayotte French overseas department (Comoros Archipelago) studying and protecting threatened species. Since 2016, he has been working in Europa as conservation officer for the Terres Australes et Antarctiques Françaises (TAAF). (Photographed by Marion Bourgeois).

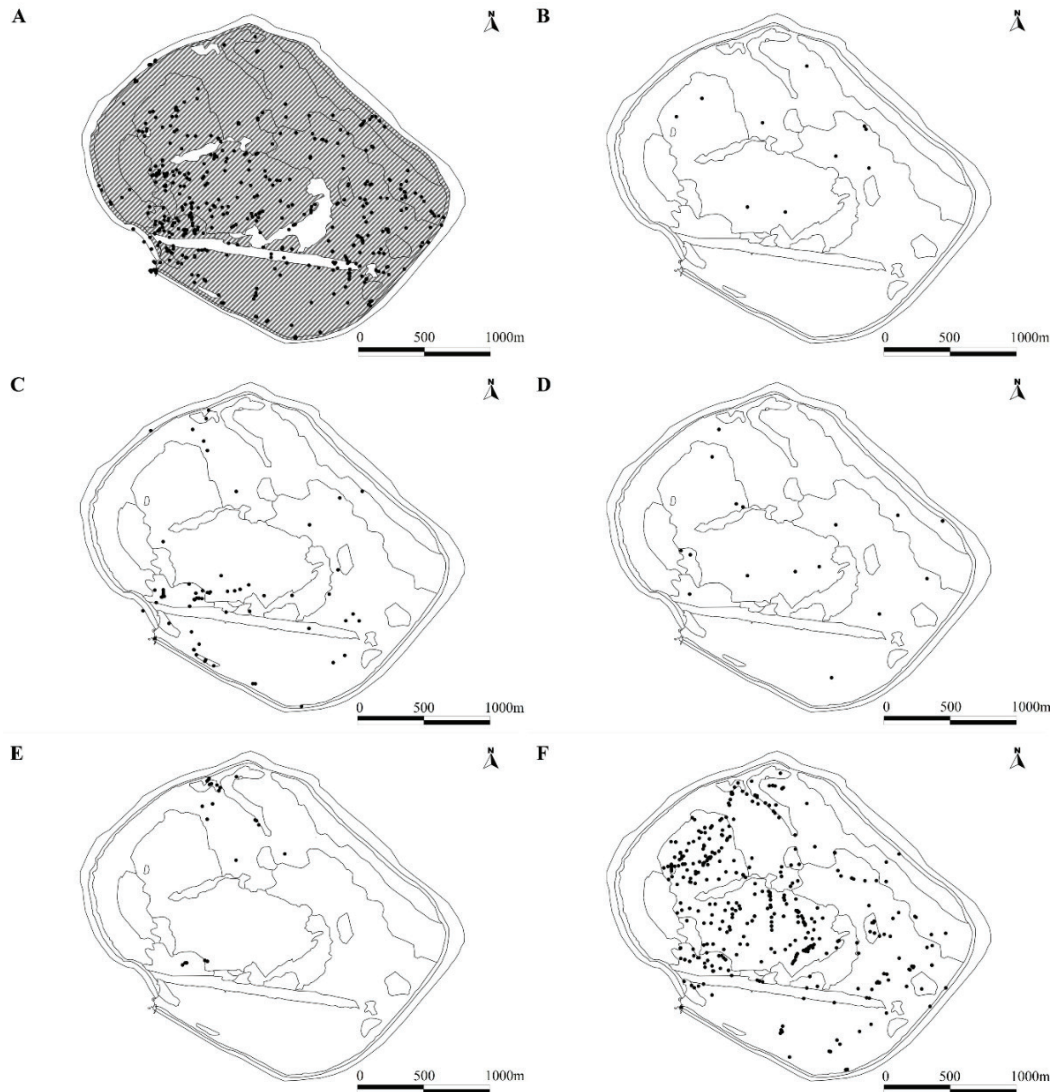
APPENDICES

APPENDIX TABLE 1. Natural habitats of Europa (Eur), Juan de Nova (Jdn), Grande Glorieuse (Glo), Ile du Lys (Lys), Ile aux Crabes (Crb), Roches Vertes (Rov) and Tromelin (Tro), area [ha] and survey points (italic: searching during day and night). Coastal habitats - CSB: Sand beach without vegetation; CRO: Rocky beach without vegetation; CHE: Herbaceous; CSH: Shrubs; CHS: Herbaceous and shrubs; CST: Shrubs and trees; CMA: Mangrove. Inland habitats - IPO: Pond area; ISS: Herbaceous salt steppes; ISM: Herbaceous salt-marshes; IHS: Herbaceous vegetation and shrubs; IST: Shrubs and trees; IEU: *Euphorbia* forest; IAN: Anthropogenic habitat (military camp, jetty, cemetery, excluding airplane landing strip); IAG: Agavaceae shrubs; ISH: Shrubland; ISP: Shrubs and trees on former phosphate mining area; IAP: Australian Pine forest; ICO: Coconut plantation. Preserved habitat is habitat with a low level of disturbance by invasive plants, and/or by human use.

