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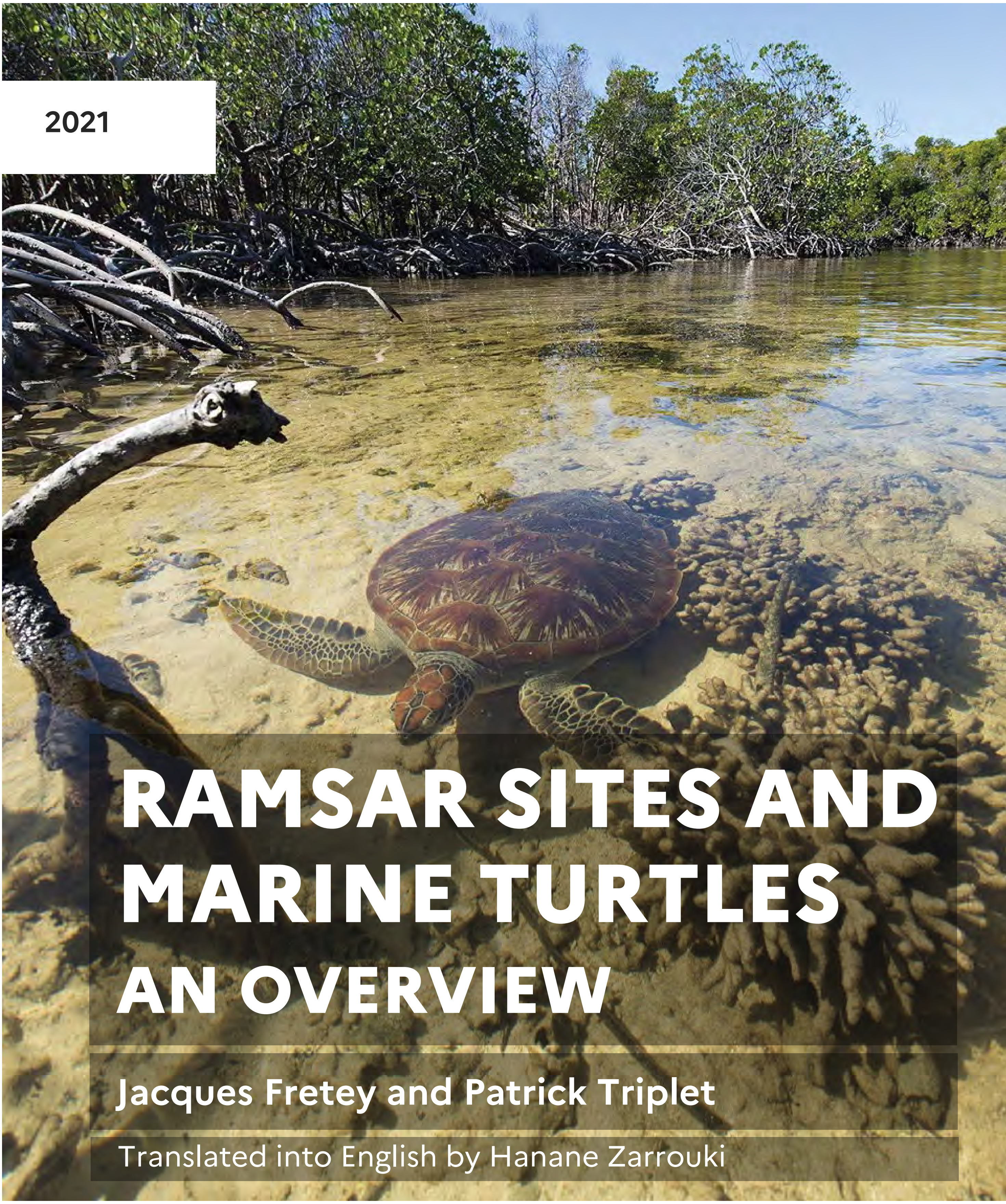

2021

RAMSAR SITES AND MARINE TURTLES
AN OVERVIEW

Jacques Fretey and Patrick Triplet

Translated into English by Hanane Zarrouki

Cover photo: Developmental habitat in the mangrove of Europa Island Ramsar site, in the Mozambique Channel
(© B. Marie)

This analytical work was carried out on behalf of France, in order to help implement Resolution XIII.24 "The enhanced conservation of coastal marine turtle habitats and the designation of key areas as Ramsar Sites", and thus contribute to the Ramsar Convention work.

Ramsar

Translation from the 2nd French edition – June 2021

Editorial

The Convention on Wetlands is the first intergovernmental treaty to address a specific ecosystem, wetlands - one of the richest and most threatened ecosystems. Signed in 1971 in the Iranian city of Ramsar, the Convention aimed at the international cooperation necessary to stop the disappearance of wetlands necessary for migratory avian species.

Its formal title is still "Convention on Wetlands of International Importance, especially as Waterfowl Habitat". However, since its inception, the Convention has significantly broadened its scope, or should we say, its concern, on the one hand to all wetlands, which all carry many challenges, and on the other hand to all species dependent on them, beyond just bird species.

As early as 1993, France proposed the Basse-Mana region (French Guiana) for classification, not by indicating as a priority justification the brackish water marshes rich in birds, but its beaches, the first Leatherback Turtle nesting place in the world. This precedent, however, did not lead to other classifications for coastal marine turtle habitats.

Thus, after the integration in 1996, in the list of criteria for designating "Wetlands of International Importance", which were initially limited to habitats and birds, of criteria relating to fish species, a very large number of which depend on functional wetlands that are well connected to aquatic environments, it was in 2005 that a new numerical criterion was added concerning animal species that depend on wetlands but do not belong to the avifauna. This broad opening, which recognizes the major role that wetlands and, in particular, the "Ramsar Sites" can play in the conservation of a in the conservation of biodiversity, has made it possible to consider using the Convention to advance the cause of other migratory species that are largely dependent on international actions, first and foremost the marine turtles, whose situation is truly dramatic at the global level.

Thus, at the 13th Conference of the Parties in October 2018, in Dubai, on the proposal of France and Senegal and, it should be emphasized, with strong enthusiasm from the Parties concerned, Resolution XIII.24 was adopted "Strengthening the conservation of coastal habitats of marine turtles, and designation under Ramsar of sites with major challenges", which provides in particular for relying on the network of Ramsar Sites, to be extended where necessary, and with adequate management measures, to better protect nesting, feeding, developmental and migration sites of marine turtles.

The French experts who prepared the draft resolution, in collaboration with their colleagues from all over the world, wished to deliver this very complete report, which synthesizes their knowledge, their detailed analyses of the cross-referenced data of the Ramsar sites and of the various species of marine turtles, and their recommendations based on these analyses, all carried out jointly with world experts, to provide a tool for all the countries interested in this subject, and thus to help with the effective implementation of the resolution.

This resolution and this implementation report are a new "consecration" for the Convention on Wetlands, which has just renewed its agreement with the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC). France and the Secretariat of the Convention on Wetlands are convinced that this initiative will facilitate the conservation of these highly endangered species. It is also a great satisfaction and an honor to be able to contribute and commit ourselves together to follow up on the experts' proposals and improve the quality of our network.

Many thanks to Jacques Fretey and Patrick Triplet for this remarkable work - may this report and the Convention on Wetlands, together with France, advance the cause of marine turtles!

The Secretary General of the Convention on Wetlands

Martha ROJAS URREGO

The Director of Water and Biodiversity

Olivier THIBAULT

Preface

Sea turtles are iconic. They have captured the attention of the global scientific and conservation community with their mysteries, endearing traits and mesmerising life cycles. Sea turtle hatchlings appear vulnerable, fragile almost, while adult sea turtles embody strength, character, and endurance. Depicted repeatedly via inspiring documentaries of the natural world, sea turtles have captured the hearts of the world through their amazing ocean voyages, indomitable nesting prowess, and adorable hatchling antics.

But sea turtles are also iconic to the multiple local, native communities around the world who depend on them – for sustenance, medicines, tourism, or as key species embedded in ancient cultures and traditions. These cultures and traditions transcend centuries, millennia even, and are as much a part of the turtles' lives as the turtles are to them.

Given the charisma of the turtles themselves, an aspect of their lives that is often relegated to background news is the sheer diversity and extent of habitats upon which they depend. Sea turtles depend on beaches upon which to lay their eggs. Sparkling white sand and dark volcanic beaches come to mind, but nests have been found along pebble-strewn coasts, and within mangroves. Sea turtles feed on shallow-water seagrasses, and inhabit coastal mangroves. They are found across the world's coral reefs, and in rocky shore habitats. Their migrations are typically depicted as epic oceanic voyages, but more often than not sea turtles prefer shallow, coastal waters through which to navigate.

These coastal habitats are increasingly lost or degraded as human populations and demand for coastal resources expand, and as climate impacts become less predictable and more violent. Sea turtles themselves are also impacted by habitat losses and degradation, and are further under pressure from increased levels of direct capture, collection of eggs, bycatch in artisanal and commercial fisheries, and global warming.

How then, are we to balance the ecological needs of sea turtles, traditions and cultures of native communities, and conservation goals of a concerned planet, when the very habitats upon which they depend are vulnerable to the slightest twist in evolutionary fate? The answer, my friends, lies in delivering a broad repertoire of solutions, each custom-tailored to local customs, peoples, needs, aspirations and capacities. There is no question that there are numerous conservation and management programmes that benefit sea turtles and their habitats: there are laws, conventions, agreements, on-the-ground patrols and enforcement, awareness and education campaigns, advocacy and outreach efforts, and countless more.

And today, a significant new addition to this suite of solutions is the Ramsar COP13 Resolution XIII.24 "The enhanced conservation of coastal marine turtle habitats and the designation of key areas as Ramsar Sites". I congratulate the authors, and indeed all Ramsar range states for developing and adopting this wonderful new initiative, which will provide a greater range of options to local managers, alongside greater access to conservation and management resources, technical solutions and legal protection, resulting in more viable and resilient sea turtle populations across the world.

It is a great honour for me, to be asked to introduce you to this amazing initiative.

Nicholas PILCHER
Founder & Executive Director, Marine Research Foundation
Past Co-Chair, IUCN[1] Marine Turtle Specialist Group
18 October 2020, Kota Kinabalu, Sabah, Malaysia

This document is dedicated to our late colleague and friend Peter Charles Howard Pritchard, a lifelong advocate for the knowledge and protection of marine turtles and their habitats, died while writing the manuscript.

[1] International Union for Conservation of Nature.

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Ramsar sites and marine turtles: An overview

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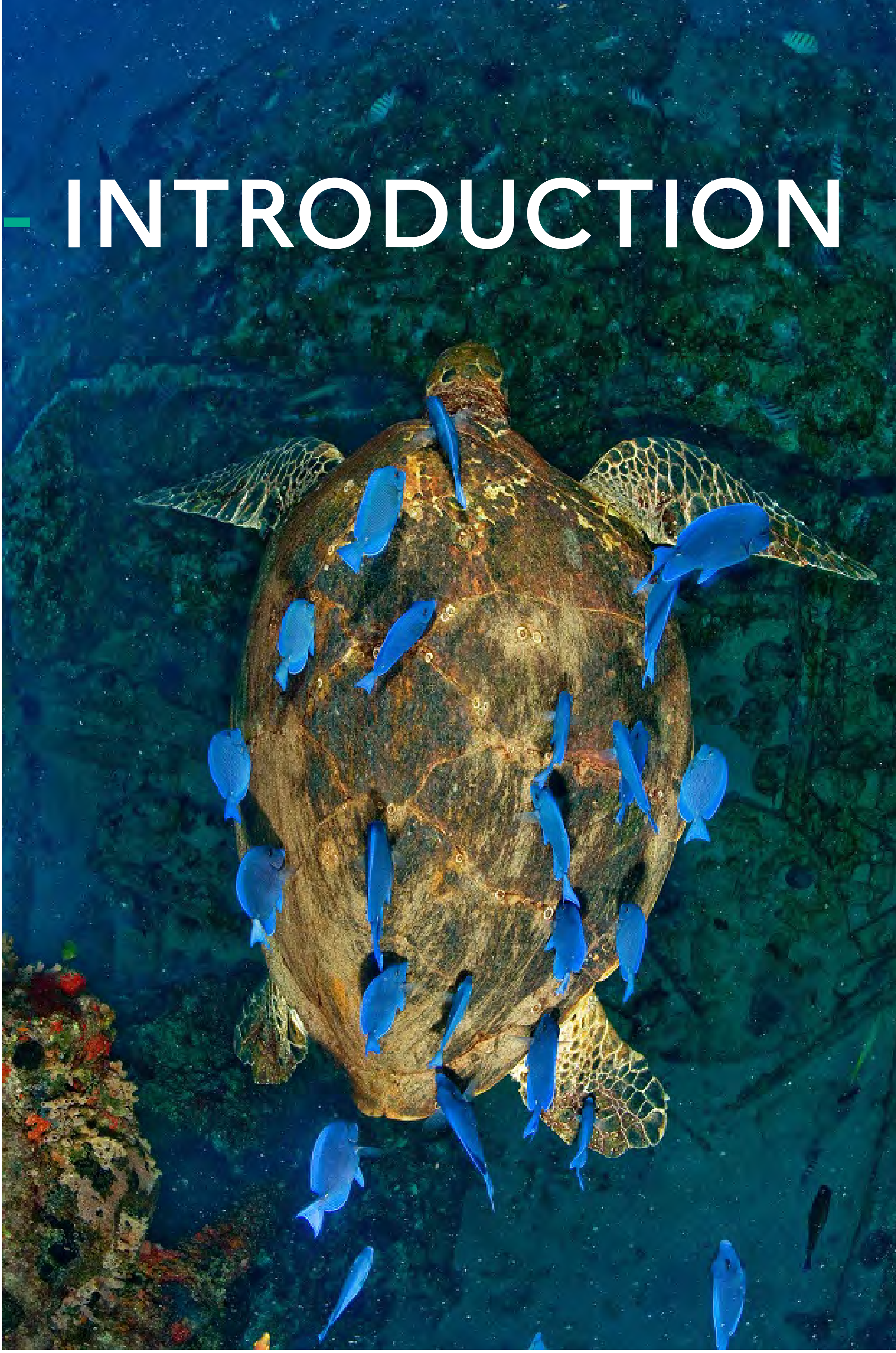
Summary – Regional conventions and agreements are not proving sufficient to conserve marine turtle habitats. During the Conference of the Contracting Parties to the Ramsar Convention on Wetlands (COP13) held in Dubai in October 2018, this resolution was adopted to that allows states to designate a site on a coastal wetland (extending to a marine depth of 6 meters at low tide) if it includes key habitats for the survival of marine turtles. The authors list and comment on existing Ramsar sites around the world that contain such developmental, feeding and nesting habitats. They also list, by major region, habitats that would be useful to designate in order to better protect the species life cycle and regional breeding stocks.

