

# SITE INFORMATION SHEET

## in support of a formal proposal to nominate a site for inclusion in the IOSEA Marine Turtle Site Network

**1. Date of submission (DD/MM/YYYY):**

The date on which the Site Information Sheet was completed.

12 / 12 / 2013

**2. Name and address of compiler(s), if not the IOSEA Focal Point**

Name and contact information (including affiliation) for the individual(s) who prepared this information sheet, for formal submission through the national IOSEA Focal Point.

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**3. Country:** The name of the country in which the site is located.

France

**4. Name of site:** The name of the site (alternative names should be given in brackets).

Europa

**5. Geographical coordinates**

The geographical coordinates (latitude and longitude) of the **approximate centre** of the site, expressed in 'decimal degrees'. For example, the location of the IOSEA Secretariat in Bangkok is 13.763483°, 100.508157°. If the site consists of two or more discrete units, the coordinates of the centres of each of these units should be given. (Add any additional coordinates in a separate annex.)

**Decimal  
Degrees**

-22.368491 °

, 40.363741 °

**6. General location**

Describe the general location of the site. This should include the site's distance (in a straight line) and compass bearing from the nearest significant administrative centre, town or city. The human population of the listed centre and its administrative region should also be stated. (See also the information requested under point 24: Site Map)

Europa Island, along with Juan de Nova, Glorieuses, Bassas da India in the Mozambique Channel, and Tromelin northeast of Madagascar, is part of the Îles Éparses in the Indian Ocean. These five islands form the Fifth District of the French Southern and Antarctic Lands (TAAF) under the Law of February 21, 2007. They are administered from TAAF headquarters based in Saint-Pierre, Reunion Island.

Europa is the southernmost of the Îles Éparses. It is located in the southern Mozambique Channel, 600 kilometres south of Juan de Nova, 300 kilometres southwest of Cape St. Vincent

(Madagascar) and 550 kilometres off the coast of Mozambique.

Europa does not host any permanent population in the strict sense. The human presence on site is limited to a military detachment of 14 men from 2<sup>nd</sup> RPIMA (“*Régiment parachutiste d’infanterie de marine*”, Marine-Parachutists’ regiment), a policeman (gendarme) and some scientists from time to time. Shift rotation occurs every 45 days on average through air transport (military aircraft) provided by the FAZSOI (Army Force of the Southern Indian Ocean Zone).

*In the remainder of this document, the codes that appear in square brackets alongside each of the titles below refer to sections of a separate document describing the evaluation criteria, which will be informed by the proponents’ submission. **Proponents are encouraged to consult the Evaluation Criteria document**<sup>1</sup> **for more explanation of the rationale behind each criterion and of the detailed information to be used for evaluation purposes.***

## 7. Area [N3]

*The approximate surface area of the site to be included in the network (in hectares or square kilometers). If the site is an island, indicate also the total surface area of the coastline directly relevant to turtle conservation. Area should correspond to the map provided under point 24.)*

The diameter of Europa is between 6 and 7 km, for a total land area of about 30 square kilometres. The reef area is about 47 square kilometres.

An internal lagoon covers a fifth of the island in the north-east (about 900 ha, including 700 ha of mangrove).

Territorial waters, which extend 12 nautical miles around the island, represent an area of 2,030 square kilometres.

The EEZ (Exclusive Economic Zone) delineated around Europa covers 127,300 square kilometres. The area to be specifically included in the network is the entire land surface and territorial waters, being 2,060 square kilometres altogether.

## 8. Physical features of the site [EB1- 4, S5, S6, N1]

*Describe the principal physical characteristics of the site, including the marine turtle habitat types occurring at the site. List the ecosystem types included in the site (nesting beach, foraging habitat, reproductive habitat, migratory habitat) and the approximate area in hectares (or km<sup>2</sup>) of each habitat type included. Indicate whether the site’s physical attributes are shared by other sites in the country, or are exceptional/unique.*

### **Geomorphology**

Europa is a lifted atoll characterized by a significant karstic structure. Its diameter is between 6 and 7 km, for a total land area of about 30 square kilometres and 47 square kilometres of reef area, all geomorphologic features combined. The island, pentagonally shaped, is low and sandy. It has a belt of dunes between 6 and 7 metres high and is surrounded by an almost continuous fringing reef, interrupted by sandy beaches.

According to Battistini (1966), the current morphology of Europa would have largely inherited the morphology of a former karimbolien atoll (125,000 years ago) with land about 3 metres above water, which included a living coral belt and a central lagoon whose coral sludge was transformed into a fine-grained limestone (Battistini, 1966).

Four distinct geomorphologic features have been identified on Europa (Quod *et al.*, 2007; Andréfouët *et al.*, 2008) :

### **Emerged land masses**

Beside habitats and vegetation systems present on the land of the island, lakes, ponds, sinkholes and tidal influenced resurgences are found lying on skeletal soils. These reveal a complex karst system that determines the functioning of the wide variety of coastal wetlands on the island.

<sup>1</sup> Criteria for the Evaluation of Nominations to the Network of Sites of Importance for Marine Turtles in the Indian Ocean – South-East Asia Region, IOSEA Marine Turtle MoU Secretariat. <http://ioseaturtles.org/sitenetwork-evaluation.php>

## **Lagoon**

First, it should be noted that the lagoon is rather an outlet of internal vacuum resulting from filling during Flandrian quaternary of a karimbolien atoll lagoon, than a true lagoon.

Very shallow with a depth of only a few tens of centimetres at low tide, the lagoon covers an area of about 8 square kilometres, including mangrove in the southern and eastern portions. In the absence of a true channel, the lagoon connects with the sea by a shallow spillway that notches the erosion platform (Quod *et al.*, 2007). There is also a small diverticulum called "small lagoon" separated from the "big lagoon" by a sand spit lying on rocks.

The substrate of the lagoon is mainly composed of coral sand (Arvam, 2003).

The lagoon is a remarkable example of morphodynamic interactions between mangrove, coral reefs, sedimentary limestone substrates and dunes, and karstic and hydrogeological formations and activities.

The lagoon also holds karst outlets shaping underground seawater systems between the lagoon and the sea. Hydrogeological circulations are mainly found in the east and the south of the island, represented by small sinkholes surrounded by healthy micro-atolls composed of Porites. The presence of these outlets is essential for oxygenation and also helps to adjust the oscillating volume of seawater in the system and the hydrodynamic flow of the lagoon.

## **Reef flat**

The reef flat is an abrasion platform shaped in a fossil reef (Battistini, 1966). The 200 to 600 metre wide reef flat emerges at low tide. The grooves on the reef flat run from the coral substrate of the island to the reef slope (Delépine *et al.*, 1976).

In the north of the island the reef flat has expanded outward with the addition of a true fringing reef with a width of a few dozen metres (Battistini, 1966).

## **Outer slope**

The outer slope begins with a fall of about ten metres, which displays caves and tunnels. A platform and a subvertical drop-off extend beyond this fall (10 to 25 metres deep). This may begin at 15 metres deep and ends with a sand accumulation (Delépine *et al.*, 1976).

The outer slope is usually very marked and home to a wide variety of corals in the area of breaking waves (Battistini, 1966). Coral communities are dominated by massive and encrusting forms of hard corals. Fish populations are abundant, including a high number of carnivores (Arvam, 2003).

## **Habitats used by turtles**

Two species of sea turtle, green turtle (*Chelonia mydas*) and hawksbill turtle (*Eretmochelys imbricata*) are present at Europa. The seagrass beds, coral reefs, beaches and mangrove habitats are of great importance for these two species in particular to meet biological functions.

## **Seagrass meadows (feeding habitat for immature green turtles)**

Seagrasses present in Europa mangrove are composed of a dominant species, spoon seagrass (*Halophila ovalis*), as well as few others such as narrowleaf seagrass (*Halodule uninervis*), sickle seagrass (*Thalassia hemprichii*) and smooth ribbon grass (*Cymodocea rotundata*). These seagrasses have a cover rate of <5% and occasionally about 5-25% (Bourjea *et al.*, 2006). *Thalassia hemprichii* is present in the reef channel, and on sandy and detrital substrates of the fringing reef. *Halophila ovalis* and *Halodule* sp. are located mainly in the arms of the mangrove and on sandy substrates and sandy mud of the lagoon floor (Bourjea *et al.*, 2010). Although adult green turtles do not visit these seagrasses (Bourjea *et al.*, 2011), this is not the case for immature green turtles. Immature green turtles have indeed been observed grazing *Halophila ovalis* in the mangrove.

### **Mangrove (growth habitat for immature green and hawksbill turtles)**

The mangrove of Europa covers an area of 700 ha and falls within a large Indo-Pacific phytogeographic unit. Ecological diversity of the mangrove is unique and is associated with hydrodynamic conditions, substrate, salinity and bank exposure. The mangrove of Europa exhibits strong ecological, structural, plant and typological affinities with other atolls in the Indian Ocean, including mangroves of Aldabra Islands and Cosmoledo (Boullet, 2008). Europa mangrove has never been exploited or destroyed by humans. As such, it constitutes a pristine system among the last remnants in the south-west Indian Ocean.

Geomorphologic and hydrographic conditions make the mangrove very suitable for the development of immature green and hawksbill turtles (Bourjea *et al.*, 2006). In addition, the mangrove serves as a protection site for juveniles of both species.

There is also in the mangrove a resurgence area of external seawater. The marine ecosystem associated with this resurgence is similar to that of the outer lagoon of the island, with the presence of tropical species of fish and coral that are typically found in coral reef flats (Bourjea *et al.*, 2006). The resurgence is a remarkable development habitat of hawksbill turtles, their main food (*Actinia* sp.) being present in large amounts while being protected from predators (Bourjea *et al.*, 2011).

### **Coral reef (foraging area of hawksbill turtles and breeding site for green turtles)**

Hawksbill adults are present on the reef of Europa, representing 23 square kilometres of coral structures (Bourjea *et al.*, 2006).

No foraging adult green turtle has been observed on the reef, due to low availability of seagrasses. No observations to date have mentioned adult green turtle feeding on algae at Europa. Adult green turtles observed in the reef are essentially breeding individuals.

### **Beaches (nesting sites for green turtles)**

Only a third of Europa beaches are available for green turtles nesting on the island. The remaining two-thirds are rocky beaches that make it almost impossible to access them.