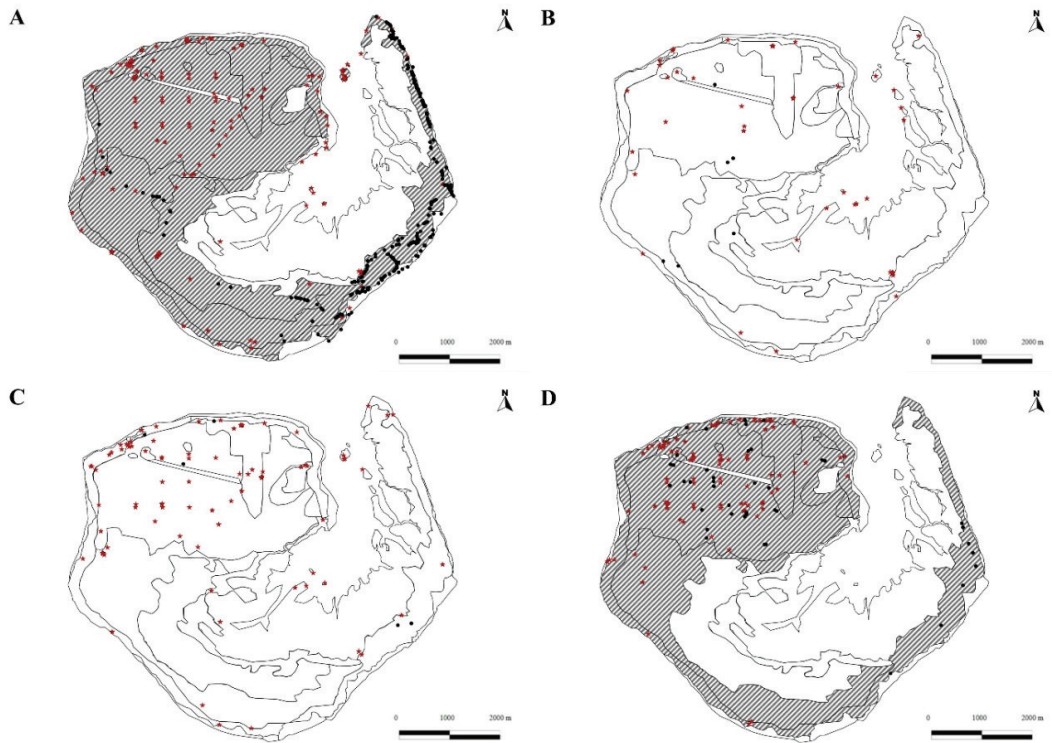
Location	Status	Habitat	Iles Glorieuses (Glo, Lys, Crb, Rov, Tro)								
			Eur	Jdn		Glo		Lys	Crb	Rov	Tro
			Area	Survey point	Area	Survey point	Area	Area	Area	Area	Area
Coastal	—	CSB	129.91	—	46.31	—	39.62	1.64	—	—	7.59
Coastal	—	CRO	5.83	—	—	—	—	1.71	0.12	0.20	2.55
Coastal	Preserved	CHE	—	—	—	—	—	8.13	—	<0.01	—
Coastal	Preserved	CSH	—	1; 2; 9	26.63	—	0.14	2.59	0.01	—	—
Coastal	Preserved	CHS	434.41	—	—	—	—	—	—	—	60.05
Coastal	Preserved	CST	—	—	—	7	16.70	0.42	—	—	—
Coastal	Preserved	CMA	698.06	—	—	—	—	—	—	—	—
Inland	Preserved	IPO	—	—	—	—	0.19	2.36	—	—	—
Inland	Preserved	ISS	323.10	—	—	—	—	—	—	—	—
Inland	Preserved	ISM	127.05	—	—	—	—	—	—	—	—
Inland	Preserved	IHS	488.30	—	—	—	—	—	—	—	—
Inland	Preserved	IST	—	3; 4; 16	219.44	<i>14; 15; 16; 17; 18; 19; 20; 21</i>	159.70	—	—	—	—
Inland	Preserved	IEU	739.66	—	—	—	—	—	—	—	—
Inland	Disturbed	IAN	10.02	—	1.54	6	16.12	—	—	—	0.92
Inland	Disturbed	IAG	104.96	—	—	—	—	—	—	—	—
Inland	Disturbed	ISH	—	—	—	22	15.49	—	—	—	—
Inland	Disturbed	ISP	—	7; 8; 10	33.86	—	—	—	—	—	—
Inland	Disturbed	IAP	—	5; 6; 11; 12; 13; 14; 15	186.23	<i>8; 9; 10; 11; 12; 13</i>	116.40	—	—	—	—
Inland	Disturbed	ICO	—	—	—	<i>1; 2; 3; 4; 5</i>	98.12	—	—	—	0.70