Keywords: Marine turtles, habitats, Ramsar Convention

1 - INTRODUCTION



Cleaning station for an adult Hawksbill turtle in Brazilian waters
(© Fondation Pro-Tamar)

INTRODUCTION

« Wetlands are ecotones, a transition zone between terrestrial and aquatic communities »

In physical geography, a wetland is an environment at the interface of terrestrial and aquatic systems, making it inherently different from them, but highly dependent on both (Mitsch & Gosselink, 1986). Wetlands are ecotones, a transition zone between terrestrial and aquatic communities.

According to the Convention on Wetlands of International Importance, better known as the Ramsar Convention, there are three types of wetlands, one of which is of interest here, namely marine and coastal wetlands such as seagrass beds, rocky shores, mudflats, saltmarshes, mangroves, estuarine areas, deltas, and coral reefs.

Wetlands are home to over 40% of the world's species and 12% of all animal species. On the seafront, coral reefs are among the most biologically diverse ecosystems.

Wetlands

2,412

Ramsar wetlands designated worldwide

990

designated marine or coastal wetlands

Marine turtles appear by name in the appendices of various major international conventions, such as the Convention on Migratory Species (CMS) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). However, regional conventions and agreements are not sufficient to conserve the marine turtle habitats necessary for their complex life cycle. With regard to biological diversity, a third important convention is the Ramsar Convention. Originally created for waterfowl habitats, but which has nevertheless allowed the classification as a Ramsar site of the Basse-Mana beaches and marshes, in French Guiana, because of their global importance for the *Dermochelys coriacea* nesting.

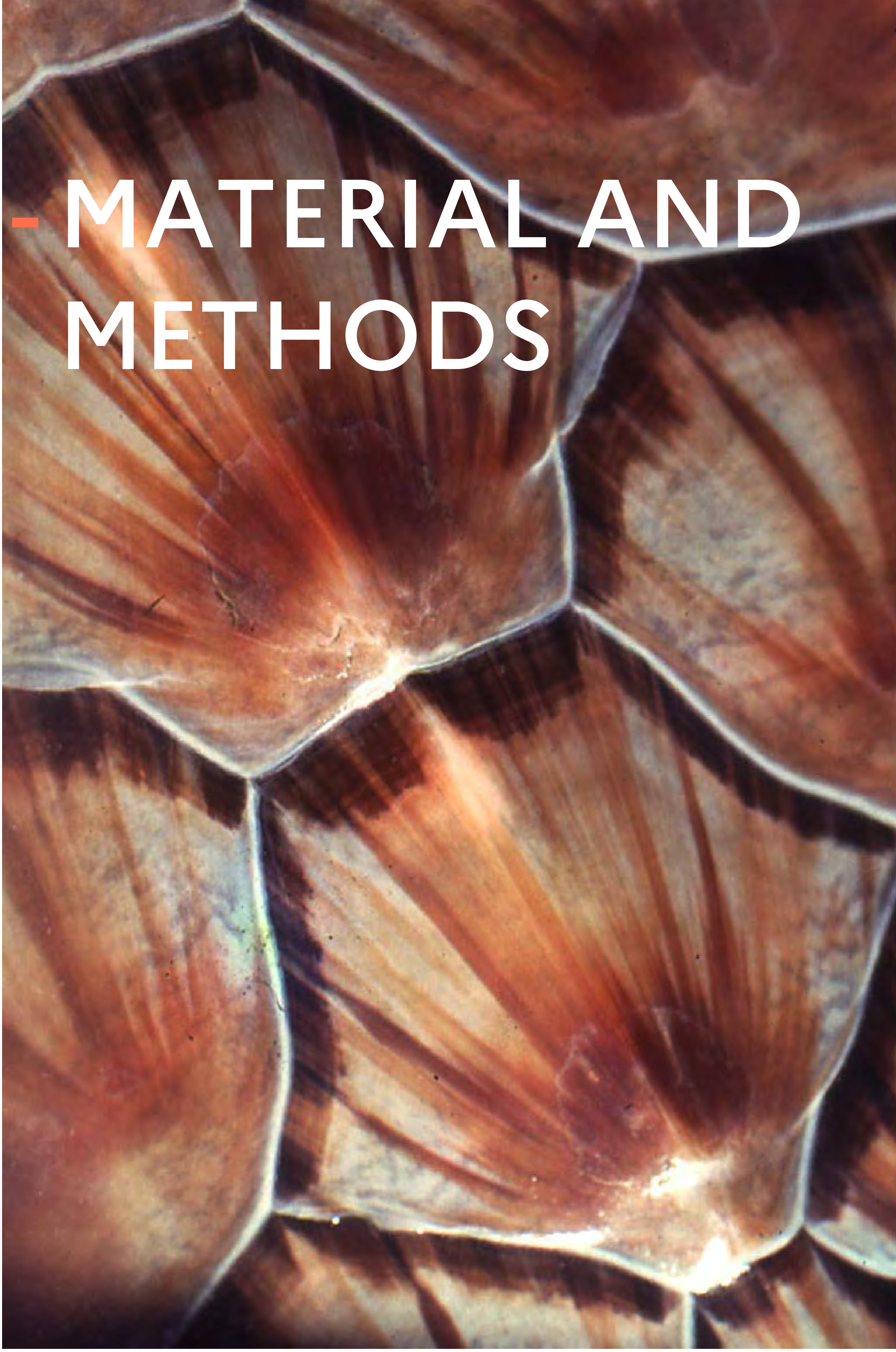
Article 2.1 of the Ramsar Convention provides that wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands".

Based on this definition, we proposed to the Convention Secretariat to draft a specific resolution on marine turtle habitats. After consultations with the Parties to this convention, France and Senegal agreed to be the initiators of this resolution.

During the Conference of the Contracting Parties to the Ramsar Convention on Wetlands (COP13) held in Dubai in October 2018, this resolution (cf. Annex) was adopted to draw the attention of States to the need to conserve the coastal and marine habitats of marine turtles and to develop activities based on ecotourism in order to generate wealth for local populations, instead of direct exploitation of turtle derivative products. The resolution thus encourages the Parties to create Ramsar sites, which can then allow the establishment of protected areas based and strengthened by administrative regulations.

The preparation of this resolution required us to review existing Ramsar sites around the world. This article attempts to extract information from the Ramsar site data file and to comment on the existing knowledge for the oceans as a whole.

2 - MATERIAL AND METHODS



Juvenile *Chelonia mydas* shell plates radiated and very colored pattern make often confuse them with juvenile *Eretmochelys imbricata*
(© J. Fretey)

MATERIAL AND METHODS

« A thorough search was also conducted in the Ramsar Sites Information Service, directly by the authors, but also with the help of the Secretariat de la convention »

A search of the marine turtle bibliography was conducted to determine which sites the various species are found at various stages of their life cycle. A thorough search was also conducted in the Ramsar Sites Information Service (https://rsis.ramsar.org/fr?language=fr), directly by the authors, but also with the help of the Secretariat de la convention, which extracted the names of the sites for which the descriptive sheets provide easily accessible information on the various species of marine turtles. Errors or omissions were sometimes detected. This work was completed by Ramsar delegates from different countries, listed in the tables. Additional information was taken from a synthesis report of the situation of sites hosting marine turtles in Central and South America (http://www.iacseaturtle.org/eng-docs/publicaciones/humedales-tortugas-marinas-ing-peq.pdf).

8

taxa are involved in this work

Eight taxa are involved in this work:

Family Cheloniidae

Lepidochelys olivacea (Eschscholtz, 1829) = Lo (IUCN Red List[2] status: Vulnerable - VU), Olive Ridley sea turtle

Lepidochelys kempii (Garman, 1880) = Lk (IUCN Red List status: Critically Endangered - CR), Kemp's Ridley sea turtle

Chelonia mydas (Linnaeus, 1758) = Cm (IUCN Red List status: Endangered - EN), Green turtle

Chelonia agassizii (Bocourt[3], 1868) ou C. *mydas agassizii* = Ca (This is not a distinct species recognised by IUCN – it is considered as *Chelonia mydas*), Black turtle

Caretta caretta (Linnaeus, 1758) = Cc (IUCN Red List status: Endangered - EN), Loggerhead turtle

Eretmochelys imbricata (Linnaeus, 1766) = Ei (IUCN Red List status: Critically Endangered - CR), Hawksbill turtle

Natator depressus (Garman, 1880) = Nd (IUCN Red List status: Data Deficient - DD), Flatback turtle

Family Dermochelyidae

Dermochelys coriacea (Vandelli, 1761) = Dc (IUCN Red List status: Vulnerable - VU), Leatherback turtle

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[2] IUCN Red List Categories and Criteria.

[3] Most of the uncertainties regarding the marine turtle taxonomy have been resolved over the past two decades through morphological, biochemical, and genetic assessments (Bowen & Karl, 2000). The only exception is the status of the Eastern Pacific Black Turtle. The debate over the Black Turtle taxonomy has been revived in recent years by the arrival of genetic data. But Peter C. H. Pritchard (1999), and we agree with him, has always stood up for Black Turtle species rank, arguing that the reproductive isolation of this melanistic form should be considered and that it could be an emerging taxon. Pritchard warned the scientific community against over-reliance on laboratory machines and modern technology supplanting traditional taxonomic classification and field observations. Black Turtle disastrous conservation status commanded us here to emphasize its notable habitats.

3 - GENERALISED SEA TURTLE HABITATS

Locomotion trace of a Loggerhead towards shrubby vegetation on an isolated islet of New Caledonia
(© J. Fretey)

GENERALISED SEA TURTLE HABITATS

« A turtle will change of habitat during its life cycle, but also sometimes between day and night »

12

marine turtle habitats covered

Marine turtles, irrespective of species, have complex life cycles including, according to the age classes, more or less long stays in different biocenosis, ecosystems sometimes neritic, sometimes benthic and for the adult females and the first reproductive stages (eggs, embryos, hatchlings) sandy or not terrestrial areas. During the ontogeny of an individual, depending on its species and population, very different habitats will be occupied, be they coastal or open sea.

A turtle will change of habitat during its life cycle, but also sometimes between day and night.

At the beginning of breeding season, the behavior of adult males is social and active. In **the mating habitat**, close to the coast or not, several males can compete for the same female. The very aggressive courtship occurs during a receptive period of the females.

Underwater or on the surface, if the female does not flee, the male places his plastron on the carapace of his partner, clings to the shoulders with or without claws, nibbles the neck, passes his long tail from which comes out his long penis in the shell posterior opening to inseminate the female cloaca.

A female can mate with several males and store the sperm for several months in a spermatheca. When she finally lays her eggs several weeks after copulation, she will have been fertilized by different males.

Some time after coitus, adult females come ashore (**nesting habitat**), dig a nest in the substrate, and lay eggs. They come ashore several times during a nesting season. Between clutches they stay in an **internesting habitat**. Eggs, compressed together in a deep chamber (**embryonic development habitat**) will incubate for six to eight weeks.

After leaving the shell membrane and emerging from the substrate, hatchlings will swim vigorously offshore (**frenzy habitat**), then spend the first few years in the ocean environment in a **developmental habitat**. They then return to the coast to spend several years in a **nursery habitat**. As adults, breeding individuals will sometimes make long journeys (migration habitat) to reach a nesting or **feeding habitat** to which they are generally faithful.