As part of a partnership between Ifremer / Kélonia and the National Gendarmerie, the gendarme has been monitoring the number of turtle tracks on the island beaches on a daily basis since June 1983; It is to be noted that this monitoring is only performed along 1,600 m of the coastline, corresponding to the 26% of sandy beaches accessible to marine turtles (Le Gall *et al.*, 1988. Lauret-Stepler 2007 Bourjea *et al.*, 2010, Dalleau *et al.*, 2012).

## 9. Ecological resources [EB1- 4, S5, S6, N1]

Describe the ecological resources at the site, including marine turtles and other noteworthy biodiversity. Describe the marine turtle species / management units occurring at the site, if they are known. Where possible, provide an abundance estimate for each marine turtle species/management unit (e.g. in terms of average number of turtles nesting annually or foraging). Evaluation Criteria EB1a and EB1b offer guidance on how to describe the relative importance of a site frequented by one or more marine turtle species. Indicate whether the site's ecological resources are shared by other sites in the country or are exceptional/unique.

Europa is by far the most pristine of the Îles Éparses. This island has indeed never been exploited in the past, or at least never to the same extent as Juan de Nova and Glorieuses Islands have been. Its marine and terrestrial habitats have therefore never been significantly modified by humans, which makes Europa such a unique nature sanctuary in the South-west Indian Ocean, as all other coastal ecosystems in this region have been dramatically impacted by human activities.

This remote tropical island, preserved from most human impacts, is a safe haven for numerous marine species (such as marine turtles, seabirds, marine mammals, sharks and various species of reef fish), among which many are designated as endangered or vulnerable in the IUCN Red List or listed in international Conventions. For instance, 13 species are considered vulnerable, endangered or critically endangered by the IUCN, 14 are listed in appendices I and II of the Bonn Convention (Convention on Migratory Species), 70 species are listed on the appendix II and 4 on appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Green (*Chelonia mydas*) (EN) and Hawksbill (*Eretmochelys imbricata*) (CR) turtles are both covered by both of the above conventions.

### **Marine biodiversity**

978 marine species have been described on Europa through scientific missions. Though the marine diversity is best known on Europa (compared to the other Îles Éparses), this knowledge on specific diversity remains scarce due to the low survey effort. Several taxonomic groups are still to be surveyed in order to complete the inventories, including nocturnal, cryptic and pelagic species. Additionally, several components of the ecosystem remain unexplored such as the marine part of the mangrove, the outer reef slopes under 40 metres depth and deep sea ecosystems outside the lagoon (under 200 metres depth).

The pristine mangrove and the seagrass meadows bordering the lagoon largely contribute to Europa's environmental value. These habitats are of high importance for the development of immature Green and Hawksbill turtles. The Mangrove is additionally a nursery for black tip sharks (*Carcharhinus melanopterus*) and sicklefin lemon sharks (*Negaprion acutidens*) (VU).

380 species of bony fish associated with coral reefs have been identified on Europa, including several species of high heritage value such as the Humphead wrasse (*Cheilinus undulatus*) (EN), the blacksaddled coral grouper (*Plectropomus laevis*) (VU) and the Bigeye Tuna (*Thunnus obesus*) (VU).

Thirteen species of shark have also been reported in Europa's waters including four species listed on the IUCN Red List as vulnerable and two as endangered. Four of those species, as well as one species of ray are also concerned by the CITES convention: the oceanic whitetip shark (*Carcharhinus longimanus*), the scalloped hammerhead shark (*Sphyrna lewini*), the great hammerhead shark (*Sphyrna mokarran*), the smooth hammerhead shark (*Sphyrna zigaena*) and the manta ray (*Manta spp.*).

Seven species of marine mammals have been spotted in Europa's waters: three species of whale and four of dolphin. The Fin whale (*Balaenoptera physalus*), which is of very high interest for conservation (EN), has also been observed in Europa's waters.

With regards to its little size, Europa Island hosts one of the most diverse avifauna of the Mozambique Channel. Eight species of marine birds, out of the 16 represented in this region, breed on Europa, including two species of frigatebirds (*Fregata minor* and *Fregata ariel*), Red-footed boobies (*Sula sula*), one of the largest colonies of Sooty terns (*Sterna fuscata*) and an endemic subspecies of the tropic bird, the White-tailed tropicbird of Europa (*Phaethon lepturus ssp. europae*). 3 million pairs are estimated to be breeding each year on the island, nearly accounting for a quarter

(25.3%) of the total number of breeding seabirds in the Mozambique Channel (LeCorre and Jaquemet, 2005).

### **Terrestrial biodiversity**

Europa's land surface hosts 212 species (fauna and flora). The island and its terrestrial habitats are remarkably well preserved and remain sanctuaries in this region where antropogenic pressures are very high on coastal and insular environments.

The terrestrial habitats of Europa, including the Mangrove, the sansouires and the salt steppes are in an exceptionnal state of conservation unlike any other similar habitats in the South West Indian Ocean.

The entomofauna of Europa shows a very high level of endemism (17 species, being 16.5% of the total entomofauna of Europa). Europa additionnaly hosts 4 species of terrestrial reptiles, half of them being endemic subspecies (two species of Scincidae).

The island finally hosts a small resident population of Madagascar Pond Herons (*Ardeola idea*) which is listed as endangered on the IUCN Red list (EN), as well as an endemic subspecies of passerine, the Malagasy White-eye of Europa (*Zosterops maderaspatana* ssp. *voeltzkowi*).

### **Relative importance of the different management units occurring at Europa for marine turtle species**

#### **Nesting areas**

Europa Island plays a key role in maintaining the Green turtle populations of the Indian Ocean.

Through a partnership between the French Research Institute for Exploitation of the Sea (Ifremer), the Observatory of Marine Turtles of La Réunion (Kélonia) and the National Gendarmerie, turtle tracks have been monitored on a daily basis along 1,600 metres of the sandy beaches of Europa (being 26% of the accessible nesting beaches for turtles on the island) since 1983. The data collected showed that Green turtles are nesting all year long with a clear peak during the austral summer, from November to February (Le Gall *et al.*, 1986; Le Gall 1988; Lauret-Stepler *et al.*, 2007). Data from 1983 to 2007 revealed an increase of 2% in the annual number of tracks monitored on Europa's beaches (Lauret-Stepler *et al.*, 2007). Bourjea *et al.* (2011) however underlines that these results must be taken carefully as they do not necessarily reflect an increase in the number of nesting females. In order to be able to link these two results, the stability of individual reproductive parameters throughout this period of time must be studied (egg-laying effort and success).

According to the authors, Europa can nevertheless be considered as the most important nesting site for Green turtles in the Indian Ocean regarding the annual number of nesting turtles, estimated between 2,000 and 11,000 in 1986, and the average annual growth rate of 2% for turtle tracks.

Finally, the genetic structure of the population of turtles nesting on Europa has been proved to be linked to the Atlantic population, making it the only marine turtle population in the Indian Ocean known to have genetic characteristics very similar to those of the Atlantic population.

It is to be noted that Hawksbill turtles do not nest on Europa. Bourjea *et al.* (2011) estimated the population size of immature hawksbill turtles to be 20-40 over an area of 7,000 to 10,000 m<sup>2</sup>.

#### **Foraging areas**

Europa island is not a major site for marine turtles foraging.

Adults of Green turtles do not seem to use seagrass meadows of Europa (Bourjea *et al.*, 2011), unlike a population of immature individuals of the same species estimated at a couple of hundred (Bourjea com. Pers.), which have been observed while grazing on *Halophila ovalis* in Europa's Mangrove.

It is to be noted that the resurgence of seawater inside Europa's mangrove is probably an important feeding ground for hawksbill turtles, as they are commonly observed in this area where their main

food (*Actinia* sp.) is present in large amounts.

### **Development area**

Europa is indeed a major site for the development of Green and Hawksbill turtles.

Geomorphologic and hydrographic conditions are very suitable for the development of immature Green and Hawksbill turtles (Bourjea *et al.*, 2006). In addition, the mangrove is a protection site for juveniles of both species.

The resurgence of external seawater in particular is a remarkable habitat for development of hawksbill turtles, their main food (*Actinia* sp.) being present in large amounts while being protected from predators (Bourjea *et al.*, 2011). Bourjea *et al.* (2011) estimated the population size of immature hawksbill turtles to be 20-40 on an area of 7,000 to 10,000 m<sup>2</sup>.

A study was also done on population genetics of juvenile green turtles that use the lagoons of Îles Éparses as a development habitat. Results showed that even if there are no differences between nesting and immature genetic structure in Juan de Nova, differences were found for Europa and Glorieuses (Taquet, 2007). Those results indicate that an important mixing may take place during the pelagic phase of the life cycle of green turtles born in Europa and Glorieuses and that there is no mechanism that structures the recruitment of juveniles in the development habitat at least for Europa and Glorieuses. The genetic composition of juveniles present in Europa is therefore the result of a pelagic mixing of hatchlings coming from both genetic stocks known in the western Indian Ocean (Bourjea Pers. com.)

## **10. Cultural importance [S1]**

*Describe the cultural / religious / spiritual importance of the site (e.g. in terms of historical associations, spiritual traditions, religious significance etc.), as well as non-consumptive traditional beliefs/practices, in relation to marine turtles. If possible, provide references to published/unpublished historical or other accounts, which may give an indication of relative importance in a national context.*

Europa Island was very likely discovered during the 16<sup>th</sup> century when the route to India was in the midst of its expansion. After several unsuccessful attempts of human settlement, a meteorological station was finally installed in 1949 and a continuous human presence has been maintained since then (beginning with only a handful of meteorologists staying to operate the station).

In 1960, Europa was annexed by the government of the French Republic. Since the regional political crisis of 1973, Europa, as well as Juan de Nova and Glorieuses Islands, hosts a military detachment of 14 men from the 2<sup>nd</sup> RPIMA (Marine-Parachutists' regiment) and one policeman (gendarme of La Réunion). This detachment assures French sovereignty over the island and operates and maintains the base's infrastructures. Shift rotation occurs every 45 days on average through air transport (military aircraft) provided by the FAZSOI (Force Army Southern Indian Ocean Zone).

Since 2007, this detachment has frequently been complemented by groups of scientists staying for short or long periods of time (from two days to several weeks) to conduct research projects.

A few vestiges of the historical human presence have been found on Europa, which attest of the historical attempts to settle on this hostile island. It is therefore possible to stumble upon a cemetery while walking along the north coast of the island or to observe old wells buried in the sand and various ruins associated with an ancient Sisal exploitation.