APPENDIX TABLE 2. Species and subspecies of reptiles, and status and habitats on Europa (Eur), Juan de Nova (Jdn), Grande Glorieuse (Glo), Ile du Lys (Lys), Ile aux Crabes (Crb), Roches Vertes (Rov) and Tromelin (Tro). For status, letters are E = Endemic, N = Native, I = Introduced, U = Undetermined, and symbols are * = Extinct, ? = Doubt about presence, X = Occurs; † = Occurs only on the edge, ‡ = Rare, ◊ = Foraging area. Abbreviations for coastal habitats are: CRO = Rocky without vegetation, CHE = Herbaceous, CSH = Shrubs, CHS = Herbaceous and shrubs, CST = Shrubs and trees; and CMA = Mangrove. Abbreviations for inland habitats are: IPO = Pond area, ISS = Herbaceous salt steppes, ISM = Herbaceous salt-marshes, IHS = Herbaceous vegetation and shrubs, IST = Shrubs and trees, IEU = *Euphorbia* forest, IAN = Anthropogenic habitat (e.g., military camp, cemetery), IAG = A gavaceae shrubs, ISH = Shrubland, ISP = Shrubs and trees on former phosphate mining area, IAP = Australian Pine forest, and ICO = Coconut plantation.

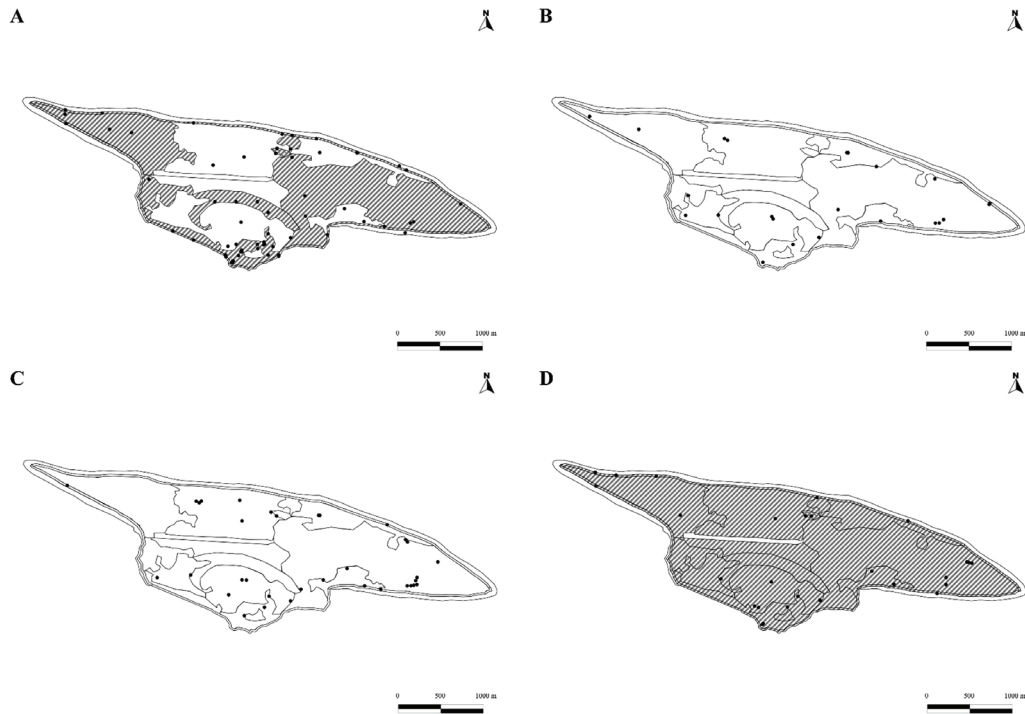
Species	Status	Eur										Jdn				Tro		
		CRO	CHS	CMA	ISS	ISM	IHS	IEU	IAN	IAG	CSH	IST	IAN	ISP	IAP	CHS	IAN	ICO
GEKKONIDAE																		
Merchants Gecko <i>Hemidactylus mercatorius</i>	Eur (U), Jdn (U), Tro (I)		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Flathead Leaf-toed Gecko <i>Hemidactylus platycephalus</i>	Jdn (U)								X	X	X	X	X					
Insular Dwarf Gecko <i>Lygodactylus insularis</i>	Jdn (E)								X	X	X	X	X	X	X			