Twelve marine turtle habitats may be covered by the Ramsar Convention (Figure 1):

Mating habitat, nesting habitat, embryonic development habitat, internesting habitat, nursery habitat, developmental habitat, frenzy habitat, resting habitat, turtle cleaning station, hibernation habitat, and basking habitat.

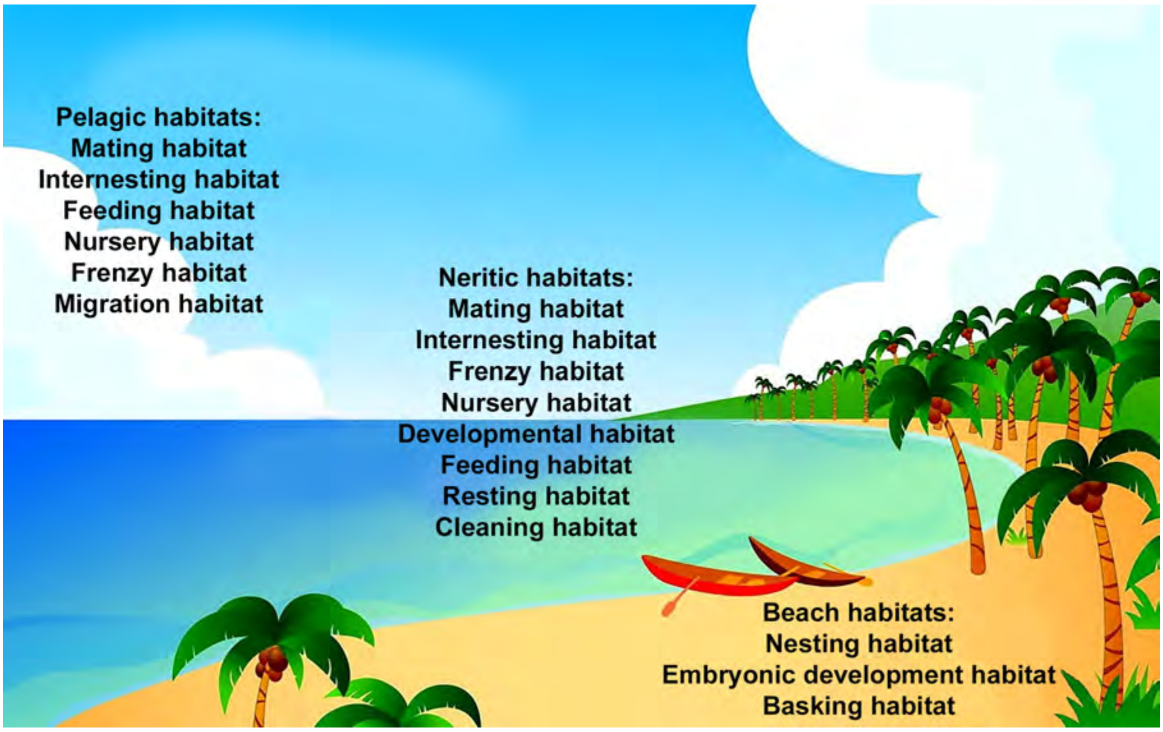


Figure 1. Location of different coastal and pelagic habitats for marine turtles.

Twelve marine turtle habitats may be covered by the Ramsar Convention (Figure 1):

Breeding stations

These habitats consist of mating habitat, nesting habitat and embryonic development habitat.

Mating habitat or mating area

Except the Leatherback turtle, mating areas can be close to the nesting areas, or distinct from them. In a few cases mating takes place at feeding grounds, but most often very close to the coast and a nesting beach, thus potentially in shallow coastal zones covered by the Ramsar resolution.

The conservation of mating areas, however important for the survival of a species, is rarely taken into account in a conservation plan and we wish to point out this shortcoming.

Nesting habitat, nesting beach, chelonery

"A nesting site for marine turtles is any coastal land area where at least one female of any species has laid eggs in historical times." (Fretey & Girondot, 1996).

Although it is not entirely clear why some beaches are used by marine turtles to lay eggs and others are not (which to us, humans, seem more "beautiful" and inviting), nesting habitat must meet a number of factors and several minimum requirements. The site must be easily accessible from the ocean; this criterion will be different for a female Leatherback turtle and for a female Hawksbill turtle. The first will avoid the rocks, which can easily hurt its body devoid of scales and horny plates. In contrast, the second, shielded in an armor carapace, will not hesitate to pass sharp beach-rocks. Theoretically, the nest must be able to be dug in a place not flooded with high tides, and the substrate to have a cohesion of grains allowing a solid construction of a well and an incubation chamber. The substrate, usually fine sand, should be such that it facilitates gas diffusion, does not retain too much humidity, and has temperatures conducive to good embryonic development (Mortimer, 1990).

One of the most remarkable and mysterious elements of marine turtle biology is the ability of some adult females to return to nest in the geographic area from which they left as emerging hatchlings, often after roaming thousands of miles. English speakers call this phenomenon natal homing, which could be translated as "homecoming". Philopatry, the tendency of a female to return to the habitat of her birth, is generally very strong in marine turtles but not systematic, not to all species, nor to all populations within a species.

It is often assumed that most nesting females exhibit some degree of fidelity to a nesting habitat, returning cyclically to the same beach to lay eggs at intervals of one or more years (Carr & Meylan, 1978). Hendrickson (1958) suggested that mature turtles aggregate at sea, and that juvenile turtles follow already mature turtles migrating to a familiar nesting beach. Lohmann (1989) and Wyneken *et al.* (1990) introduced the idea that magnetic imprinting of the future geographic nesting area occurs in hatchlings during the offshore frenzy phase. It is known that most, if not all, marine turtles exhibit some degree of natal self-guidance, although the accuracy of this self-guidance can vary considerably among species and populations within species. Two hypotheses are that marine turtles record distinctive chemical cues associated with their natal beach (Owens et al., 1982; Grassman et al., 1984) or that they memorize a "magnetic signature" of birth and nesting habitat, and navigate with an internal "magnetic compass" (Lohmann *et al.*, 2008; Lohmann & Lohmann, 2019).

This terrestrial nesting habitat includes the three littoral zones of the emerged part, more or less long, of the beaches: infralittoral zone, intertidal or mediolittoral zone (foreshore), supralittoral zone.

Females *D. coriacea* frequent terrestrial habitats accessible via deep water and strong waves, devoid of rocky mass, beach-rocks or any other abrasive obstacle that could cause injury.

Photo 1. Leatherback nesting habitat in French Guiana, with children of the Amerindian village Kaliña of Yalimapo observing the nest re-capping by the female hind legs
(© J. Fretey)

The periods that adult female turtles spend in the terrestrial habitat has several immutable phases. First of all, it requires an exit from the sea at the infralittoral or mediolittoral zone. This landing often takes place during the incoming tide, but depending on the region, the species or the population, it can also occur during the ebbing tide. This access habitat can be roughly defined as follows. Female Leatherbacks, for example, prefer deep, unobstructed access to a nesting beach, whereas Hawksbill turtles may cross shallow, rocky, or coral habitat (Mortimer, 1981-1982). After ascending an inclined plane to a beach, the female stops at the point where she will dig the nest. *D. coriacea* nests in wide-open environment like *C. caretta*, but the Leatherback's range is from the edge of the waves to the edge of shrubby vegetation, and it may dig in grassy or creeping Ipomoea (Ipomea pes-caprae also known as bayhops) areas. *Chelonia mydas* lays eggs in open environment or under the first branches of shrubs at the top of the beach. *Lepidochelys* commonly use narrow beaches on the edge of lagoons or estuaries. *E. imbricata* can easily cross rocks and coral debris to reach a beach of coarse substrate; it is the species that goes farthest inland, making its way through low shrub vegetation at the supralittoral level and even beyond (Figure 2).

Hearth (1980) uses the word *chelonery* (plural *cheloneries*) to refer to nesting habitat for marine turtles. This word has not been used subsequently, it seems to us. Instead, Anglo-Saxons conveniently use the word "rookery" to refer to a major nesting site or an entire region where a species breeds regardless of political boundaries (e.g., *D. coriacea* in the three Guianas). We will use it sometimes in this text. The Anglo-Saxons also use the word "hotspot" to indicate an exceptional site of regional or international interest.

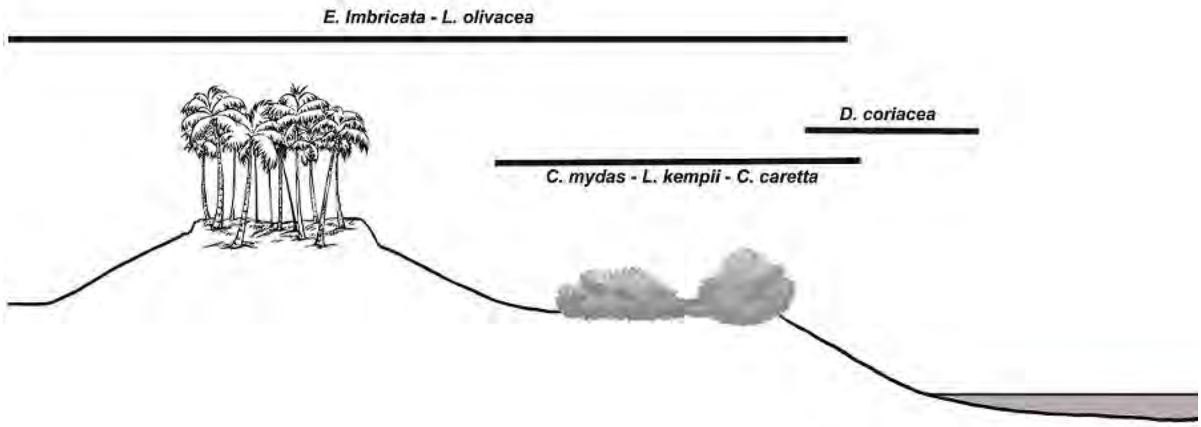


Figure 2. Specific distribution of nests at different terrestrial zones.

The main aggregations of female Olive Ridley sea turtles that nesting in hundreds or tens of thousands of individuals, called *arribadas* (with *synchronization*), occur in Costa Rica (Nancite, Ostional), in Mexico and on the eastern coast of India, in the state of Odisha (ex-Orissa). The hypothesis put forward to explain the triggering of these synchronized emergence onto land is a communication at sea between individuals by the emission of pheromones through pores located on the carapace plastron inframarginals and connected to glands called Rathke's glands.

Embryonic development habitat

Once the site is chosen, the female digs a cylindrical well with alternating work of the hind legs (Figure 3). The bottom is widened to form a chamber where the eggs she lays are deposited.

The nest of a marine turtle is a true ecosystem in itself. Its depth varies according to the species and the size of the female hind legs, from 30 to approximately 80 cm. In species that have created a body bowl like those of the genus *Chelonia*, the angle of the female's body with the ground will determine the total depth. A strong tide can decrease this depth by erosion of the sandy layer or, conversely, another female installed next to the nest, can, by sweeping, bring sand on top. The incubation habitat in which the eggs develop must have a relatively humid but low-saline and well-ventilated environment.

Embryos are vulnerable to extreme environmental conditions in four areas: substrate humidity and salinity, gas exchange and temperature (Mortimer, 1990a).

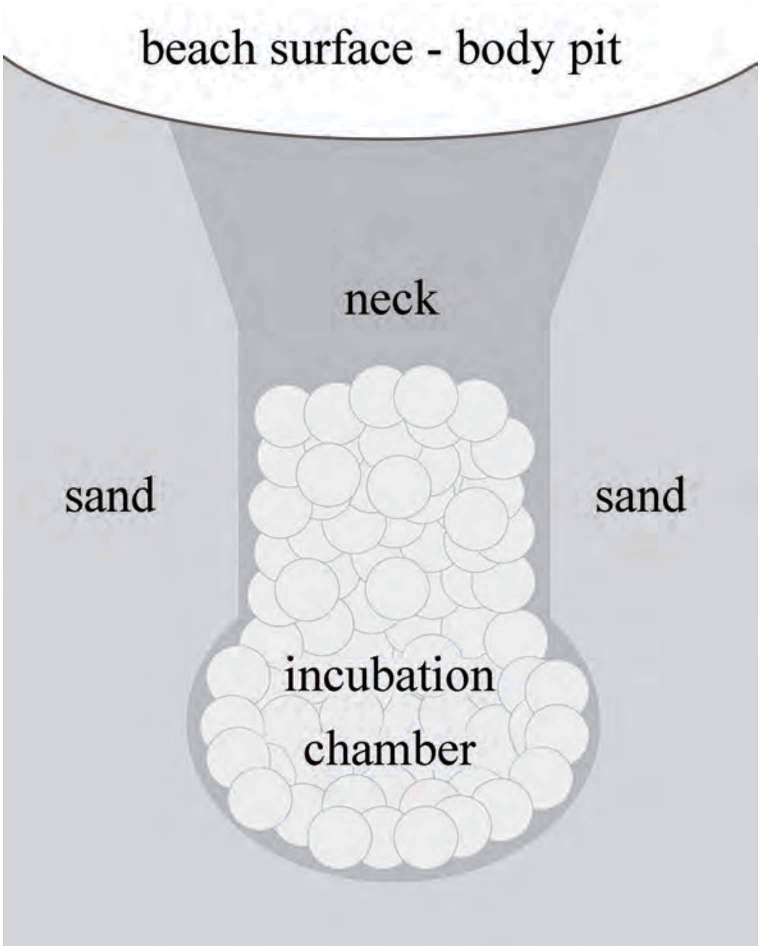


Figure 3. Nest schematic section. The body bowl is only present in species of the genera *Chelonia* and *Caretta*.