In 2009, the DRASSM (Department for Subaquatic and Submarine Archeological Research) located four wrecks dislocated on the higher part of Europa's reef flats, along the south coast of the island which is the windward coast much more exposed to the open sea swell. The oldest wreck might be from the mid-19<sup>th</sup> century. Two other vessels from the same period mentioned in national archives (gendarmerie) are thought to have wrecked near the meteorological station, though they have not been found yet.

Overall, Europa has been relatively recently discovered and never had a permanent population. As a consequence, its cultural, religious or spiritual heritages are relatively poor.

## 11. Jurisdiction [G1]

*The name of the government authority with: (a) territorial jurisdiction over the site, e.g. state/province, region or municipality etc.; and the name/description of the authority with (b) functional jurisdiction for conservation purposes, e.g., Department of Environment, Department of Fisheries, traditional owners, etc.*

### **Territorial Jurisdiction**

The Southern and Antarctic Lands (TAAF) authority became responsible for the management of the Îles Éparses on 3 January 2005 by Ministerial order, though the five islands were not at that time officially attached to the TAAF territories. On 21 February 2007, under the national law 2007-224, the Îles Éparses officially became the fifth district of the TAAF along with Kerguelen, Crozet, Saint Paul and Amsterdam, and the Terre Adélie on the Antarctic continent.

### **Functional jurisdiction**

The TAAF are an ultramarine local authority with legal personality and are legally and financially independent from the French Government. They are indeed explicitly referred as such in Article 72-3 of the Constitution of the French Republic, within the section dedicated to its local authorities, since the revised Constitution of 28 March 2003.

The TAAF come under the legislative specialty rule and as a consequence none of the national legislations (whether they are laws or regulations) automatically apply to the TAAF territories, unless it is specifically mentioned otherwise. The sovereignty legislations are the only exception to this principle as they systematically apply to all French territories.

The TAAF are placed under the authority of a senior administrator, who is designated since 2005 among the body of prefects. Its administrative powers are attributed in accordance with the national law of 6 August 1955 and the associated implementing Decree of 11 September 2008. The Prefect is both the State representative for the local territory and the executive authority for the administration. He is represented in each district of the TAAF by a District Commander, except on the Îles Éparses where his legal representative is a Gendarme (Military police officer). As the State representative, the Prefect is the Depositary of the State authority; he therefore represents the Government and receives its instructions directly from the Minister for Overseas Territories. The Prefect is in charge of the national interests, is responsible for law enforcement and is the State representative before the court if necessary. He issues the appropriate general directives of the Public Administration. He is, amongst other things, bound to guarantee the maintenance of public order and public security, the protection of citizens and their rights, as well as the conservation of the environment. As the local authority, the senior administrator ensures that the interests of the territory are taken into account in national and international policies, represents the TAAF before the court if necessary and finally can, with regards to its competencies, adapt Ministerial orders or Decree to the specificities of its territory.

The Prefect is empowered to manage all resources of the territory and more specifically to ensure the sustainable management of fisheries. In accordance with the Article 3 of the national law n°66-400, he is responsible for managing fish stocks within its territory and thus is in charge of drafting fisheries regulations and recommendations, delivering fishing licenses, fixing the Total Allowable Catches (TAC) as well as the dates for fisheries opening, and finally of setting and raising fishing fees. Right after the Îles Éparses were attached to the TAAF, the Ministerial Decree establishing the conditions for fishing activities in TAAF waters (Decree n°96-252) was revised to include the Îles Éparses (Decree n°2009-1039 of 26 August 2009). Regulations were then edited by TAAF to provide a better framework for this new tropical fishery (mainly targeting tuna species) and prefectural orders establishing fishing conditions and recommendations have since been updated each year to be in line with best available scientific knowledge and national or regional regulations (e.g. IOTC).

TAAF present the particularity of having no permanent population and therefore have neither voters nor elected representatives or local deliberative assembly. The senior administrator can nonetheless rely on a Consultative Committee and is assisted by a Secretary General, a Director of the Office, several District Commanders, numerous project managers and if needed can ask for the assistance



of local civilian administration of State services based in La Réunion Island.

Finally, the Îles Éparses come under the military high command of the FAZSOI (Force Army Southern Indian Ocean Zone) and fall within the jurisdiction of La Réunion Regional Court (Tribunal de Grande Instance de Saint-Denis de La Réunion).

## 12. Management authority [G1]

*Name, address and contact details of the body responsible for the direct local conservation and management of the site.*

Headoffice of the French Southern and Antarctic Lands (TAAF)

Rue Gabriel Dejean

97410 Saint Pierre

La Réunion Island

Phone number : +262 (0)2 62 96 78 78

## 13. Current protected status and governance framework [G1, S4]

*Describe any applicable legislation / regulations (or traditional laws / norms) relevant to the protection / conservation of marine turtles and their habitats at this site, and comment on their effectiveness. Include details of how any incompatible human activities and/or uses of land and sea at the site are prohibited or mitigated.*

*Mention any nationally relevant protected area status, international conservation designations and, in the case of transboundary sites, bilateral or multilateral conservation measures which pertain to all or part of the site. If a protected area or reserve has been established (at a national/regional level), give the date of its establishment and size. If only a part of the site is included within a protected area, the area of marine turtle habitat that is protected should be noted.*

*International designations may include sites listed under the UNESCO/World Heritage Convention, Man and Biosphere Reserve Network, Ramsar Convention, other site conservation networks, etc. Where appropriate, list the IUCN (1994) protected areas management category(ies) that apply to the site.*

As every other Îles Éparses (except Juan de Nova), Europa is designated as a Natural Reserve under the prefectural order n° 13/DG/IOI signed on 18 November 1975. This status forbids “all depredation on marine or terrestrial fauna and flora”, therefore prohibiting all sorts of botanical or zoological sampling (including dead organisms and minerals resulting from bioconstruction), unless a specific authorization is delivered by the administration (usually for scientific programmes). It also protects the site from any kind of disturbances to wild fauna and from environmental degradations (e.g. no waste dumping allowed). With regard to this level of protection Europa could be classified as a category Ia terrestrial protected area (the strictest) according to the IUCN protected areas framework.

The conservation of marine fauna and flora in terrestrial waters (12nm) mainly rely upon another local regulation, the prefectural order signed on 15 February 1994. This legislation “bans all kind of fishing activities within the 12 nautical miles of Europa as well as around Tromelin, Glorieuses, Juan de Nova and Bassas da India”. Again, specific authorizations can be accorded by the administration for scientific purposes.



Europa island additionally became the 42<sup>nd</sup> French site listed under the Ramsar Convention on October 27, 2011. The island was nominated because of its exceptionally pristine habitats but also for its importance as a breeding or nesting area for numerous protected and endangered species such as marine turtles. Europa being one of the most important sites in the world for green turtle reproduction and a major site for immature of hawksbill turtle development in the South-west Indian Ocean, it was then underlined that these pristine wetlands (mangrove, coral reefs, etc.) should be preserved at all costs. The management plan for this site is currently being elaborated by the administration with scientific support.

Additionally, the project to classify Europa as a National Natural Reserve was officially included in the French political agenda in December 2009 (adopted in the National “Blue Book for the Sea” and validated during the following Inter-ministerial Committee for the Sea – CIMer). Once the national

reserve is created a budget will be attributed each year by the French government and dedicated to implement conservation actions on Europa (five-year management plan), including several actions targeting marine turtles conservation.

Finally, Europa has been identified in 2013 by the IUCN as a potential candidate to be listed among other French sites under the UNESCO World Heritage Convention.

#### 14. Land/sea tenure/ownership [G1]

*Provide details of ownership of the site and ownership of immediate surrounding areas (e.g., state, provincial, private, etc.) which may have a bearing on the conservation of the site. Describe any local or customary law relevant to the land / sea tenure, and explain any terms that have a special meaning in the country or region concerned.*

All the territories managed by the TAAF administration, whether marine or terrestrial areas, belong to the public domain. As such, there is no private property on or near the island of Europa that could influence conservation processes.

Similarly, no specific concession is to be reported on Europa Island.

#### 15. Socio-economic values and land/ocean uses and activities within the vicinity of the site [EB4, G5, S2, S5, S6]

*Describe, in general terms, the principal social and economic values of the site, including human activities and land uses (past, current and planned) within the vicinity of the site (e.g., agriculture, fishing, resource extraction, grazing, water supply, urban/industrial development, tourism, outdoor recreation, education and scientific research), irrespective of whether or not they are considered to directly impact the conservation of marine turtles. Some indication of the relative importance of each form of land use should be given, whenever possible.*

##### **Past and present terrestrial activities**

Europa is the most unspoiled district of the Îles Éparses. Indeed, it has not been exploited in the past (unlike Juan de Nova or Glorieuses) and its landscapes and natural habitats have remained free from any significant change. The natural and primal character of this island makes it exceptional in a regional context where human pressures are particularly important.

Europa Island was discovered in the 16<sup>th</sup> century, during the development of the route to India. Even so, the first colonists only settled in 1860: French people from Tuléar, les Rosiers. They brought with them chickens, rabbits and goats which then returned to the wild. Today, only the goats remain on Europa.

In 1903, a small concession was granted to individuals who certainly lived from fishing and gathering the eggs of birds and turtles. A European and a few Malagasy lived that way for some time until they were evacuated due to a lack of fresh water.

The history of the various successive settlers is vague. It appears that a small population of fishermen and hunters was present in 1910. They probably built the old buildings of the island (boxes, tanks, dryers, ovens). There is also a small cemetery where two women, who died in March and May 1910, are buried. Later settlers probably built the sisal plantation, which thereafter returned to the wild. When Dr. Poisson stopped on the island in 1923 it was uninhabited. Europa probably hosted shipwrecked sailors during the First World War.

The construction of the meteorological station in 1949 let people permanently settle in Europa. The following year, a 60-metre long SSE/NNW oriented runway was built in the south of the island. Two other runways followed it because the places they were built were liable to flood. The last one was inaugurated on 18 April 1973 and is located in the north of the island. In 1981, a new station was built under the direction of the meteorological engineer Marc Gérard. It is called the « Station des Rosiers », in tribute to the first inhabitants of the island.

Europa was annexed by the Government of the French Republic in 1960. Just as Juan de Nova and Glorieuses, Europa has hosted a military unit ensuring the sovereignty of France since the 1973 regional political crisis. This detachment consists of a group of 14 men of the 2<sup>nd</sup> RPIMA and a gendarme relieved every 45 days.