Mocquard's Dwarf Gecko <i>Lygodactylus verticillatus</i>	Eur (N)		X	X			X	X	X									
SCINCIDAE																		
Europa Snake-eyed Skink <i>Cryptoblepharus bitaeniatus</i>	Eur (E)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Juan de Nova Snake-eyed Skink <i>Cryptoblepharus caudatus</i>	Jdn (E)								X	X	X	X	X	X	X			
Europa Speckle-lipped Skink <i>Trachylepis m. infralineata</i>	Eur (E)		X				X	X	X	X	X	X	X	X	X			
THYPHLOPIDAE																		
Brahminy Blindsnake <i>Indotyphlops braminus</i>	Eur (E)																	
CHAMAELEONIDAE																		
Pollen's Chameleon <i>Furcifer polleni</i>	Glo (E)																	
GEKKONIDAE																		
Stump-toed Gecko <i>Gehyra mutilata</i>	Glo (I)				X													
Common House Gecko <i>Hemidactylus frenatus</i>	Glo (I)	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Merchants Gecko <i>Hemidactylus mercatorius</i>	Glo (U), Lys (U)	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Flathead Leaf-toed Gecko <i>Hemidactylus platycephalus</i>	Glo (I)						X											
GERRHOSAUROIDAE																		
Madagascar Girdled Lizard <i>Zonosaurus m. insularis</i>	Glo (N), Lys (N)	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
PELOMEDUSIDAE																		
East African Black Mud Turtle <i>Pelusios subniger</i>	Glo (E)																	
SCINCIDAE																		
Glorioso Snake-eyed Skink <i>Cryptoblepharus g. gloriosus</i>	Glor. archipelago (E)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Valhalla Skink <i>Flexiseps valhallae</i>	Glo (E*), Lys (E*)																	