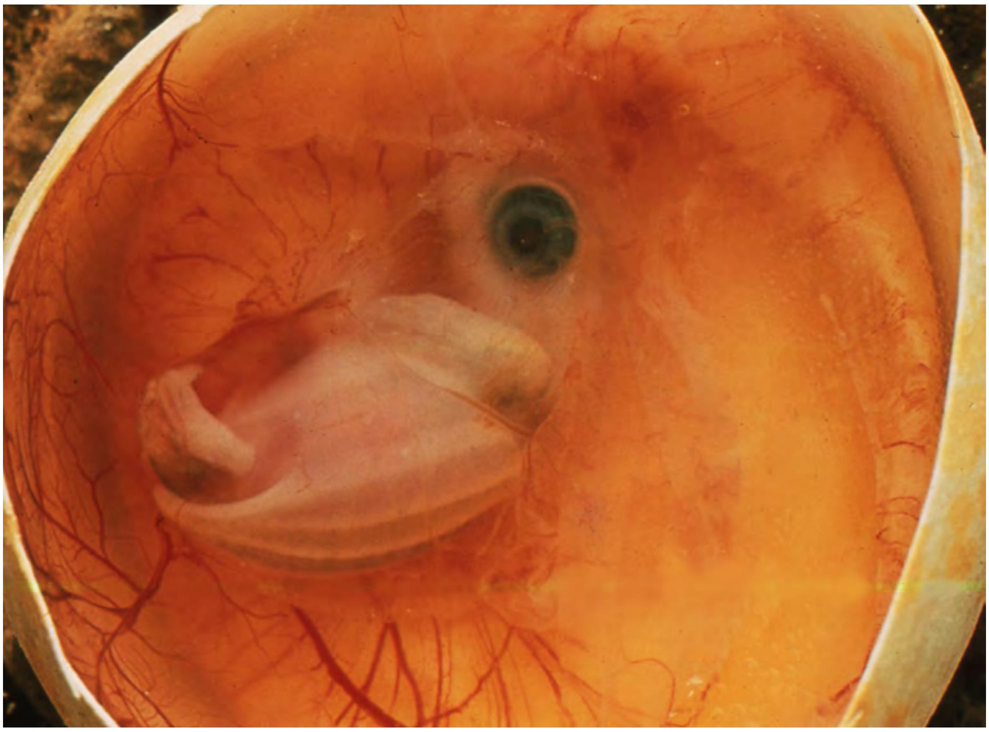


Photo 2. All the environmental factors (depth, grain size, hygrometry, gas, temperature, etc.) of the embryonic development habitat will be important for the normal development of this Leatherback embryo
(© J. Fretey)

Photo 3. After about sixty days, the developed embryo, will appear by an opening of the torn shell membrane through which the head, and then the front legs of this hatchling Green turtle emerge
(© J. Fretey)

The characteristics of the sand (color, composition, compaction, etc.) surrounding eggs are important for determining humidity levels during the two months or so of embryonic development humidity levels within the nest may be critical in maintaining the temperature, salinity, and gas exchange necessary for proper embryo development.

The synergy between humidity, gas exchange, and temperature within the nest can modify environmental conditions. For example, as temperature within the nest increases, embryonic oxygen uptake and humidity exchange increase (Ackerman,1997; Maloney *et al.*, 1990; Mortimer, 1990a).

Another consideration in optimizing the nesting environment is the sand grain size. Within each egg, the embryo has a vital need to exchange respiratory gases with the outside. Because the eggs will be surrounded on all sides by sand grains, gases that would normally diffuse in and out of the egg may be inhibited by an overly compact sandy barrier (Gulko & Eckert, 2004).

These different factors, as well as the location of the nest in relation to the sea and the vegetation, and the position of each egg inside the chamber, influence the ambient temperature, which, during a short thermosensitive period, determines the sex.

Incubation time is defined as the time between laying eggs in a nest and the hatchling emergence from the shell membrane (hatching). The minimum temperature for successful incubation is about 25°C; at this temperature, development is normal but slow, taking about 13 weeks.

The maximum temperature for successful incubation is 33-34°C with incubation periods of approximately six weeks. Higher temperature conditions may be lethal or the possibility of teratological consequences is greater. With a constant temperature incubation of 26-32°C, a change of 1°C increases or decreases the incubation period by about five days (Mrosovsky, 1980).

Full-term embryos use their caruncle at the end of the upper beak ("egg tooth" or oviruptor) to drill the amnion, chorio-lantoic membranes, and soft membrane (Miller, 1985). After hatchlings emergence, the extra-embryonic fluids (amnion and allantoic) having flowed into the substrate and the empty membranes were dragged to the bottom of the incubation chamber and the nest greatly decreases in volume (Kraemer & Richardson,1979). Digging in hatchlings ceases when ozone and CO_2 levels reach critical thresholds in the context of their ability to function anaerobically. It is usually a drop in temperature (cessation of daylight, rain) that causes emergence from the nest.

Internesting habitat

The same species are generally resident in the vicinity of the site(s) where they lay their eggs. This *internesting habitat* can be close to the coasts, at less than 20 km (except for *Natator depressus* for which it can be up to 60 km) and need to keep its natural environment, especially if it is close to a merchant port with a dangerous ship traffic, an agglomeration or a polluting industry.

Between egg-laying seasons, the females return to their feeding habitat to which they are generally faithful. They reconstitute their fat reserves there before leaving one, two, three or four years later for their nesting habitat a few hundred kilometers away but sometimes over much longer distances, which is often the case for Leatherback and Green turtles.

Frenzy habitat

After racing seaward from the chamber and leaving the natal beach (nesting habitat) and after their often tumultuous entry into the waves, hatchlings will swim rapidly offshore during a *"frenzy period"*, against the current, for about 24 hours (Wyneken & Salmon, 1992). This is a period during which a Green turtle hatchling, for example, moves at an average speed of 1.58 km/h (Okuyama *et al.*, 2006).

After this frenzied period, hatchlings make minimal movements, usually residing in a nursery habitat in deep oceanic waters (*post-frenzy period*) where they remain for several years (Bjorndal *et al.*, 2000; Reich *et al.*, 2007).

Photo 4. Its long flippers allow the hatchling Leatherback, despite a heavier body than other species, to move very quickly away from its natal beach and through a frenzy habitat
(© Y. Lanceau / J. Fretey)

Nursery habitat

Pelagic passive migration is still poorly understood in most species, where hatchlings are thought to drift with the currents for a period of time called *"lost years"* or *"lost decade"*. Juvenile *Chelonia mydas* and *Caretta caretta* find Sargasso habitats attractive, but the two species occupy different microhabitats (Smith & Salmon, 2009). Small turtles are thought to sometimes allow themselves to be carried to the surface in Sargasso communities for thermoregulatory basking allowing for improved digestive efficiency and better vitamin D synthesis (Mansfield *et al.*, 2014).

Kemp's Ridley hatchlings remain in a nursery until they are two years old (and an SCL[4] size of 20-25 cm). The nurseries of *L. olivacea* are not known but it is assumed that they are pelagic.

Various authors such as Hunter & Mitchell (1967) and Shomura & Matsumoto (1982) suggest a vital, marine, association of the young animals with a biomass accumulation created by the currents. *A contrario* to this hypothesis, Witham (1988, 1991) suggested that juvenile marine turtles would be safer from predation, and more able to find sufficient quantities of gelatinous zooplankton for survival and growth, if they behaved as individuals independent of concentrated marine biomass, in a pelagic environment away from drifting sargassum.

Developmental habitat

This concept, called *"developmental habitat"* by Carr *et al.* (1978), typically describes an underwater location or a series of residential habitats where juvenile and subadult turtles pass through and stay as they grow to adult size. Growth is slow for some species, so residence in a developmental habitat can sometimes last for decades.

There is growing evidence that in their first months of life, most hatchlings do not always disperse with ocean currents and drift passively, but are very active swimmers to favorable habitats (Mansfield *et al.*, 2014; Christiansen *et al.*, 2016).

These developmental habitats, more or less coastal, rarely correspond, for the same species, to adult feeding areas.

Upon reaching a certain size, with the exception of *D. coriacea* and *C. caretta* which remain pelagic, juvenile turtles have sufficient swimming power to break free from the currents and move to coastal habitats for a benthic stage of development. Juvenile and subadult Loggerheads less than 80 cm in size may migrate seasonally from a muddy estuary area to the open ocean. In *L. kempii*, initial recruitment of juveniles from pelagic oceanic habitats to neri-demersal habitats occurs at 20-25 cm (CCL) in northern Gulf of Mexico and New England waters. Juvenile Olive Ridley sea turtles may have a developmental habitat that is also muddy bottom feeding habitat that they sometimes share with adults.

After several years of an oceanic stage, juvenile Green turtles have a coastal existence and reside in a shallow neritic habitat dominated by seagrass beds or algae production on submerged rocks. Upon entering this developmental habitat, juvenile C. mydas typically change from an omnivorous oceanic system to a more predominantly herbivorous one after a few years (Bolten, 2003; Bresette *et al.*, 2013).

[4] Scientists studying marine turtles usually use the acronyms SCL for Straight Carapace Lengh or CCL for Curved Carapace Lengh.

Photo 5. This Hawksbill turtle hatchling leaving its embryonic developmental habitat is moving to a developmental habitat
(© J. Fretey)

Little is known about the movements and developmental habitats of post-natal *E. imbricata*. Reich *et al.* (2007) assume that they are stationed in a pelagic zone; then, when they reach a size of 20-25 cm (CCL), they move to neritic habitats, preferentially coral reefs (Boulon, 1994), before migrating about 10 years later to a feeding habitat close to their original beach (Bowen *et al.*, 2007). Aggregations of immature Hawksbill turtles are generally formed from mixed stocks with the contribution of females from multiple nesting habitats (Bjorndal *et al.*, 2016). At sexual maturity, depending on species and populations, there may be a long oceanic migration or shorter trips to mating habitats.

Understanding the ecology of juvenile turtles residing sometimes for decades in their developmental habitats is critical to designing strategies to ensure species survival (Meylan *et al.*, 2011).

The protection of developmental habitats is thus essential to ensure continuity for the recruitment of adult breeding populations.

Table I. Patterns of habitats frequented by *E. imbricata*, by age class, in the southwestern Pacific (based on Chaloupka, 2005)

Habitats	Age group (in years)	State	Sizes CCL (in cm)
Oceanic	1	Hatchling	4- ?
Oceanic	2-4	Post-hatchling	?-35
Neritic	5-14	Juvenile	35-50
Neritic	15-24	Immature	50-70
Neritic	25-34	Subadult	70-80
Neritic	+35	Adult	80

Feeding habitat

Each species-specific feeding pattern determines the presence of turtles in different residential habitats.

Feeding habitats consist of coastal or offshore areas where sexually immature or mature marine turtles feed, sometimes in an aggregated manner. Tropical seagrass beds, coral reefs, and sedimentary estuaries are often feeding areas. Adult turtles spend most of their lives in adult-only feeding habitat, rarely with immatures. But sometimes cohabitation exists (e.g. Abu Dhabi, Ras Al Khaimah, N. Pilcher, pers. com.).

Turtles of the genus *Chelonia*, omnivorous in their immature period, become ontogenetically almost strictly herbivorous as adults. Juvenile turtles move from a pelagic feeding habitat with omnivorous diet to a strict herbivorous neritic feeding habitat (Bolten, 2003; Arthur *et al.*, 2008). However, a study in the temperate waters of the southwestern Atlantic Ocean (González Carman *et al.*, 2013) indicated that juvenile Green turtles in this region had a diet consisting of 50% gelatinous plankton.

E. imbricata is primarily spongivorous but may eat mangrove fruits. *L. kempii*, *L. olivacea* and *N. depressus* are omnivorous but target mainly Crustacea and Molluscs as prey. In the juvenile stages, *C. caretta* typically feeds on planktonic elements such as gelatinous zooplankton in oceanic habitats deeper than 200 m, then as diving abilities develop, as well as when sexually mature, its prey consisting of Molluscs and Crustaceans are caught at shallower depths in their neritic habitat. *L. olivacea* often hunts its prey in estuaries, and muddy areas. Adults of this species appear to use pelagic oceanic feeding habitats when not breeding (Chambault *et al.*, 2016). Leatherbacks feed among jellyfish swarms.

Species' food choices, and thus habitats, influence their growth rate and age of maturity. Demographic differences are attributable to variability in diets, ingested quality, and quantity (Gillis *et al.*, 2018).