Three main sets of infrastructures are today present in the Europa island:

- the runway built in 1973,
- the military camp (located at the north-western end of the runway)
- the weather station, built in 1981

All of these structures are located in the northwestern part of the island.

### **Fishing activities**

Two distinct types of fisheries are carried out in the marine territories of the Îles Éparses: industrial and artisanal fisheries.

Industrial fishing is done offshore (beyond 12 nautical miles for bottom-line fishing and 24 nautical miles for seine fishing) and mainly targets tropical tuna and swordfish. This type of fishing is prohibited in the territorial waters of the Îles Éparses, including Europa, as stated in the Order N°257 of the prefect of la Réunion, dated 15 February 1994. Beyond 12 nautical miles, fishing is subject to authorization from the prefect, senior director of the TAAF. Licences must be granted for deep sea fishing, which is mainly seine fishing practiced by French and Spanish vessels. The legal framework for these activities is set out in a prefectural order containing technical requirements that aim at managing sustainably the fishery resources and reducing the impacts on ecosystems.

Artisanal fishing, usually associated with coral reefs, is not allowed in the territorial waters of the Îles Éparses, as set out by the prefectural order N°257 dated 15 February 1994.

### **Scientific research activities**

The international scientific community considers that the location of the Îles Éparses and their exceptional state of preservation provide unique opportunities for the development of international research. The scientific work conducted on these islands, as well as on other territories managed by the TAAF, can help address global challenges, such as the effects of global climate change, changes in biodiversity, geosciences, etc.

Beyond allowing research development in the tropics, the integration of the Îles Éparses within the TAAF territories enables to consider developing research on a latitudinal gradient that extends from the 13<sup>th</sup> southern parallel (with Glorieuses Islands) to the 66<sup>th</sup> southern parallel (with Terre d'Adélie). This gradient, which extends over more than 80% of the Southern Hemisphere, is exceptional for France. The establishment of a biodiversity observatory throughout this gradient will sustain the major position of France in the Indian Ocean and, more generally, in the southern hemisphere.

Moreover, the ongoing and future scientific programmes at the site enable France to meet some of its regional and international commitments. By way of example, all of the research work carried out on marine turtles serves to populate the database of the IOSEA MoU and, in compliance with France's commitments, to help draft a plan for the conservation and management of marine turtles in the South-west Indian Ocean. Similarly, France has ratified the Nairobi Convention and shall, in accordance with the objectives of the Convention, ensure the protection and management of marine and coastal areas that fall under the Convention, and ensure an adequate natural resource management from the point of view of the environment. Some species in the Îles Éparses are listed under the Nairobi Convention and must therefore be particularly protected.

Unlike the in the sub-Antarctic islands and Terre d'Adélie, the Paul-Emile Victor Polar Institute (French acronym IPEV) has no jurisdiction over the development of scientific programmes on the Îles Éparses. Between 2005 and 2009, the TAAF have therefore taken the responsibility of addressing requests from scientists that wish to work on the Îles Éparses.

In order to secure for the Îles Éparses a logical research framework that meets the expectations of the State with regards to knowledge and development, the TAAF requested the assistance of the Institute of Ecology and Environment (CNRS-Inee). This project is now led by Inee in collaboration with the National Institute of Sciences of the Universe (CNRS-INSU), the Institute of Research for

Development (IRD), the Agency for Marine Protected Areas (AAMP), Ifremer, the Muséum National d'Histoire Naturelle (MNHN), the Paul-Emile Victor Polar Institute (Ipev), the Foundation for Research on Biodiversity (FRB) and the TAAF.

Thanks to the financial support of the consortium members, to the equipment provided by FAZSOI (use of Transalls and of infrastructure on the islands) and logistical support from TAAF (provision of the Marion Dufresne in 2011, link with the military for the organization of missions), more than 100 field missions in total were carried out in nearly three years of research within the framework set for 2011-2013.

Thus, multidisciplinary programs enabled to bring new knowledge on marine and terrestrial ecosystems as well as on interactions between these. Some marine biodiversity monitoring stations (11 Biodiversity stations and 6 GCRMN stations on Europa; 24 Biodiversity stations and 6 GCRMN stations on Glorieuses islands; 27 Biodiversity stations and 7 GCRMN stations on Juan de Nova; and 2 GCRMN stations on Tromelin) and terrestrial habitats monitoring stations (60 permanent plots on Europa, 63 on Glorieuses, 71 on Juan de Nova and 46 on Tromelin) were respectively established by the BioRéCIE programme and the CBNM. Observational stations dedicated to sciences of the universe (tide gauges, seismometers, GPS, etc.) were also set up. These programmes also allowed a comprehensive mapping of terrestrial habitats of all islands and of the marine habitats of Europa island to be undertaken (via a complementary Ifremer-funded project). Many of the collected samples are still being analyzed and the end of the consortium will be the opportunity to consolidate all of the results obtained from all of the programmes.

On Europa, research activities conducted within the CNRS-Inee Consortium in the period 2011-2013 helped to carry out 41 scientific missions. The disciplines covered by these missions are numerous and involve the study of terrestrial and/or marine organisms and ecosystems, genetic connectivity, conservation biology, climatology as well as geosciences. It should be noted that the presence of the Marion Dufresne scientific vessel in 2011 in the Îles Éparses largely contributed to this scientific effort, with 15 scientific missions that were able to access the island. All of these missions represent a cumulative total of 664 days-men on the field and required the use of 17 Transalls and 6 sailboats.

Given these figures, Europa is the island that hosts the most scientific missions. This shows the interest of the scientific community vis-à-vis Europa and must be closely related to the biological richness and exceptional state of preservation that characterize it.

Given that the Research Consortium established for 2011-2013 officially ends this year, TAAF is already planning, in collaboration with CNRS-Inee, to launch a new call for proposals to continue research activities in this reference territory.

Research activities will also continue on a regional level through the implementation of the tenth European Development Fund (EDF) including campaigns on « Estimation of fish biomass of the banks of Geysier, Zélée and Iris », « Exploration of outer slopes and seamounts », and « Inventory and monitoring of coral reefs in Mayotte and Îles Éparses ».

Research activities will also continue through sustaining terrestrial and marine monitoring stations so as to allow the Îles Éparses soon to serve as a reference in the context of the establishment of a regional biodiversity observatory (Grand Observatory of the Indian Ocean).

In order to sustain its research activities, TAAF is planning to install a permanent research station that could host the successive scientific teams in the best possible conditions.

### **Leisure activities**

The main touristic attraction of Europa is undoubtedly its natural heritage. The island is the most important nesting site of the Indian Ocean for green turtles and hosts a wide variety of nesting birds whose colonies are among the largest in the region. The presence of a primary mangrove, of sarrasins and saline steppes of exceptional conservation status also greatly contributes to the heritage value of Europa.

According to Decision No 12/DG/IOI of 18 November 1975 on the regulation of people living on the Îles Éparses, access to the islands is subject to authorization from the Prefect, who is the senior

administrator of TAAF. Therefore access to the Îles Éparses for eco-touristic purposes is conditional on providing information including the nature of business, dates of stay, means of transport, impacts potentially generated by the activity and how to limit them, etc. In addition, all stays are subject to mooring and/or residence taxes and are supervised by an agent from the TAAF.

It was decided in April and May 2009 to open the Îles Éparses to tourism, with a stopover on Europa. This decision is based on the vision that the whole country must remain open to the public in compliance with the protection of its natural heritage. Besides, the success of the presence of the Marion Dufresne scientific vessel in the Îles Éparses has demonstrated the interest of the general public to these remote islands. In April 2011, the Marion Dufresne welcomed 16 tourists, accompanied by two eco-guides.

Nevertheless, the presence of visitors in proximity to animals can cause visual and noise pollution that may affect the behaviour and dynamics of certain populations that are particularly sensitive. This is particularly the case of terns, frigate birds and (nesting) marine turtles. Thus, touristic activities and the frequentation of areas of significance should be controlled in order to minimize disturbances to the animals. Similarly, trampling in the most sensitive areas should be limited. Indeed, the presence of too many humans could cause a local destruction of vegetation.

## **16. Factors adversely affecting the site's overall ecological character, as well as threats to marine turtles and their habitat at the site [EB4, S2]**

*Describe the human and natural factors negatively affecting the ecological character of the site, both within and in the vicinity of the site. These may include existing, new or changing activities/uses, major development projects etc., which have had, are having, or may have a detrimental effect on the natural ecological character of the site. For all adverse and change factors reported, supply measurable/quantifiable information (if such data exist), as well as information on the scale, extent and trend of the change factor and its impact. For example, describe in terms of the percentage of coastline (or other area) modified/affected by a particular threat; for egg collection, describe in terms of number of nests, per species, per year. Mention also data-deficient threats, where a threat is known to be present but is not quantified. Collectively, this information should provide a basis for monitoring of ecological character of the site.*

### **Threats to turtles and their habitats**

#### **Poaching**

Currently, there is no poaching of sea turtles and eggs on Europa. Indeed, the human presence is very small and limited to 14 soldiers and a gendarme. They have a deterrent effect on poaching.

Furthermore, customs control is carried out in Réunion Island for each transfer by military aircraft to the Îles Éparses, limiting the possibility of turtle shell traffic.

#### **Accidental catch (Fishing)**

As in most countries in the South-west Indian Ocean, the main interaction between human and sea turtle activities in the Îles Éparses (and more broadly across the Indian Ocean) is fishing. The incidental catches of sea turtles around the islands are due to the activity of oceanic tuna seiners and some pelagic longline vessels operating in the EEZ of the Îles Éparses. However, a recent study showed that catches of sea turtles in the EEZ of Europa by tuna seiners are extremely rare (Bourjea *et al.* submitted). No information is available on the impact of longline fishing. However, the number of boats operating in the EEZ of Europa remains extremely limited and subject to licensing (6 longliners licensed in 2012 with anecdotal presence in the EEZ of Europa).

#### **Anthropogenic habitat change**

Human presence on Europa is very limited, so are human infrastructures, concentrated in the north-west of the island. These are sufficiently far from the edge of coastline to have no impact on sea turtles.

In general, the human impact on the terrestrial and marine habitats of Europa is extremely low. This is the most pristine island of the Îles Éparses and as such is a great reference site in a regional context where natural environments are particularly impacted. Plant dynamics are completely natural and are free of human influence.

Coral reefs – breeding habitat for green turtles – have not suffered any direct human-induced degradation.

Similarly, the mangrove, which plays a key role in the development of immature green and hawksbill turtles, has never been exploited or degraded by humans.