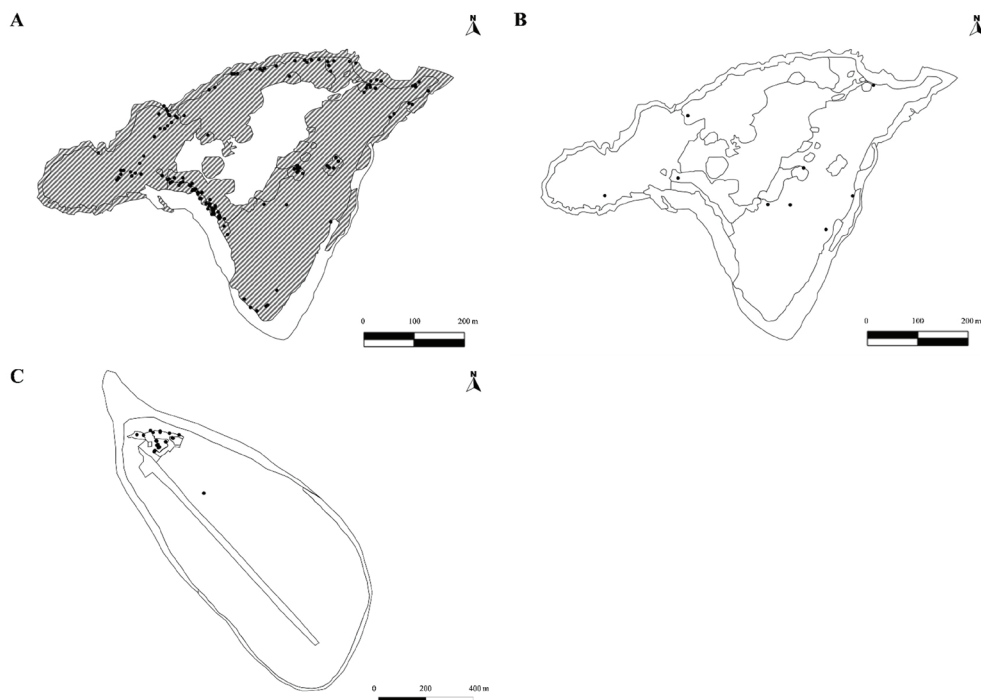
APPENDIX FIGURE 1. Distribution maps of (A) the Glorioso Snake-eyed Skink, *Cryptoblepharus gloriosus gloriosus*, (B) the Stump-toed Gecko, *Gehyra mutilata*, (C) the Common House Gecko, *Hemidactylus frenatus*, (D) the Merchants Gecko, *Hemidactylus mercatorius*, (E) the Flathead Leaf-toed Gecko, *Hemidactylus platycephalus*, and (F) the Madagascar Girdled Lizard, *Zonosaurus madagascariensis insulanus* on Grande Glorieuse, with area of occupancy (hatched area) for endemic subspecies. Black dots represent species distribution data.



APPENDIX FIGURE 2. Distribution maps of (A) the Europa Snake-eyed Skink, *Cryptoblepharus bitaeniatus*, (B) the Merchants Gecko, *Hemidactylus mercatorius*, (C) the Mocquard's Dwarf Gecko, *Lygodactylus verticillatus*, and (D) the Europa Speckle-lipped Skink, *Trachylepis maculilabris infralineata* on Europa Island, with area of occupancy (hatched area) for endemic species and subspecies. Black dots represent species distribution data collected in the surveys of this work; red crosses represent distribution data extracted from Sanchez and Probst (2015).



APPENDIX FIGURE 3. Distribution maps of (A) the Juan de Nova Snake-eyed Skink, *Cryptoblepharus caudatus*, (B) the Merchants Gecko, *Hemidactylus mercatorius*, (C) the Flathead Leaf-toed Gecko, *Hemidactylus platycephalus*, and (D) the Insular Dwarf Gecko, *Lygodactylus insularis*, on Juan de Nova, with areas of occupancy (hatched area) for endemic species. Black dots represent species distribution data.



APPENDIX FIGURE 4. Distribution maps of (A) the Glorios Snake-eyed Skink, *Cryptoblepharus gloriosus gloriosus*, on Ile du Lys, (B) the Merchants Gecko, *Hemidactylus mercatorius*, on Ile du Lys, and (C) *Hemidactylus mercatorius*, on Tromelin, with areas of occupancy (hatched area) for endemic subspecies. Black dots represent species distribution data.