It should be noted that limited food resource constraints would lead to unusually early maturity, directing energy for growth to reproduction and maximizing resource conversion efficiency (Tiwari and Bjorndal, 2000).

Marquez (1990) writes that *E. imbricata*, in its tropical range, frequents sponge habitats (Sponges, Porifera), and Meylan (1988) specifies that during its migrations, this species seeks these same habitats.

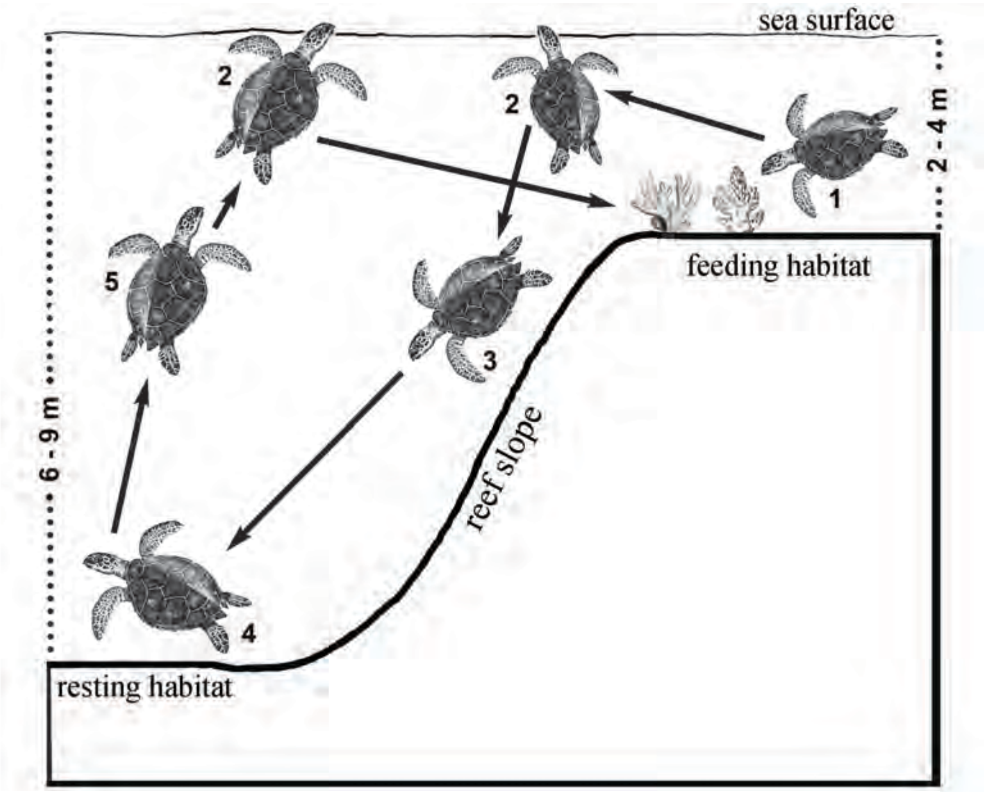


Figure 4. Diagram showing the movement of Hawksbill turtles between feeding and resting habitats: (1) hunting on the reef flat; (2) surfacing after the feeding phase is complete; (3) descending to the bottom of the reef; (4) resting habitat (usually sandy bottom); (5) surfacing after the resting period and returning to the feeding habitat (inspired by Houghton et al., 2003).

Hawksbill turtles are anatomically and "mechanically" well adapted to these benthic habitats with thick, non-tearable plates of the carapace in reefs, its elongated and hooked rhamphotheca[5] allowing it to feeding and searching for prey such as sponges in coral hollows (Van Dam & Diez, 1996). Juvenile *E. imbricata* of about 20 centimeters and migratory adults temporarily reside in pelagic habitats. Juveniles, subadults, and adults of both sexes feed in benthic habitats, sometimes shallow, most often in coral reefs or mangroves (Nivière *et al.*, 2018). There is a clear dichotomy of habitats between the shallow one (usually around 3 m, thus within the limits of a Ramsar site), where the active turtle fetches its prey, and a resting habitat, much deeper (on average 6-7 m) where it can remain motionless for about 30 minutes before surfacing (Houghton *et al.*, 2003; Van Dam & Diez, 1996).

[5] The rhamphotheca is a horny integument of the upper and lower mandibles.

It appears that when nesting habitat is in close proximity to dual nursery - feeding habitat, adult females no longer feed *in situ* at the end of the nesting season, but move to other resource areas to avoid competition (Figure 4).

Evans *et al.* (2019) identify four types of feeding behavior in *C. caretta*: primary, secondary, seasonal, and *loop movements*. Loop movements are associated with changes in sea surface temperature as observed turtles move to avoid cold temperatures.

Resting habitat

Near the coasts, the marine turtles, between periods of activity, can settle on the bottom, sometimes a part of the body entered in a rocky cavity, and remain there between ascents to the surface to breathe and then look for food at various depths.

Photo 6. Juvenile Green Turtle in a resting habitat in the Diani Beach Barrier Reef, Diani-Chale Management Area, southern Kenya
(© Joana Hancock / Olive Ridley Project)

Hibernation habitat

This really is a winter lethargy and not true hibernation. The dormancy of a turtle, usually on a sandy or muddy bottom, happens during a significant decrease of the sea water temperature. A temperature threshold for going dormant is assumed to be just below 15°C. Dormant turtles are often buried in sediment, covered with mud. In a state of light anaerobic dormancy, they must however come up (at night it seems) to breathe, which shows that it is not a deep hibernation as in the palustrine turtles.

Overwintering observations were made early on in various oceans with *Chelonia mydas, Chelonia agassizii, Lepidochelys kempii, Caretta caretta* (Carr & Caldwell, 1956; Felger *et al.*, 1976; Carr *et al.*, 1980; Ogren & McVea, 1981), but hibernation habitat appears very rarely in publications and conservation plans.

The phenomenon has been described mainly in *Caretta caretta* in the United States (Carr *et al.*, 1980), Tunisia (Laurent & Lescure, 1994), Greece (Hochscheid *et al.*, 2005), as well as in *Chelonia mydas* in Mexico (Felger *et al.*, 1976). As in diseased marine turtles with swimming difficulties, algae develop on the scutes of lethargic individuals.

Hochscheid *et al.* (2005) found that overwintering Loggerheads tracked in the southern Tyrrhenian Sea can remain asleep on the bottom for up to 7 h without surfacing.

At low water temperatures, the metabolic rates of marine turtles are inherently low, and thus they have limited energy requirements (Hochscheid *et al.*, 2004).

Only some populations enter overwintering and only a portion of these populations choose this overwintering strategy, while others migrate to warmer regions (Ogren and Mcvea, 1995).

Such a phenomenon does not concern *Dermochelys coriacea*, which in the Labrador Sea, sometimes frequents waters close to 3°C.

Basking habitat

The phenomenon of basking in the sun or at night with warm air of land-based adult both male and female *Chelonia* turtles has been observed in Australia (Bustard, 1973; Whittow & Balazs, 1982; Maxwell *et al.*, 2014), on the Mexico coasts, and the Galapagos Islands (Fritts, 1981), and has been most commonly described in the Hawaiian Archipelago on the coral island of Laysan, Pearl & Hermes Atoll, the Necker Islands, and the French Frigate Shoals (Balazs & Ross, 1974; Balazs, 1977; Kam, 1986).

Basking on land never takes place during rainy weather. During this basking period, the turtle is inactive, with only a lifting of the head when breathing. The carapace absorbs a significant amount of solar radiation and its surface temperature can reach 42.8°C.

Juvenile turtles can also remain on the sea surface, carried by mats of Sargassum, in order to benefit from the sun.

It is assumed that this particular thermoregulation favors the synthesis of vitamin D and allows a better digestion of the food bolus.

For adults, this habitat often overlaps with nesting beaches.

Photo 7. Group of turtles basking in the sun on Ho'okina Beach on the Maui north shore, Hawaii (© J. Morrison)

Pelagic and allopelagic habitats

Nekton (term attributed to Haeckel, 1890) is the set of living organisms having an active capacity of marine allowing swimming sometimes against the current, and having the ability to orientate. Marine turtles are part of the nekton and can have, during their life cycle, a pelagic habitat, i.e. the open water oceanic environment for all the species.

A species such as *D. coriacea* may also be allopelagic, able to dive to great depths. Leatherbacks show a tendency to use pelagic habitat not always related to prey search (Hays *et al.*, 2006).

Zug *et al.* (1995) and Polovina *et al.* (2006) showed that in the North Pacific juvenile, subadult and adult *C. caretta* occupied a pelagic habitat with surface temperatures and oceanic productivity appropriate to their needs, but that these remained virtually unknown to us (Kobayashi *et al.*, 2008).

Turtle cleaning station

Some species (*Chelonia mydas, Caretta caretta, etc.*) may have a preferred location on a reef, free of predators and turbulent water movements, where they can intentionally rest and be cleaned by fish or crustaceans. We do not know how such symbiotic associations and cleaning stations are established, and how turtles identify them. Cleaning is usually done in the Pacific Ocean by surgeonfish (family Acanthuridae). The fish peck at algae and various parasites or commensals (Epibionts) present on the turtles' skin and carapace. Beyond this role of cleaning, the stations may also have for the turtles an anti-stress function and suppress the negative effects of the parasites on the health.

Turtles can also self-clean by rubbing against rocks.

Photo 8. Cleaning station for female Loggerheads off Zakynthos Island. Here the cleaner fishes belonged to three species (families Mullidae and Sparidae) including mainly sharpnose sears, *Diplodus puntazzo*
(© K. Papafitsoros)

Underwater surveys in the Mediterranean show that the location of cleaning stations for female Loggerheads near the nesting habitat on the island of Zakynthos (Greece), changed every year, ruling out the use of long-term cognitive memory. It was also found that several turtles could compete for the same station and that an individual could return to the same station several times in a day. It was noted that when a turtle entered a station where another turtle was already being cleaned, several of the cleaner fish immediately switched turtles (Schofield *et al.*, 2017).

Migration habitat

Most hatchlings, after the frenzy period, undertake a mostly passive migration, drifting in pelagic habitat entrained within oceanic gyre systems. After a number of years, these now larger juveniles move to demersal nursery habitats in tropical and temperate zones. Juveniles from some temperate populations make seasonal migrations to feeding areas at higher latitudes in summer and lower latitudes in winter.

Migrations then proceed in the opposite direction, with sometimes transoceanic movements from a natal habitat to a succession of nursery habitats. It is therefore understandable why, because of these migratory habits and varied habitats, sometimes geographically very distant, the conservation of marine turtles needs international cooperation.

As they approach maturity, pubescent turtles move into adult feeding habitats. In some populations, adult habitats are geographically distinct from juvenile developmental habitats. In others, they may overlap or coincide (Musick & Limpus, 1996).
Oceanic migration corridors sometimes exist in marine turtles. Many long-distance adult migrations provide a link between breeding (mating, nesting) and foraging habitats, sometimes using the earth's magnetic field (Lohmann *et al.*, 1999; Lohmann *et al.*, 2008; Lohmann & Lohmann, 2019).

Migration patterns differ not only among species, but also among populations. Some populations nest and feed in the same area; others migrate great distances. Long migrations may be seasonal, but may also depend on biotic factors such as competition for food or prey habitat, breeding (Alerstam *et al.*, 2003; Dingle & Drake, 2007).

Ocean characteristics, such as sea surface temperature, salinity, currents, chlorophyll density play a large role in migrations and foraging habitats (Georges *et al.*, 2000). Briscoe *et al.* (2019) define the existence of thermal corridors (*"thermal corridors"*) under specific seasonal and interannual conditions, and facilitating the movement of juvenile *C. caretta* from the central North Pacific to the coastal waters of Baja California.

Some populations of *Chelonia mydas* migrate along the coast. Other populations, such as the females laying on Ascension Island, may travel more than 2,000 km across the Atlantic Ocean to feeding areas on the Brazilian coast. This long-distance oceanic migration is described as aparadigmatic, and it has been shown that these turtles possess a complex "biological compass" that allows them to calculate their position and the direction of their target geographic habitats using the tilt and intensity of the Earth's magnetic field (Papi *et al.*, 2000). In the Brazil-Ascension direction, it is hypothesized that the turtle is guided by a combination of chemical cues composed of substances originating from the island and transported in a west-southwest direction by the South Atlantic equatorial current (Luschi *et al.*, 1998).
In the North Pacific, migrating *C. caretta* follow the Transitional Zone Chlorophyll Front (TZCF) where they seem to find their prey easily; they spend 40% of their time at the surface and otherwise at depths of some 40 m. In the same region, *L. olivacea* spend only 20% of their time at the surface and are associated with major oceanic currents such as the North Equatorial Current (NEC) and the Equatorial Counter Current (ECC) (Polovina *et al.*, 2003).