Finally, seagrass beds – feeding sites for juvenile green turtles – occur naturally and are free from human pressure.

## **Natural habitat change**

### *Cyclones*

The frequency of cyclones on Europa is about 1 every 5 to 30 years. On 13 February 1997, cyclone Josy hit Europa Island with winds up to 220 km/h destroying large numbers of trees.

Europa is regularly threatened by storms or tropical cyclones. These extreme climate events can be catastrophic for beach morphology and vegetation. Colonies of seabirds and marine turtles that use these habitats for nesting or laying can be heavily impacted. An increase in the frequency of this type of extreme weather events is not to be excluded due to global climate change.

### *Warming waters*

Like the other islands in the South-west Indian Ocean, Europa has suffered from mass coral bleaching in 1998. The most affected areas were the upper part of the outer slope and parts of the lagoon. The fringing reef on the north coast of the island today shows a high rate of recruitment suggesting good resilience of corals.

It was also shown that regional synchronization of green turtle nesting in the South-west Indian Ocean is influenced by sea surface temperature (Dalleau *et al.*, 2012). Thus, warmer waters could induce a change in the timing of egg-laying of marine turtles.

### *Ocean acidification*

Ocean acidification causes a slowdown in coral and zooplankton (including shellfish) growth. This in return can affect the whole reef food web.

### *Rising sea levels*

Rising sea levels gradually decrease the surface of nesting beaches. This process is slow and does not constitute an immediate threat to the conservation status of marine turtle populations in the region. It is a greater concern on a longer time scale. To better understand changes in sea level and ocean dynamics in the Mozambique Channel, a permanent tide gauge was installed as part of the Europa NIVMER programme.

### *Elevated atmospheric temperatures*

Studies have shown that a rise of 1°C in incubation temperatures cause a change in the sex ratio of turtles in favour of females, and a general rise of 3°C in the nest causes lower reproductive success. These findings may have significant consequences on the conservation status of marine turtles.

Furthermore, and as already shown in other oceans, a recent study focussing on the South-west Indian Ocean and including Europa nesting site (Dalleau *et al.*, 2012) shows that the temperature is certainly one of the most important environmental factors for the reproductive biology of turtles. Temperature may play a role in egg-laying activity, with an egg-laying peak occurring when conditions are most favourable. The peak can also occur when the temperature is conducive for the development and survival of embryos. An egg-laying peak may also occur when thermal conditions for emergence are optimal. Thus, temperature elevation could lead to changes in the reproductive phenology of marine turtles.

### **Pollution (Ships)**

Europa is located on the "Highway of Hydrocarbons". Also, beach pollution by hydrocarbons related to grounding or to degassing is not excluded. Tar balls were found on Europa in 2002. In this context, TAAF developed a specialized emergency plan (MARPOL) across all districts in order to rapidly and efficiently deploy human resources and equipment in response to pollution.

### **Pollution (Marine litter)**

Ocean currents deposit significant amount of waste on the beaches, especially glass bottles and plastic caps, slippers, pieces of polystyrene, clothes, iron, etc. Some of the waste is collected by the gendarme who either stores it for disposal or burns it in the case of organic waste.

Offshore, waste can be a real threat to top predators or turtles that ingest them and die of asphyxiation or weakness.

### **Predation**

On Europa, only natural predators (crabs, frigatebirds) are likely to affect the survival of green turtle hatchlings.

### **Light pollution**

Europa beaches are devoid of human infrastructure and lighting. In addition, the military and TAAF staff have limited use of power resources (solar, generators). Light pollution does not constitute a threat to marine turtles.

### **Disturbance of nesting turtles**

During their 45-day stays on Europa it is common for military personnel or civilians to observe egg-laying events. Despite the instructions given by the gendarme (avoid camera flash, intrusive contacts, etc.), the frequency and the number of interactions can lead to disturbance of turtles and ultimately influence population renewal. It is therefore necessary to establish a measure of systematic and effective advocacy tool to limit disturbance on turtles breeding or feeding on Europa.

### **Other threats**

#### **Waste**

For several decades various types of waste have accumulated on the islands (plastic waste, fishing nets, old water tanks, glass wastes, PVC and metal tubes, sheet metal and scrap, etc.). They can cause chemical pollution of soil and water. Piles of waste may be an important risk factor for starting fires. TAAF have developed a policy for waste clearance and site decontamination. In this context a tour of the scientific vessel "Marion Dufresne" in the Îles Éparses (2009) was devoted to cleaning the islands. Nowadays, waste is incinerated daily (when possible) or stored and then sent to La Réunion for treatment.

#### **Fires**

Although fires are infrequent in the Îles Éparses, such an event can have disastrous effects on the fauna and flora. The long-term preservation of the unique natural heritage of the Îles Éparses requires locating waste that may contribute to start a fire and removing them from the island. In the past, fires have occurred on Europa (1980) and have had disastrous consequences for the native vegetation of the island. More recently, in June 2013, 4ha of vegetation burned following a

fire that broke out north of the island. Since that event, a fire risk management plan on the Îles Éparses was established by TAAF, in cooperation with SDIS Réunion and FAZSOI.

### **Invasive species**

Two species of introduced mammal are present on Europa, the goat and the black rat. The goat population fluctuates between 500 and 800 individuals and has a strong impact on native plant species that are not adapted to herbivory and associated fauna. The black rat has a significant impact on ground-nesting seabirds. For example, studies have shown that the rat is the main cause of reproductive failure among white-tailed tropicbirds.

Exotic flora (43 taxa) represents a significant part of the flora of Europa. Although almost exclusively related to anthropogenic habitats (human settlements, roads, the airstrip), potential plant invasions remains an issue. Indeed, whereas 6 taxa are found only in their introduced state, 33 were locally naturalized and 4 are considered widely naturalized.

Although the sub-arid climate and high soil constraints (salinity, skeletal soils) are probably important obstacles to invasive processes, three species are considered as invasive species: *Furcraea foetida* (choca) and *Sisalana agave* (sisal), two species formerly cultivated, and *Casuarina equisetifolia* (Australian pine) that grows in coastal indigenous formations north of the island. Initiated over three years ago, eradication of choca is a priority for the conservation of the terrestrial natural heritage of Europa.

### **Anthropophilic native species**

Two indigenous species have benefited from human presence on Europa: pied crows (approximately 250 individuals) and barn owls (30 pairs). Their impact on native bird species (boobies, terns, tropicbirds, frigatebirds) is significant.

## **17. Conservation and management interventions taken [G2, G3]**

*Describe conservation and management interventions already taken at the site to address threats. Note that some of this information may have been recorded in abbreviated form in the IOSEA Site Data Sheets, available online ([www.ioseaturtles.org/reporting](http://www.ioseaturtles.org/reporting)). Any application of coastal and marine spatial planning, or integrated coastal/marine zone management planning, involving or affecting the site should be noted.*

*Describe the management planning process for the site, including the state of implementation of any management plan that has been developed and approved for the site. Describe any other conservation measures taken at the site, such as restrictions on development, management practices beneficial to wildlife, closures of hunting, etc. (Note that information on any monitoring schemes and survey methods should be given under point 19, below.)*

*Where applicable, describe the involvement of local communities and indigenous people in the participatory management of the site, including co-management activities, surveillance and enforcement, and performance evaluation.*

TAAF have implemented a territorial use policy which supports ecosystems' sustainability. This work was carried out with the FAZSOI and has significantly reduced the human footprint on the island through waste management, installation of dry toilets, picking up litter on beaches and public awareness.

Given the very limited threats to habitats and marine turtles, there are few conservation actions conducted on Europa that target the most important threats:

### **Action plan for the eradication of Choca**

Sisal (*Agave sisalana*) and choca (*Furcraea foetida*) were deliberately cultivated on Europa for the purpose of fibre production in the early twentieth century. Their cultivation, on the north of the island, required to clear a large area in the euphorbia forest. The failure of human settlement led to the release of these two species which became invasive, especially the choca, causing disturbances in the functioning of terrestrial ecosystems (habitat loss, especially breeding sites for seabirds).

Initiated over three years ago, eradication of choca is a priority for the conservation of the terrestrial



natural heritage of Europa. However, the work undertaken by successive military detachments suffered from lack of a formal framework and specific eradication protocols.

In this context, it was proposed that this action should be coordinated by TAAF (DCPN), with technical support experts from CBNM (Conservatoire National Botanique de Mascarin) and implemented by the detachments of FAZSOI present on Europa (2nd RPIMa). Military groups are trained and supervised and action is regularly monitored by both partners mentioned above. The management plan implies a tripartite partnership agreement between the TAAF, the CBNM and FAZSOI.

### **Actions against bycatch/mortality of marine turtles (Fishing)**

As specified in Chapter 16, fishing can be responsible for bycatch and cause mortality of marine turtles. There is a specific regulatory framework for Îles Éparses EEZ the purpose of which is to regulate fishing in the area, in particular to reduce impacts on ecosystems.

Industrial fishing is prohibited in the territorial waters of the Îles Éparses, as stated in Order No. 257, from 15 February 1994. Beyond this limit, fishing is subject to authorization from the Prefect of the TAAF. Authorized fishing (granted licences) is mainly operated by French and Spanish seiners. TAAF regularly update fishing technical requirements to maintain sustainable resources and reduce impacts on ecosystems.

Technical requirements updates made in March 2010 and March 2013 helped to limit the risk of incidental capture of marine turtles and the impact of these catches. Besides it is prohibited since January 2011 to set up drifting FADs which may cause hazardous entanglement of non-targeted species and marine turtles. Use of pieces of fishing nets is also formally discouraged. Fishing vessels are required to report bycatch, to carry an observer on board, to have a turtle release kit and to use circular hooks (for longliners). All these requirements largely reduced the number of catches, about a dozen each year (data for seining). In addition, the majority of captured turtles were released alive.

At the regional scale, from 2014 onwards IOTC will require the use of ecological FADs to limit bycatch.