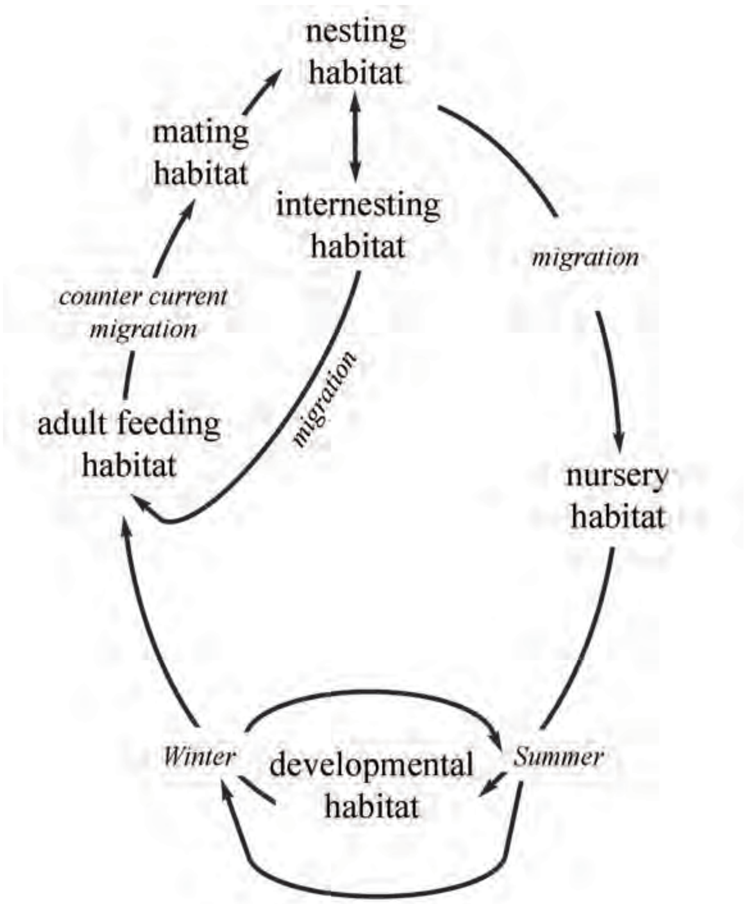


Figure 5. Conceptual model of ontogenetic habitat stages in marine turtles (inspired by Musick & Limpus, 1996).

Kemp's Ridley sea turtles follow three major migratory directions from the Gulf of Mexico: one to the Bank of Campêche near the Yucatan Peninsula; juveniles are heading to Bermuda (Marquez, 1994); post-nesting dispersal of juveniles, subadults and females has been observed northward to the Mississippi River and into Canadian and European waters (Bleakney, 1965; Brongersma, 1972; Fretey, 1999).

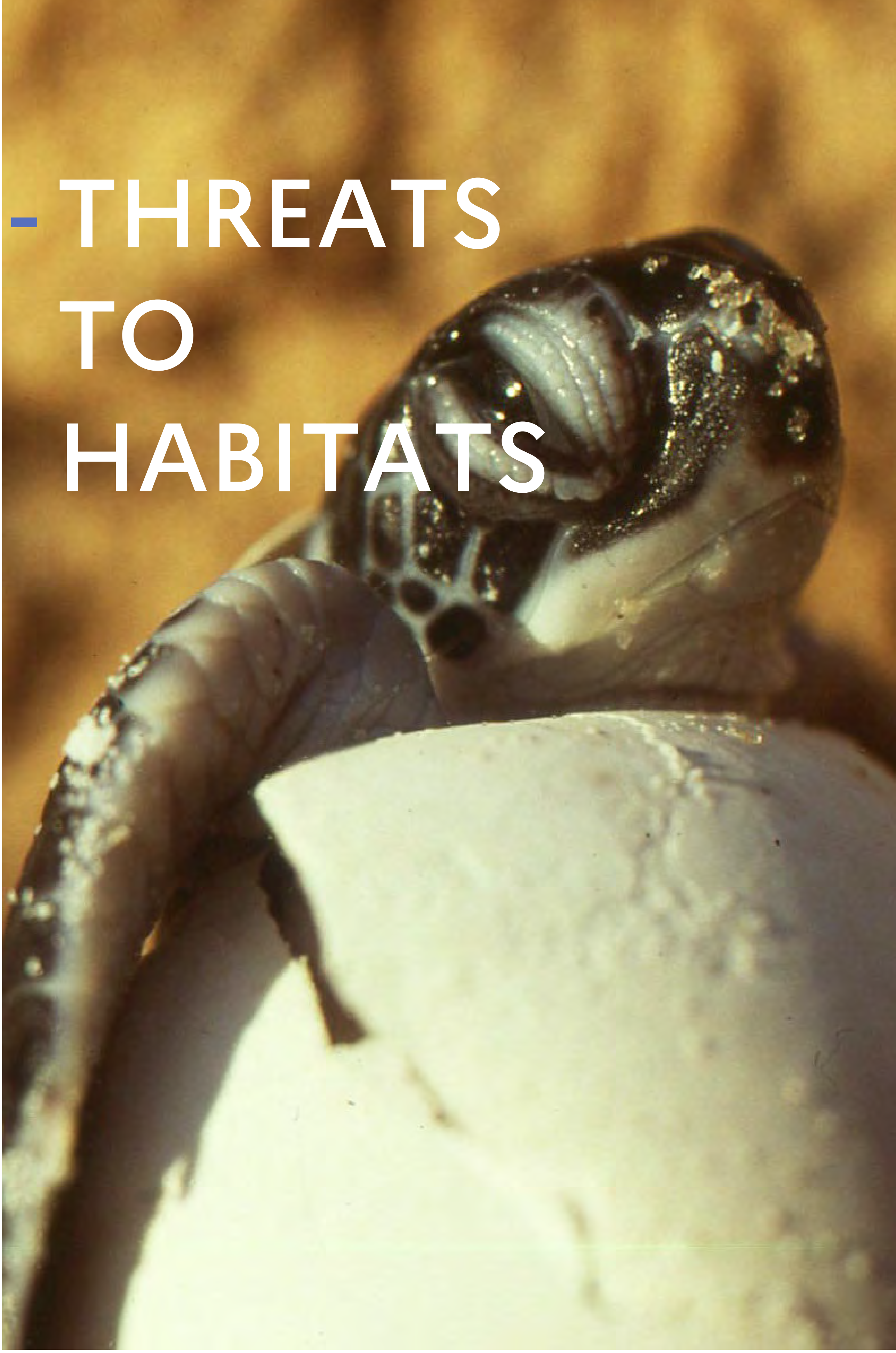
L. olivacea often migrates in large flotillas, but regional populations are known to be non-migratory.

Little is known about the migratory behavior of *E. imbricata*, which appears to be the most restricted of all species. Some adult females would migrate cyclically. Several females tracked from the Great Barrier Reef, Australia, made a breeding migration to neighbouring countries including Vanuatu, Solomon Islands, Papua New Guinea and Indonesia. Migratory distances between foraging areas and nesting beaches ranged from 368 to 2,425 km (Miller *et al.*, 1998).

Adults of *Natator depressa* leave nesting habitats on the northern coast of Australia and migrate 200 to 1,300 km to their feeding habitats (cf. Chapter V.1.7.), but generally remain in Australian territorial waters.

Adult *D. coriacea* travel the longest transoceanic migratory routes, sometimes approaching 5,000 km (Pritchard, 1973; Goff *et al.*, 1994; Fretey & Fernandez-Cordeiro, 1996). They tend to remain in food-rich habitats. Some populations of *L. olivacea* can also make migratory journeys of some 4,500 km, particularly in the Atlantic, between Brazil and West Africa (Santos *et al.*, 2019).

4 - THREATS TO HABITATS



After having projected a front leg out of the egg membrane, this green turtle at the end of incubation takes out the head before the 2nd leg
(© J. Fretey)

THREATS TO HABITATS

« The development of beaches and back beaches in tourist areas increases the potential of human trampling »

It is important to note that human activities threaten marine turtles and their habitats both on land and at sea (Coston-Clements & Hoss, 1983).

Beaches suitable for nesting are threatened in their natural integrity and tranquillity in all oceans. The concentration of human populations on the coasts with urbanization on the terrestrial part of the high tide line (public maritime domain), industrialization, construction of commercial ports, destruction of the natural vegetation cover or on the contrary plantations of non-indigenous plants, extraction of marine sand, tourist infrastructures, vehicle traffic, erosion due to the construction of commercial or mineral ports, military activities, sea level rise caused by global warming reduce the available space of terrestrial habitats for egg-laying, all constitute a disturbance of females by a permanent human presence and artificial lights, as well as hazards when approaching the coasts by boats and motorized sports machines.

The development of beaches and back beaches in tourist areas increases the potential of human trampling, leading to sand compaction, and leads to habitat modification with the creation of obstacles with recreational and catering materials, as well as the accumulation of waste attracting predators.

28%

of the world's coastline is already altered by human activities

Mainland beaches near villages or in island environments are invaded by domestic species (dogs, cats, pigs, etc.) or wild species (rats, mice, ants, beetles, paddles, raccoons, etc.) introduced or proliferating due to unmanaged waste. These invasive animals prove to be major predators of eggs and hatchlings, leading terrestrial breeding habitat that offers very little chance of successful nesting.

Destruction of native creeping and shrubby backshore vegetation, which stabilizes the dunes, can promote erosion that is detrimental to turtle nesting. Artificial plantings of ornamental shrubs on beaches can provide unusual shade in these areas and alter the normal sex ratio (Mrosovsky *et al.* 1995).

Pollution by hydrocarbons, various contaminants (PCBs - polychlorinated biphenyls, PAHs - polycyclic aromatic hydrocarbons, cadmium, copper, lead, mercury, zinc, etc.), plastics and other floating debris, ghost nets have become essential causes of deterioration of marine habitats, appearance of new pathologies and death traps for turtles.

Photo 9. Pigs, large nest predators, foraging in the sand on an African nesting habitat
(©J. Fretey)

Mangrove wetlands, seagrass beds, and coral reefs dominate the land-sea margin of tropical regions and are vital habitats for marine turtles. Mangroves are exploited for timber, charcoal, agriculture, aquaculture or destroyed for coastal construction. Mangrove deforestation leads to increased runoff and sedimentation, increased nutrients from wastewater. Seagrass beds are torn up by the anchors of sailing ships, dredged for ports. Coral reefs have an internal cycle that requires nutrients due to a symbiotic association between zooxanthellae and corals. They require clear water for their development, and they are heavily impacted by sediment and terrestrial runoff. A river discharge containing a heavy sediment load can destroy or severely restrict community development of coral reefs (Kjerfve *et al.*, 1998). Stressed corals bleach and die.

Ocean pollution of marine turtle habitats by marine plastic debris is rapidly becoming one of the major concerns for the conservation of these species. Among a variety of problems posed by the approximately 12 million tons of such debris discarded into the oceans each year, is their ingestion by turtles and turtle entanglement in such debris have become lethal threats to them. It is clear from the modelling by Schuyler *et al.* (2015) that the coasts of southern China, Southeast Asia, eastern Australia, the United States of America, and the Pacific Ocean gyre are critical areas with respect to these hazards.

Food areas such as seagrass beds and estuaries rich in crustaceans, contaminated by organochloride pesticides (OCPs) from agriculture, are found throughout the food chain of Green turtles, Loggerheads and Lepidochelyds.

Coastal nursery and feeding habitats, particularly seagrass beds and coral reefs, have been undergoing major deterioration for several decades by human activities in physical, mechanical and chemical ways, thus reducing food availability.

Nesting habitats are facing increasing anthropogenic pressure due to urbanization and global tourism development. Mainly in the Caribbean and the Mediterranean, beach development, recreational activities and water sports for millions of tourists have a serious impact on breeding habitats and female turtles approaching the coast.

The locomotion of an adult female turtle (mainly *Eretmochelys imbricata*, but also sometimes *Lepidochelys olivacea*) can lead it to go beyond its usual zone, voluntarily or by accident (artificial lights leading to disorientation).

Photo 10. Attempt to clear a female Leatherback from a rock barrier against erosion to protect backshore villas (built on the public maritime domain), on the beach of Remire-Montjoly, French Guiana
(© Kwata)

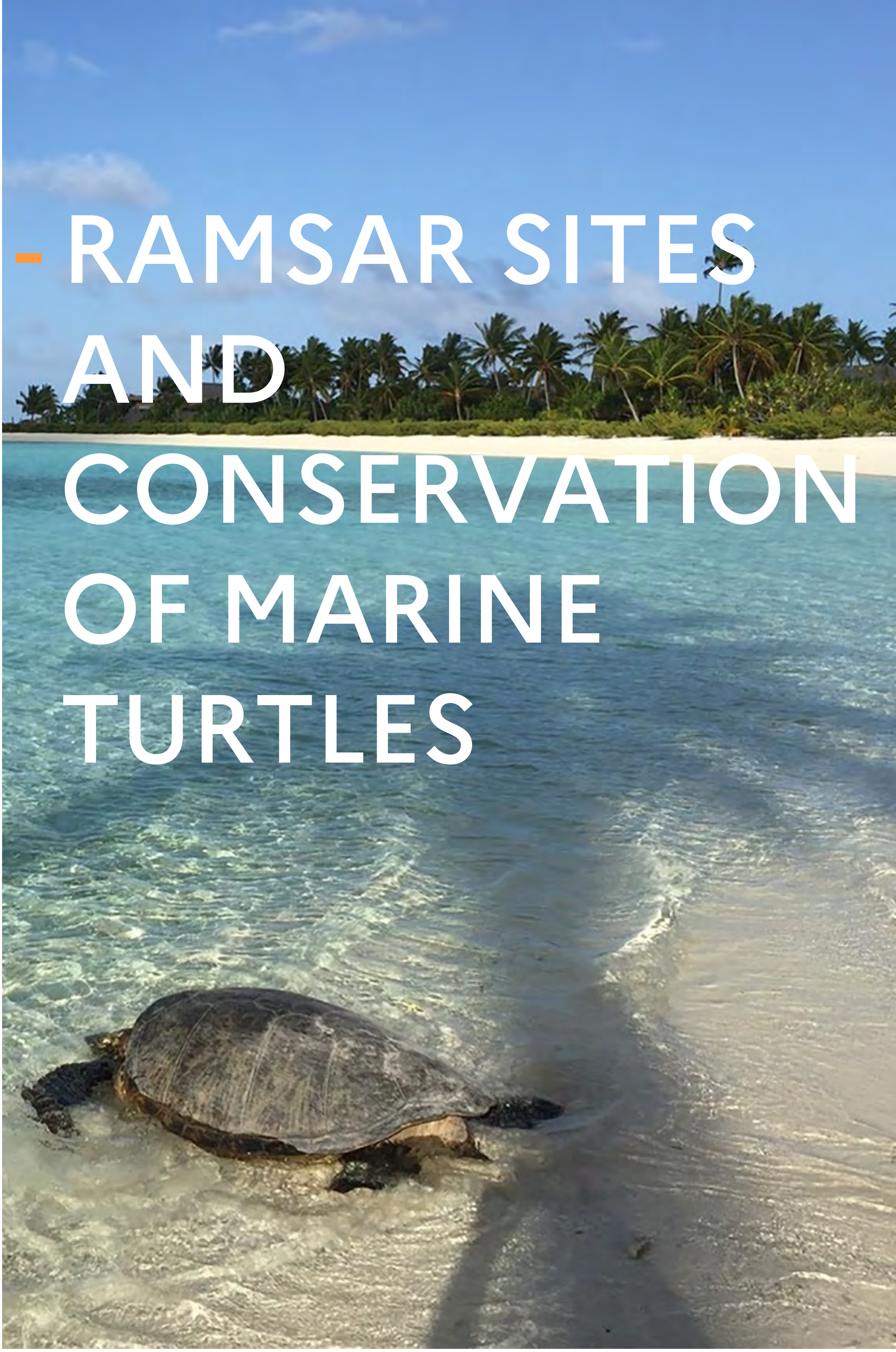
Some 28% of the world's coastline is already altered by human activities (Martinez *et al.*, 2007), and the estimated increase in human population to 9.3 billion by 2050 will further dramatically increase coastal pressure.

Due to the melting of the ice sheets, sea level rise over the next century could exceed 2 m (Bamber *et al.*, 2019). Heavily altered coastal areas are likely to invest in coastal walls and armouring that will result in a net reduction in beach area ("coastal squeeze"). These threats will inexorably reduce nesting habitat, forcing females to dig their nests in high-risk areas (Witherington *et al.*, 2011). Incubation chamber microclimate is related to nest location vis-à-vis its distance from shore and vegetation (Swiggs *et al.*, 2018). Many hypotheses have been made regarding a female's choice of nest location, characteristics across species and populations. Females are likely to concentrate on very small sandy areas in the future, increasing the risk of digging up pre-existing nests and disease transmission (Tiwari *et al.*, 2006; Girondot *et al.*, 2006; Leighton *et al.*, 2010).

Widespread temperature increases will alter the phenology of egg-laying seasons and may lead to feminization of populations (Jensen *et al.*, 2018).

Because habitats for different age classes are often scattered, marine turtle conservation requires collaboration among governments of multiple nations over large ocean regions, which involves implementing legislation in sometimes complicated and contradictory ways (Mortimer *et al.*, 2007; Whiting *et al.*, 2008). The Action Plan for *Caretta caretta* in the South Pacific adopted by the CMS Conference of the Parties in Quito in November 2014 and the development of the Action Plan for the Conservation of the Hawksbill Turtle (in accordance with CMS COP12 Decision 12.17) are examples of regional ocean plans that need to be scaled up to ensure the conservation of a multitude of vital habitats.

5 - RAMSAR SITES AND CONSERVATION OF MARINE TURTLES



Nesting track of a Green turtle on the beach of Tetiaroa
(© Te mana o te moana)

RAMSAR SITES AND CONSERVATION OF MARINE TURTLES

5-1 Existing and potential Ramsar sites and notes on their interest

« With its overseas territories located in all oceans [...] France has a great responsibility. »

We hereafter inventory the sites designated by the Ramsar Convention that contain terrestrial and marine turtle habitats that possess the properties described above. This inventory, carried out with the help of the Contracting Parties to the Convention, is intended to be exhaustive, but it probably is not. Conversely, some States may have incorrectly indicated the presence of marine turtles, and as these sites are unknown to us and to the scientific literature, we have not been able to detect the error.

We will sometimes add comments on the importance of a particular site on a regional or global scale, as well as for the maintenance of genetic diversity within a species. As nesting sites are better known to the scientific community than developmental and feeding habitats, they will be given priority here.

With its overseas territories located in all oceans, sometimes with marine turtle habitats of international interest, France has a great responsibility. We will therefore make some recommendations for the classification of new sites in the French Overseas Territories under the Ramsar Convention.

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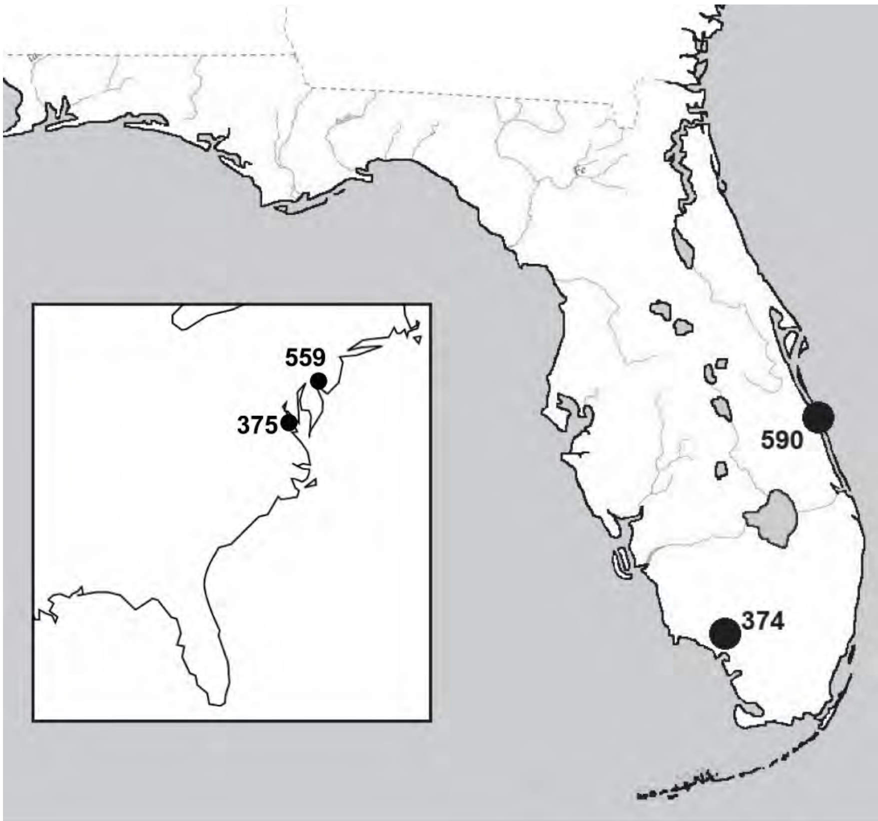
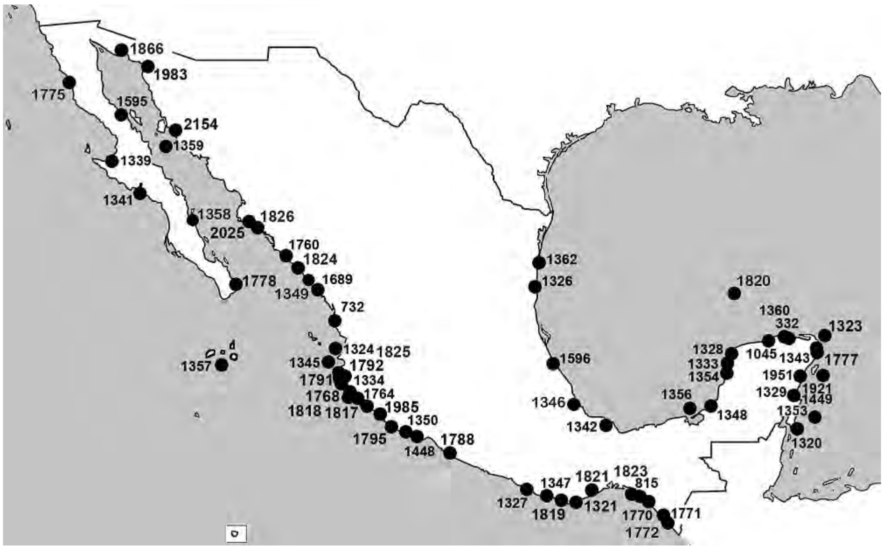
Ramsar sites already involved in marine turtle conservation

REGION 1

North America.



Map 1. Location of Ramsar sites in the United States of America.



Map 2. Location of Ramsar sites in Mexico
White square: location of the Clipperton atoll protection zone.

Table II. Inventory of North America sites

Site number	Contracting Parties	Administrative region	Site name	Species present
374	United States of America Ratification: 18/12/1986	Florida	Everglades National Park	Cc, Cm, Ei, Lk
375	United States of America	Virginia	Chesapeake Bay Estuarine Complex	Cc, Lk
559	United States of America	Delaware, New Jersey	Delaware Bay Estuary	Cc
590	United States of America	Florida	Pelican Island National Wildlife Refuge	Lk, Cm, Cc, Ei
332	Mexico (United Mexican States) Accession: 04/07/1986	Yucatán	Humedal de Importancia Especialmente para la Conservación de Aves Acuáticas Reserva Ría Lagartos	Dc, Cc, Cm, Ei
732	Mexico (United Mexican States)	Sinaloa	Marismas Nacionales	Ei, Dc, Lo, Ca
815	Mexico (United Mexican States)	Chiapas	Reserva de la Biosfera La Encrucijada	Ca, Lo, Dc
1045	Mexico (United Mexican States)	Yucatán	Dzilam	Ei
1320	Mexico (United Mexican States)	Quintana Roo	Parque Nacional Arrecifes de Xcalak	Cc, Ei, Dc, Cm
1321	Mexico (United Mexican States)	Oaxaca	Cuencas y corales de la zona costera de Huatulco	Dc, Ei, Lo, Ca
1323	Mexico (United Mexican States)	Quintana Roo	Parque Nacional Isla Contoy	Cm, Cc, Ei, Dc
1324	Mexico (United Mexican States)	Nayarit	Parque Nacional Isla Isabel	Ca, Lo, Ei
1326	Mexico (United Mexican States)	Tamaulipas	Playa Tortuguero, Rancho Nuevo	Lk, Ei, Cc, Cm, Dc
1327	Mexico (United Mexican States)	Guerrero	Playa Tortuguera Tierra Colorada	Dc, Lo, Ca
1328	Mexico (United Mexican States)	Yucatán	Reserva Estatal El Palmar	Ei
1329	Mexico (United Mexican States)	Quintana Roo	Sian Ka'an	Cm, Cc, Ei, Dc
1333	Mexico (United Mexican States)	Yucatán	Reserva de la Biosfera Ría Celestún	Ei, Cc
1334	Mexico (United Mexican States)	Jalisco	Reserva de la Biosfera Chamela - Cuixmala	Dc, Lo, Ei, Ca
1339	Mexico (United Mexican States)	Baja California Sur	Laguna Ojo de Liebre	Ca
1341	Mexico (United Mexican States)	Baja California Sur	Laguna San Ignacio	Ca
1342	Mexico (United Mexican States)	Veracruz	Manglares y humedales de la Laguna de Sontecomapan	Cc, Dc, Ei, Lk