## **18. Conservation interventions proposed, but not yet implemented [G2, G3]**

*Provide details of any concrete conservation measures that have been proposed, or are in preparation, for the site, including any proposals for legislation, protection and management. Summarize the history of any longstanding proposals that have not yet been implemented, and differentiate between those proposals that have already been officially submitted to the appropriate government authorities and those which have not as yet received formal endorsement, e.g., recommendations in published reports and resolutions from specialist meetings. Also mention any management plan that is in preparation but has not yet been completed, approved or implemented.*

### **Ramsar site designation**



Europa island became the 42<sup>nd</sup> French site listed on the Ramsar Convention on October 27, 2011. The island was nominated with regard to its exceptionally pristine habitats but also for its importance as a breeding or nesting area for numerous protected and endangered species such as marine turtles. With Europa being one of the most important site in the world for green turtle reproduction and a major site for immature hawksbill turtles' development in the South-west Indian Ocean, it was then clear that these pristine wetlands (700ha of mangrove, coral reefs, etc.) should be preserved at all costs. The management plan for this site is currently being elaborated by the administration with scientific support.

### **National Action Plan for marine turtles: Reunion, Mayotte and the Îles Éparses**

Marine turtles in the South-western Indian Ocean: the Green Turtle (*Chelonia mydas*), Hawksbill Turtle (*Eretmochelys imbricata*), Olive Ridley Turtle (*Lepidochelys olivacea*), loggerhead turtle (*Caretta caretta*) and leatherback turtle (*Dermochelys coriacea*) are facing a high risk of local and global extinction. Thus, it is a priority to carry out actions aimed at improving ecological knowledge

(their distribution, their dynamics, their migratory patterns) and conservation actions in favor of habitats and populations currently known.

In this context, the Ministry of Ecology, Sustainable Development and Energy (MEDDE), locally represented by the Departments of Environment, Physical Planning and Housing of Mayotte and Réunion and the prefecture of the French Southern and Antarctic Lands (TAAF), launched in 2013 the drafting of a National Action Plan for marine turtles. Delivery of the final document is originally scheduled for early 2014.

### **National Natural Reserve Designation project**

Additionally, the project to classify Europa as a National Natural Reserve was officially included in the French political agenda in December 2009 (adopted in the National “Blue Book for the Sea” and validated during the following Inter-ministerial Committee for the Sea – CIMer). Once the National reserve will be created a budget will be attributed each year by the French government and dedicated to implement conservation actions identified as a priority on Europa (five-year management plan), including several actions specifically targeting marine turtles.

## **19. Current / proposed scientific research and monitoring [G4]**

*Describe any current and/or proposed scientific research on marine turtles and their habitats, as well as information on any special facilities for research. In particular, describe past and current marine turtle monitoring activities at the site (e.g., tagging, satellite tracking, genetic sampling, nesting and foraging ground surveys, ongoing beach monitoring, etc.).*

*Describe the survey methodology in sufficient detail to allow for an assessment of its efficacy. Indicate the number of years of continuous monitoring, and whether data have been used to estimate trends in the size of the management unit. Cite relevant published papers in support of the submission.*

### **Research focusing on marine turtles**

(Source : Bourjea et al., 2011)

Led by Ifremer and Kélonia (the Observatory of Marine Turtle in Réunion Island) within the Convention linking Ifremer, Kélonia and TAAF, « marine turtle » programmes in Îles Éparses are structured as followed :

#### **Monitoring of nesting activity**

Initiated in 1983 in Europa, this monitoring is realized in cooperation with Ifremer, Kélonia and the National Gendarmerie (military staff). Every morning a staff member walks index beaches to record the number of turtle tracks. Daily counts have been carried out on a 1600m stretch of beach, representing approximately 26% of the sandy beaches suitable for nesting turtles (Lauret-Stepler *et al.*, 2007). This monitoring allowed estimates to be made of the abundance of nesters on Europa as well as the nesting seasonality. It was completed in 2008 and for a period of five years by a new estimate of reproductive parameters (nesting success, number of nest per female, etc.) of Europa's nesting green turtles. In parallel to this monitoring, nest monitoring also started recently. The objectives are to estimate the hatchling productivity as well as the consequence of temperature rise on the sex ratio in the context of climate change. A recent study using most of the data collected on Îles Éparses allowed the nesting phenology of green turtles in the Western Indian Ocean to be unravelled and investigating environmental factors that may influence nesting pattern (Dalleau *et al.* 2012).

#### **Monitoring of Juveniles**

The objective of this monitoring activity is to better understand the growth rate and spatial dynamics of juvenile green and hawksbill turtles in Europa, Juan de Nova and Glorieuses. This study aims to estimate growth rates by species and by carapace length.

Based on numerous field trips organized on Îles Éparses since 2005, more than 250 juveniles were tagged (Europa: 79 green turtles and 29 hawksbills) and 30 recaptured between 2008 et 2009

(Europa: 4 greens et 1 hawksbills). First results indicate that the average growth rate per month varies according to site (Europa:  $0,09 \text{ cm} \pm 0,001$ , Bourjea et al. 2006b; Juan de Nova:  $0,07 \text{ cm} \pm 0,01$ ; Bourjea et al. 2007c; Glorieuses:  $0,23 \text{ cm} \pm 0,07$ , Ciccione 2005, Bourjea & Benhamou 2008, 2009a). In the case of Îles Éparses, these rates cannot be validated because of the low sampling size and need to be associated with a habitat study. Such a work is programmed for the coming years.

More recently, and in order to better understand the spatial dynamics of juvenile green turtles in Europa, 11 FAST-LOC GPS tags were deployed on juveniles (Bourjea et al 2012, Ciccione 2012). Data are being processed but seem to indicate an important fidelity of individuals to specific foraging areas and well as an important residency rate. These GPS data will be associated with a habitat mapping that is ongoing for the mangrove of Europa using hyperspectral data (precision  $<1\text{m}$ ).

### **Spatial dynamics of nesting green turtles (DYMITILE)**

This study was undertaken within the framework of a regional program aiming at better understanding the spatial dynamics of marine turtle nesting in the French territories of the Indian Ocean (identification of foraging grounds, migratory corridors, and interaction with open sea fisheries...). This project in cooperation with Comoros, Seychelles, Mauritius and Mozambique was part of the South West Indian Ocean Fishery Project (SWIOFP) funded by FFEM, Région Réunion, Diren, TAAF, Kélonia and Ifremer.

Satellite tracking of female green turtle nesting in Îles Éparses from 1998 to 2012 allowed having a good estimate of their regional foraging grounds.

Under the DYMITILE project (Dynamique Migratoire des Tortues marines nidifiant dans les ILEs de l'océan Indien), 105 green turtles nesting in seven sites of the SWIO were equipped with a satellite tag. From June 2009 to February 2012 only, 81 tags were deployed on nesting turtles, including 20 from Europa. These 105 tags allowed the final foraging ground of 77 turtles to be identified (Bourjea *et al.*, 2013). It allowed identifying foraging ground hotspots for those turtles, with the ones from Europa being the most southerly ones, in south-east Mozambique and south-west Madagascar (Bourjea *et al.*, 2013).

This project also allowed migratory corridors to be identified in the SWIO of post-nesting green turtles, as well as the density of utilization of open sea and costal area by migrants. As a matter of fact, all tracks proved that the northern part of the Mozambique Channel is primarily used by post-nesting green turtles. However, two different patterns of migration were identified: one oceanic, mainly in straight lines targeting of the east coast of Africa or the Malagasy coast, and one neretic following the coasts bordering the Mozambique Channel (Bourjea *et al.*, 2013).

### **Genetic structure of green turtles**

Genetic studies provided evidence that green turtles nesting at the rookeries of the South Mozambique Channel (SMC) and those nesting in the North Mozambique Channel (NMC) belong to separate genetic stocks. Furthermore, the SMC could be subdivided in two different genetic stocks, one in Europa and the other one in Juan de Nova. We suggest that this particular genetic pattern along the Mozambique Channel is attributable to a recent colonization from the Atlantic Ocean and is maintained by oceanic conditions in the northern and southern Mozambique Channel that influence early stages in the green turtle's life cycle (Bourjea *et al.* 2007a). This study proved that green turtle nesting in Europa represents an important potential for genetic diversity for the SWIO region and should be considered as a key rookery to maintain the genetic diversity of green turtles in this region.

A study was also done on population genetics of juvenile green turtles that use the lagoons of Îles Éparses as a development habitat. Results showed that even if there are no differences between nesting and immature turtle genetic structures in Juan de Nova, differences were found for Europa and Glorieuses (Taquet, 2007). Those results indicate that an important mixing may occur during the pelagic phase of the life cycle of green turtles born on Europa and Glorieuses and that there is no mechanism that structures the recruitment of juveniles at least for Europa and Glorieuses. The

genetic composition of juvenile turtles present in Europa is therefore the result of a pelagic mixing of hatchlings coming from both genetic stocks known in the western Indian Ocean (Bourjea 2011.)

### **Research focusing on habitats**

(Source : French National Action Plan)

Added to the research programme targeting marine turtles (see above), several other projects coming from the research Consortium « Éparses 2011-2013 » led by CNRS-inee, focus on marine turtle habitats.

The SMANG programme (*Structuration, fonctionnement, dynamique de la mangrove et des formations associées des Îles Éparses – CNRS*): aims at establishing a global model of the structure and dynamics of the mangrove of Europa, main habitat for juvenile green and hawksbill turtles.

The BIORECIE programme (Biodiversité, ressources et conservation des récifs coralliens des Îles Éparses – IRD) and the ORCIE programme (Observatoire du réchauffement climatique aux Îles Éparses: Diversité des coraux zooxanthellés et capacités de résilience – MNHN) aim to study marine coral reefs, an important resources for hawksbill turtles.

The study of the terrestrial flora of Îles Éparses is conducted by the Conservatoire National Botanique de Mascarin (CBNM) and allows others to better understand the impacts of the introduction of plant species into island ecosystems. On Europa, the CBNM notably identified coastal areas where the casuarina (*Casuarina equisetifolia*) is present. Under the TeMeUm micro-project co-supported by the CBN-CPIE Mascarin and Kélonia, a study will be conducted in 2014 on the island of Grande Glorieuse to identify the influence of vegetation on the choice by female turtles of nesting areas and on hatchlings emergence success. This investigation is also part of the National Action Plan for several species of marine turtles in the South-west Indian Ocean. Management action recommendation arising from this study can be extended to other Îles Éparses including Europa.

The ECOMAR laboratory of the University of La Réunion leads research on introduced species. This research, as well as eradication programmes for rats and cats led by TAAF and ECOMAR on other Îles Éparses, have provided insight into the impact of introduced animals and have contributed to the recovery of the original ecosystems (Bourjea *et al*, 2011). Results could serve as a reference for the development of ecological restoration programs on other islands, including on Europa where rats are still present.

In May 2010 hyperspectral imaging data were acquired on the Îles Éparses under the Spectrhabent-IO project. It aims to develop a method for processing hyperspectral data (coupled with Lidar data) to draw up maps of subtidal benthic habitats in reef areas of the French islands in the Indian Ocean. This project is being conducted under a quadripartite agreement between the Prefecture of La Réunion, the Prefect of the TAAF, the Agency for Marine Protected Areas and Ifremer. Field missions performed on Juan de Nova and Europa in May 2010 and Glorieuses in 2009 have allowed:

- the completion of an in situ inventory of underwater spectral signatures started in 2009 on Glorieuses Islands, the Geyser Bank, Mayotte and La Réunion, taking into account the diversity of coral reefs of the Îles Éparses. The goal is to compile a spectral library as completely and comprehensively as possible for hyperspectral data processing: identification of distinguishing criteria of the different types of bottom substrates (corals, algae, seagrass, bare mineral substrates, etc.) so as to allow differentiated treatment.
- the obtention of detailed field-based truths (French vérités-terrains VT) (type of bottom substrates, recovery rates, etc.) to be obtained, which are essential for good image classification and the validation of results. These will allow the types of habitats to be precisely determined in relation to

the spectral signatures (typology developed under the theme « geomorphology + substrate + biotic communities ») of the work conducted by the French Coral Reef Initiative (IFRECOR), national declination of the international coral Reef Initiative (ICRI). This work adds itself to the monitoring of marine habitats frequented by marine turtles (coral, seagrass, mangrove, etc.) carried out in all of the French overseas territories by IFRECOR.

### **Use of data for evaluating trends and size of management units**

Data acquired over 20 years as part of the scientific programmes carried out by Kélonia and Ifremer on the Îles Éparses are integrated and centralized in the "Turtles from the South-west Indian Ocean" (TORSOOI; [www.torsooi.com](http://www.torsooi.com)) database. Data acquired on the Îles Éparses are used to study, among others, changes in the tracks of nesting female and to calculate standard reproduction indices of marine turtle (reproductive success, inter-spawning and offseason intervals) that are essential for monitoring the health of these populations. This database is used to determine trend indicators of "biodiversity" developed as part of the National Biodiversity Strategy for Overseas Territories (National Observatory of Biodiversity) to which the TAAF contribute, as well as those of IUCN (revised red list).

## **20. Current / proposed communication, education, and public awareness activities [S3]**

*Give details of any existing and/or planned site-based programmes, activities and facilities for communication, education and public awareness, including training. Comment on potential opportunities for future educational and outreach activities at the site.*

### **Information centers**

A permanent exhibition about the Îles Éparses and the TAAF is publicly available all year round in the lobby of the TAAF administration headquarters in St. Pierre de la Réunion. This exhibition presents all issues that concern TAAF and the whole territory (part of the explanatory panel is dedicated to marine turtles);

Kélonia, the observatory of marine turtles in La Réunion ([www.kelonia.org/](http://www.kelonia.org/)) also offers information about the Îles Éparses and conducts regular awareness-raising films and exhibitions about the Îles Éparses. In addition, the "Europa, sea turtle sanctuary" exhibition opened in August 2012 at Kélonia. Ifremer website ([www.ifremer.fr/lareunion](http://www.ifremer.fr/lareunion)) also offers a synthesis of past and ongoing marine turtle scientific programs lead by Ifremer and Kélonia in the Western Indian Ocean

### **Multimedia (DVDs, movies)**

#### Vidéos:

- « La mystérieuse mangrove d'Europa » (26 min video, 2007)
- « Glorieuses...génétique, L'origine des tortues vertes du canal du Mozambique » (13 min video, 2005)
- « MadaNova : quel avenir pour les tortues marines ? » (13 min video in Juan de Nova, 2008)
- « Le secret des tortues vertes », documentaire qui présente le programme de recherche CNRS/Ifremer/Kélonia sur le mécanisme de navigation des tortues marines (17 min video)
- « Les Îles Éparses, Sanctuaire de biodiversité – Territoires de recherche et de conservation » (15 min video, 2011)
- 40 ans de recherche à Europa (28 min video, 2013)

#### Expositions:

- « Mada Nova », centre Kélonia, 2010 (posters, pictures, book)
- « Europa, sanctuaire des tortues marines », Kélonia, 2012

## 21. Financial resources available for management of the site and other activities [G5]

*Identify human and financial resources (including in-kind contributions) available to support immediate and near-term activities, as well as resources available to sustain site-based activities in the longer-term (e.g. in relation to monitoring, management interventions, surveillance and enforcement, and performance evaluation).*

### Human Resources

The management of the Îles Éparses is entrusted to the Prefect, as senior director of TAAF. He is assisted by an Advisory Board. The top administrator is also assisted by a Secretary General, a chief of staff, heads of district, heads of mission and – as necessary – heads of decentralized departments of the civil state administrations based on La Réunion.

Contrary to what is found at the Natural Reserve of French Southern Territories, there are currently no field agents stationed on the Îles Éparses. Two agents (2 ETPs) from the Directorate for Conservation of Natural Marine Heritage at the TAAF headquarters are nevertheless specifically assigned to issues related to the Îles Éparses.

### Financial Resources

Most funding for research, personnel and equipment in the Îles Éparses come from France.

The French Ministry of Ecology, Sustainable Development and Energy (MEDDE) contributes to the protection of endangered species by funding studies and conservation programmes, such as the PNA for marine turtles of the South-western Indian Ocean. It also funds the National Nature Reserve of the Southern Territories, under the National Biodiversity Plan.

Funding of activities in favour of biodiversity in the Îles Éparses also comes from partnerships established with corporate foundations, the use of European financial instruments (tenth regional EDF) and specific applications.

The TAAF work closely with the National Institutes of Research (CNRS-INSU and Inee; IRD; FRB; AAMP), particularly within the research consortium « Îles Éparses from 2011 to 2013 ». The latter was coordinated by CNRS-Inee. It has enabled to assess the potential of research on Îles Éparses, to select the most relevant scientific projects and has provided logistical and financial support in 2011-2013, allowing for the production of more than one hundred field trips throughout the country.

On the other hand, the Îles Éparses are subject to specific funding for the conservation of coral reefs and associated ecosystems in the context of the French Coral Reef Initiative (IFRECOR). The funds are used to implement the actions of the TAAF under the local IFRECOR action plan for the Îles Éparses district, set for 2011-2015. These actions are included in the overall management strategy for these areas and are primarily aimed at developing research activities in a sustainable way as well as tools for the management and conservation of the natural environment in general, and of coral reefs in particular.

Finally, the National Action Plan (NAP, PNA in French) for marine turtles of the French territories of the southwest Indian Ocean, planned for a duration of five years, is funded by the French Ministry of the Environment (Ministry of Ecology, Sustainable Development and Energy - MEDDE), whose policy is implemented in these territories by the Departments of Environment, Spatial Planning and Housing of Mayotte and La Réunion, as well as TAAF. The NAP has the specificity of being multi-territorial (La Réunion, Mayotte and the Îles Éparses) and of considering five different species. The migratory nature of these species also requires the adoption of a far more extensive conservation strategy that goes beyond the French territories. As such, the NAP Marine Turtles of the Indian Ocean incorporates local, regional and inter-regional scales. The document is being drafted, and delivery is scheduled for the end of 2014.

### Other collaborations

The TAAF provide logistical support to partners who need to travel to the islands (scientific community, Météo France, etc.). In addition, it relies heavily on hardware support from the FAZSOI

for transport and accommodation at the site.

A partnership with the National Gendarmerie allows nesting tracks on the Îles Éparses to be monitored.

## 22. Additional resource needs at the site [G5]

*Where specific needs are identified (e.g. skilled personnel, specialised training, facilities, field equipment etc.) indicate how marine turtle conservation activities are presently impaired on account of their unavailability (e.g. inability to carry out regular surveys, to conduct certain types of research, to monitor certain parts of the range etc.) This information may be useful for compiling a general picture of deficiencies and resource needs that could be presented to potential programme sponsors.*

All specific needs for the conservation of marine turtles of Europa have been identified within the SWIO PNA for marine turtles (local plan for « Îles Éparses »): studies needed to improve the knowledge on the population, actions needed to deter to human impacts, as well as habitat preservation/restoration actions needed.

To be implemented, the actions identified in the NAP will necessarily rely on external funding (in addition to the funds allocated by the Ministry of Ecology), notably for the following actions:

- Reducing the mortality of marine turtles related to fishing activities in the Îles Éparses EEZ: funding needed for qualified personnel to train observers on fishing vessels; for additional fishing observers to expand coverage on longline vessels that especially impact turtles; etc. ;
- Sustaining nesting turtle track monitoring on Europa: funding for training provided to gendarmes posted on Europa to perform monitoring activities; for the TORSOOI database management (FTE); etc. ;
- Completing studies on regional connectivity to improve the conservation of marine turtles of Europa outside their nesting site: funding for field trips, equipment (eg Argos) and analysis (eg DNA analysis);
- Educating users of Europa (military, civilian): purchase of communication materials, funding for working time for their development as well as for short-term missions on the ground.

Up until today the funding for marine turtle conservation actions on Europa has been opportunistic and very punctual, which fails to ensure long-term preservation (impossibility of extending research studies, to sustain daily track counting or to interact with the main fisheries that impact turtles).

## 23. References [e.g. S1, G2, G4]

*List key references relevant to marine turtle records and to the site, including management plans, major scientific reports, and bibliographies. When a large body of published material on the site is available, only the most important references need be cited, with priority being given to recent literature containing extensive bibliographies. Reprints or copies of the most important literature should be appended whenever possible. Provide website addresses of references where available.*

Andréfouët S., Chagnaud N., Chauvin C., Kranenburg CJ., Atlas des récifs coralliens de France Outre-Mer, Centre IRD de Nouméa, Décembre 2008, 153 p.

Arvam 2003 – Connaissance et suivi des récifs coralliens des îles françaises de l’océan Indien, Plan d’action Îles Éparses (2002-2006), Rapport de la phase Une (2002-2003). IFRECOR / DIREN-Réunion, 81 p.

Boullet V. 2008 – Extrait partiel de la Typologie de la Typologie de la végétation et des habitats de l’île d’Europa : Système de mangroves lagunaires coralliennes. Conservatoire Botanique National de Mascarin, 13 p.

Bourjea J, Gravier-Bonnet N, Boullet V, Ciccione, Rolland R. 2006 – Mission Europa - 22 mai au 6 juin 2006. Rapport de mission Kélonia / Ifremer / Université de la Réunion / CBNM, 20 p.

Bourjea J, Mouquet P, Quod JP, Ciccione S. 2010 – Expédition pluridisciplinaire «Îles Éparses » 2010 – Europa & Juan de Nova, 14 mai – 7 juin. Rapport de Mission Ifremer, Le Port, La Réunion.



Bourjea J., Ciccione S., Lauret-Stepler M., Marmoex C., Jean C. 2011 – Les Îles Éparses, vingt-cinq ans de recherche sur les tortues marines. Bull. Soc. Herp. Fr., 139-140 : 95-111

Bourjea J. 2005 – Projet « Génétique tortue », Évaluation de la variabilité génétique des différentes colonies de tortues vertes (*Chelonia mydas*) du Sud-Ouest de l'océan Indien. Ifremer / CEDTM / Cirad / MOM

Bourjea, J., Lapègue, S., Gagnevin, L., Broderick, D., Mortimer, A., Ciccione, S., Roos, D., Taquet, C., Grizel, H. 2007a – Phylogeography of the green turtle, *Chelonia mydas*, in the SWIO. Molecular Ecology, 16: 175-186

Bourjea J., Ciccione S., Dalleau M. 2013 – DYMITILE, DYnamique MIgratoire des Tortues marines nidifiant dans les ILEs françaises de l'océan Indien. Rapport final Phase I et II. Ifremer / DEAL Réunion, 55 p.

Cacérés, S. 2003 – Étude préalable pour le classement en Réserve Naturelle des Îles Éparses. Mémoire de DESS Sciences et Gestion de l'Environnement Tropical de l'Université de la Réunion. DIREN Réunion - 55 Laboratoire ECOMAR, 191 pp.

Ciccione, S., Sauvignet, H., Boulet, V., Rota, B. 2005 – Rapport de mission scientifique dans les Éparses, Glorieuses 2005. CEDTM / IFREMER / CBNM / Globice, 11 p.

Dalleau M., Ciccione S., Mortimer J. A., Garnier J., Benhamou S et al. 2012 – Nesting Phenology of Marine Turtles : Insights from a Regional Comparative Analysis on green Turtle (*Chelonia mydas*). PLoS ONE 7(10): e46920. Doi:10.1371/journal.pone.0046920

Girard C. 2005 – Étude du comportement d'orientation d'espèces pélagiques tropicales vis-à-vis d'attracteurs. Thèse de Doctorat de l'Université de La Réunion, Biologie Marine. 250 p.

Glénard Z., Bourjea J., Ciccione S. (non publié) Modèle pour la soumission du Rapport National pour le Memorandum d'entente pour la Conservation et la Gestion des Tortues Marines et de leurs Habitats de l'Océan Indien et l'Asie du Sud Est (IOSEA). Rapport technique Taaf / Ifremer / Kélonia, 44 p.

Hivert J., Dumeau B. & Gigord LDG. 2012a – Compte-rendu scientifique et technique de mission de longue durée d'étude de la flore et des habitats de l'île d'Europa (Octobre-Décembre 2011).

Lauret-Stepler, M., Bourjea, J., Roos, D., Pelletier, D., Ryan, P., Ciccione, S., Grizel, H. 2007 – Reproductive seasonality and trend of *Chelonia mydas* in SWIO, a 20-year study based on tracks count. Endangered Species Research 3: 217-227.

Le Corre M. & Jaquemet S. 2005 – Assessment of the seabird community of the Mozambique Channel and its potential use as an indicator of tuna abundance. Estuarine, Coastal and Shelf Science 63 (2005) 421–428, 8 p.

Le Gall J.Y. & Hugues G.R. 1987 – Migration de la tortue verte *Chelonia mydas* dans l'Océan Indien sud ouest observées à partir des marques sur les sites de ponte Europa et Tromelin (1970-1985). Amphibia-Reptilia, 8(3): 227-282

Le Gall J.Y. 1988 – Biologie et évaluation des populations de tortues vertes *Chelonia mydas* des atolls Tromelin et Europa (océan Indien S.O.). Mésogée, 48: 33-42.

Le Gall J.Y., Bosc P., Château D. & Taquet M. 1986 – Estimation du nombre de tortues vertes femelles adultes *Chelonia mydas* par saison de ponte à Tromelin et Europa (Océan Indien) (1973-1985). Océanog.Trop., 21: 3-22.

Le Goff R., Ropert M., Bourjea J., Le Rû L., Fleury PG., Evano H., Scolan P., Le Couls S., Laurence A., Lemoigne V., Maurel L., Vermentot C., Aurèche V., Da Cunha J., Perrine A., Bajjouk T., Gauthier E., Mouquet P., Muths D. 2012 – Rapport d'activité 2011 de la Délégation Ifremer océan Indien. 75 p.

MEDDE et al., en cours de rédaction – Plan National d'Actions en faveur des Tortues marines dans le sud-ouest de l'océan Indien.

Quod J.P., Barrère A., Chabanet P., Durville P., Nicet J.B & Garnier R. 2007 – La situation des



récifs coralliens des Îles Éparses françaises de l’océan Indien. Rev. Écol. (Terre Vie), vol. 62, 14 p.

Taquet C. 2007 – Diversité et différenciation génétiques des populations de tortues vertes (*Chelonia mydas*) dans les sites de ponte et d’alimentation du sud-ouest de l’océan Indien : Application aux stratégies de conservation de l’espèce. Thèse de Doctorat de l’Université de la Réunion, Biologie Marine, 226 p.

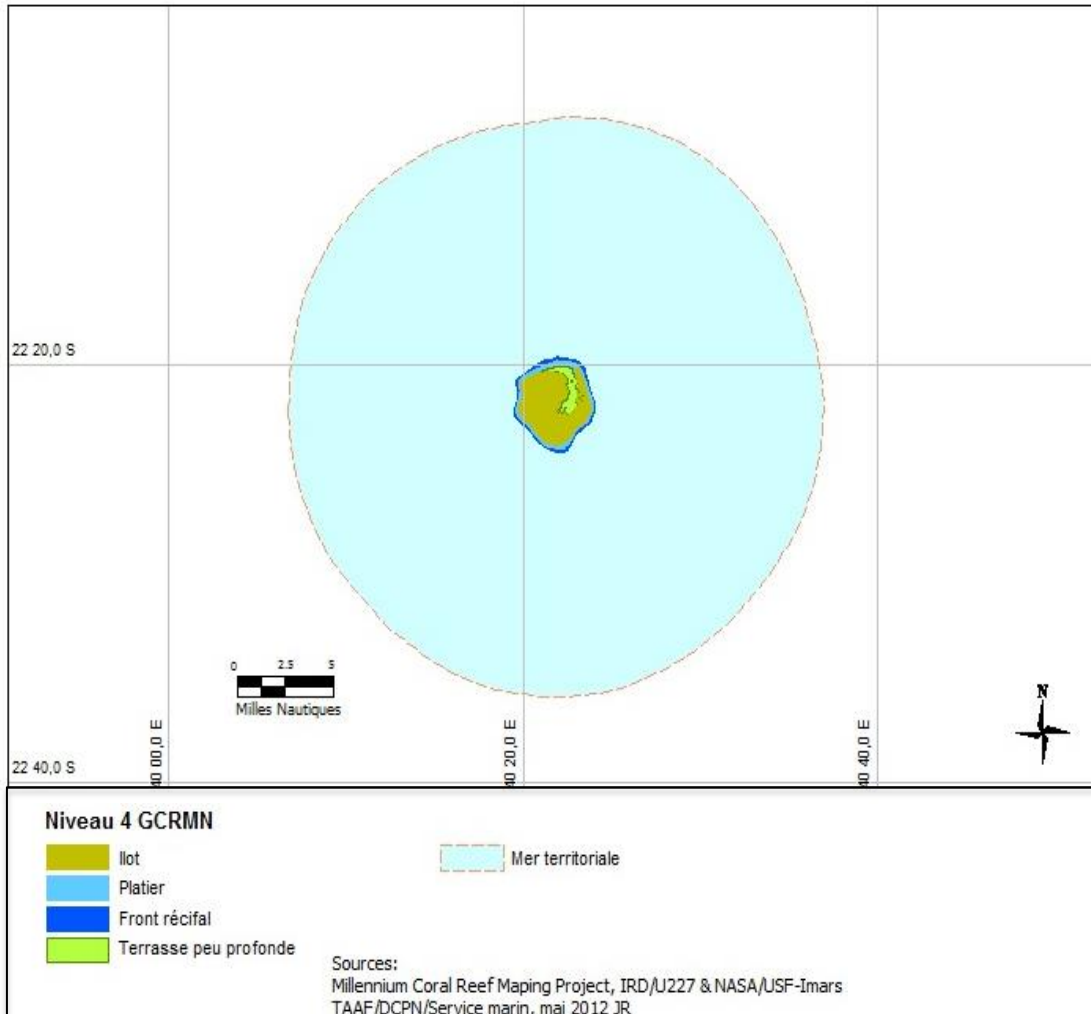
<http://ileseparses.cbnm.org/>

#### **24. Site map [N2, N3]**

*The most detailed and up-to-date map of the site available should be appended to the Site Information Sheet in digital and/or hardcopy format. The ideal site map will clearly show the area boundaries of the site, scale, latitude, longitude and compass bearing, administrative boundaries (e.g., province, district, etc.), and display basic topographical information, the distribution of the main site habitat types and notable hydrological features. It will also show major landmarks (towns, roads, etc.). Indications of land use activities are especially useful.*

*If applicable (and available), provide a zoning scheme to indicate areas where certain activities that might be incompatible with turtle conservation are permitted, buffer zones, and areas where such activities are not permitted (i.e. sanctuary areas).*

*The optimum scale for a map depends on the actual area of the site depicted. Generally the map should have a 1:25,000 or 1:50,000 scale for areas up to 10,000 ha; 1:100,000 scale for larger areas up to 100,000 ha; 1:250,000 for areas exceeding 100,000 ha. In simplest terms, the site should be depicted in some detail. For moderate to larger sites, it is often difficult to show detail on an A4 sheet at the desired scale, so generally a sheet larger than this is more appropriate. While an original map is not absolutely necessary, a very clear image is desirable. A map exhibiting the above attributes will be more suitable for scanning.*



**Map 1.** Delimitation and morphological units of Europa (provided by the Site proponent).



**Map 2.** Google Earth map of Europa (provided by the IOSEA Secretariat).