1343	Mexico (United Mexican States)	Quintana Roo	Parque Nacional Arrecife de Puerto Morelos	Ei, Cm, Cc
1345	Mexico (United Mexican States)	Nayarit	Islas Marietas	Lo, Ei
1346	Mexico (United Mexican States)	Veracruz	Parque Nacional Sistema Arrecifal Veracruzano	Cc., Cm., Ei., Lk., Dc
1347	Mexico (United Mexican States)	Oaxaca	Playa Tortuguera Cahuitán	Ca, Lo, Dc
1348	Mexico (United Mexican States)	Campeche	Playa Tortuguera Chenkán	Cm, Ei
1349	Mexico (United Mexican States)	Sinaloa	Playa Tortuguera El Verde Camacho	Cm, Ei, Lo, Dc
1350	Mexico (United Mexican States)	Michoacán	Playón Mexiquillo	Lo, Ca, Dc
1351	Mexico (United Mexican States)	Quintana Roo	Playa Tortuguera X'Cacel-X'Cacelito	Cc, Cm
1353	Mexico (United Mexican States)	Quintana Roo	Reserva de la Biosfera Banco Chinchorro	Cm, Ei, Cc
1354	Mexico (United Mexican States)	Campeche	Reserva de la Biósfera Los Petenes	Ei
1356	Mexico (United Mexican States)	Campeche	Área de Protección de Flora y Fauna Laguna de Términos	Lk, Ei, Cm
1357	Mexico (United Mexican States)	Mexican Island Territory	Reserva de la Biosfera Archipiélago de Revillagigedo	Ca, Dc, Lo
1358	Mexico (United Mexican States)	Baja California	Parque Nacional Bahía de Loreto	Cc, Ca, Lo, Dc, Ei
1359	Mexico (United Mexican States)	Sonora	Reserva de la Biosfera Isla de San Pedro Mártir	Cc, Ca, Lo, Dc
1360	Mexico (United Mexican States)	Quintana Roo	Area de Protección de Flora y Fauna Yum Balam	Ei, Cc, Cm, Lk, Dc
1362	Mexico (United Mexican States)	Tamaulipas	Laguna Madre	Cm, Lk
1448	Mexico (United Mexican States)	Michoacán	Laguna Costera El Caimán	Ca
1449	Mexico (United Mexican States)	Quintana Roo	Parque Nacional Arrecifes de Cozumel	Cc, Ei, Cm, Dc
1595	Mexico (United Mexican States)	Baja California	Corredor Costoro La Asamblea - San Francisquito	Ca, Cc, Ei, Dc, Lo
1596	Mexico (United Mexican States)	Veracruz	Laguna de Tamiahua	Lk, Cm
1689	Mexico (United Mexican States)	Sinaloa	Laguna Huizache-Caimanero	Lo
1760	Mexico (United Mexican States)	Sinaloa	Ensenada de Pabellones	Lo
1764	Mexico (United Mexican States)	Colima	Santuario Playa Boca de Apiza – El Chupadero – El Tecuanillo	Lo, Ca, Dc
1768	Mexico (United Mexican States)	Jalisco	Laguna Xola-Paramán	Dc, Lo, Ca
1770	Mexico (United Mexican States)	Chiapas	Sistema Estuarino Boca del Cielo	Ca, Lo, Dc

1771	Mexico (United Mexican States)	Chiapas	Zona Sujeta a Conservación Ecológica Cabildo-Amatal	Ca, Lo
1772	Mexico (United Mexican States)	Chiapas	Zona Sujeta a Conservación Ecológica El Gancho - Murillo	Lo
1775	Mexico (United Mexican States)	Baja California	Bahía de San Quintín	Lo
1777	Mexico (United Mexican States)	Quintana Roo	Manglares de Nichutpé	Cm
1778	Mexico (United Mexican States)	Baja California Sur	Parque Nacional Cabo Pulmo	Ca, Cc, Ei, Dc, Lo
1788	Mexico (United Mexican States)	Michoacán	Playa de Colola	Dc, Lo, Ca
1791	Mexico (United Mexican States)	Jalisco	Estero El Chorro	Dc, Ca, Lo
1792	Mexico (United Mexican States)	Jalisco	Estero Majahuas	Lo, Dc, Ca
1795	Mexico (United Mexican States)	Michoacán	Playa de Maruata	Lo, Dc, Ca
1817	Mexico (United Mexican States)	Jalisco	Laguna Barra de Navidad	Ca, Dc, Lo
1818	Mexico (United Mexican States)	Jalisco	Laguna Chalacatepec	Lo, Dc, Ca
1819	Mexico (United Mexican States)	Oaxaca	Lagunas de Chacahua	Ca, Lo, Dc
1820	Mexico (United Mexican States)	Yucatán	Parque Nacional Arrecife Alacranes	Ei, Cc, Cm, Lk, Dc
1821	Mexico (United Mexican States)	Oaxaca	Playa Barra de la Cruz	Dc, Ca, Ei, Lo
1823	Mexico (United Mexican States)	Chiapas	Sistema Estuarino Puerto Arista	Ei, Ca, Lo, Dc
1824	Mexico (United Mexican States)	Sinaloa	Sistema Lagunar Ceuta	Lo, Dc, Ca
1825	Mexico (United Mexican States)	Jalisco	Sistema Lagunar Estuarino Agua Dulce - El Ermitaño	Lo, Dc, Ca
1826	Mexico (United Mexican States)	Sinaloa	Sistema Lagunar San Ignacio - Navachiste - Macapule	Ei, Ca, Lo
1866	Mexico (United Mexican States)	Sonora	Humedales de Bahía Adair	Ca, Dc, Cc, Lo
1891	Mexico (United Mexican States)	Sonora	Canal del Infiernillo y esteros del territorio Comcaac (Xepe Coosot)	Cc, Ca, Lo, Dc, Ei
1921	Mexico (United Mexican States)	Quintana Roo	Manglares y Humedales del Norte de Isla Cozumel	Cc, Cm, Ei
1983	Mexico (United Mexican States)	Sonora	Humedales de Bahía San Jorge	Lo, Ca, Dc, Cc
1985	Mexico (United Mexican States)	Colima	Laguna de Cuyutlán vasos III y IV	Dc, Lo, Ca
2025	Mexico (United Mexican States)	Sinaloa	Lagunas de Santa María-Topolobampo-Ohuira	Ca, Ei, Dc, Lo
2154	Mexico (United Mexican States)	Sonora	Humedales de la Laguna La Cruz	Ca

Notes:

In North America, *Caretta caretta* has four important nesting regions: eastern Florida (USA) with more than 10,000 nests per season, followed by South Carolina, southwest Florida and the state of Quintana Roo (Mexico) with between 1,000 and 10,000 nests (COSEWIC[6], 2010). A 41% decline has been observed in Florida since 1998 (NMFS[7] & USFWS[8], 2008). It is estimated that 80% of Atlantic nests (42.4% for all oceans) of the species are located on the beaches of the Florida peninsula (TEWG[9], 2009). The most important nesting areas of the species, for all oceans, are Florida, then the Cape Verde archipelago and Masirah Island - Wilāyat Maṣīrah – (Oman).

In Florida, nests are sparse in the Keys, except on Boca Grande, Marquesas and Dry Tortugas. Approximately 80% of the 50,000-92,000 *C. caretta* nests recorded per season in the U.S. are located in six Florida counties: Brevard, Indian River, St. Lucie, Martin, Palm Beach and Broward (Ehrhart *et al.*, 2003). A remarkable density of nests was noted on Melbourne Beach in the 1970s (Bjorndal *et al.*, 1983), but declines were noted in subsequent decades. On the 40.5 km of beach between Sebastian Inlet and the southern boundary of Patrick Air Force Base, from 1989 to 2003, the number of nests fluctuated between 13,000 and 25,000 (Weishampel *et al.*, 2004).

The region from the Florida-Georgia border to southern Virginia has eleven major nesting habitats: Hammocks Beach State Park, Onslow Beach, Bald Head Island, Cape Island, Edisto Beach State Park, Edisto Beach, Fripp Island, Pritchards Island, Wassaw Island, Blackbeard Island and Little Cumberland Island. There was an average annual total of 5,215 nests between 1989 and 2008, with a significant decline of 1.3% per year since 1983. However, this region remains the second largest Loggerhead nesting hotspot in the Northwest Atlantic with an approximate increase of 1,270 females (National Marine Fisheries Service & U.S. Fish and Wildlife Service, 2008).

Four species of marine turtles are found in Virginia waters (Bellmund *et al.*, 1987). *C. caretta* is most common in the Chesapeake Bay (#375) and adjacent waters (Bellmund *et al.*, 1987). The other common species is *Lepidochelys. kempii*. It is estimated that between 2,000 and 10,000 Loggerheads use the bay during the summer, where they feed on an abundant fauna of invertebrates. In the fall, the turtles migrate out of the bay and along the coast to south of Cape Hatteras. The Chesapeake Bay is an important developmental habitat for Loggerheads and Kemp's Ridleys (Keinath *et al.*, 1987).

Dermochelys coriacea occasionally enters the Chesapeake Bay (Hardy, 1969). *Chelonia mydas* was historically reported there (Brady, 1925), but is now rarely observed.

The seasonal presence of marine turtles (Loggerhead, Olive Ridley, Green turtles) in the Delaware Bay estuary (#559) from May through November was reported by Schoelkopf & Stetzar (1995). This feeding habitat is rich in crustaceans, molluscs, fish, benthic invertebrates and aquatic vegetation. An analysis of stomach contents in *L. kempii* and *C. caretta* (Burke *et al.*, 1990) indicates the presence of 75% blue crab *Callinectes sapidus*.

[6] Committee on the Status of Endangered Wildlife in Canada.
[7] National Marine Fisheries Service, informally known as NOAA Fisheries, National Oceanic and Atmospheric Administration.
[8] U.S. or United States Fish and Wildlife Service.
[9] Turtle Expert Working Group.

The Crystal River area in northwest Florida, between Crystal Bay and Homosassa Bay, including St. Martins Marsh Aquatic Preserve and Chassahowitzka National Wildlife Refuge, also exhibits sympatry between *L. kempii*, *Chelonia mydas*, and *Caretta caretta* within exceptional developmental habitat (Eaton *et al.*, 2008). Wildermann *et al.* (2019) observed a specific spatial sharing of this habitat at this site, especially with different behavior during dives and at the surface.

Pelican Island National Wildlife Refuge site #590 supports *Lepidochelys kempii*, *Eretmochelys imbricata*, *Chelonia mydas* and *Caretta caretta* clutches. Not far from this site, Hutchinson Island (27°25'N/80°17'W) also appears to merit Ramsar designation, not only as breeding habitat with 5-8,000 nests (Ecological Associates, 2000), but also as nursery habitat for immature *C. caretta* (CCL: average 63.3 cm). These immature turtles are not only native to southern Florida (69%), north-eastern Florida and the Carolinas (10%), but also to Mexico (20%) (Witzell *et al.*, 2002).

The migration of juvenile North American Loggerheads from their natal habitat to nursery habitats across the Atlantic in the waters of Madeira and the Azores, takes them away between seven and 12 years before they return as sub-adults to the coasts of Florida and South Carolina (Bolten *et al.*, 1993). The trapping of immature Loggerheads by monofilament longlines in Macaronesian waters, attracted by the fish caught, has led to a project to modify the shape of the hooks and thus preserve the tranquillity of these critical habitats (Ferreira *et al.*, 2001; Bolten & Bjorndal, 2004). This phenomenon shows the difficulty of protecting turtles throughout their life cycle.

The thousands of islands in the Ten Thousand Islands National Wildlife Refuge (Gullivan Bay) and the Cedar Keys National Wildlife Refuge in southwest Florida are outstanding developmental habitats for juvenile *L. kempii* (Witzell *et al.*, 2005). This area has rather flat bottoms, with depths ranging from 2 to 4 m, but the preferred habitat is around 2 m (Sasso & Witzell, 2006).

Female Kemp's Ridley sea turtles tracked by satellite transmitters from major nesting beaches have shown dispersal in the northern and southern Gulf of Mexico. Approximately 82% of the adult female stock is faithful to its migratory corridors and feeding habitats (Gredzens & Shaver, 2020).

In Mexico, the Ramsar sites network is remarkable in its density, and unique for all the Parties. It is exemplary for the major habitats of marine turtles, both on the Caribbean coast and on the long Pacific coast. All species of marine turtles are listed in the (Diario Oficial de la Federación, 2010).

The Mexican site # 1326 (23°14'N 097°46'W) of Rancho Nuevo includes a 20 km long beach that is major for the nesting of *L. kempii* (cf. Photo 1). About 60% of all nests of the species in the Gulf of Mexico are located at this site. Since 2002, the number of nests has exceeded 4,000 per year. During the 2006 nesting season, several hundred nests were counted near Tampico (Altamira and Ciudad Madero) and about 100 nests in Texas. On 18 June 1947, a film historically recorded an "arribada" of approximately 40,000 females on the beach at Rancho Nuevo (Hildebrand, 1963). In the 21st century, such events are only known, with varying decline and importance, with *L. olivacea* at Escobilla and El Morro Ayuta (not Ramsar sites) in Mexico, at Gahirmatha and Rushikulya in India and Costa Rica.

A count during the whole season of 1966 in Rancho Nuevo, recorded only 2,060 females that came to lay eggs (Marquez, 1994). This 95% decline alerted the international scientific community to the threats posed to the species by the industrial shrimp fisheries accidentally capturing many Kemp's Ridley sea turtles in the Gulf of Mexico. Rancho Nuevo was declared a nature reserve in 1977 and *L. kempii* was included in the MEXUS-Gulf program [10], which combines research and protection in a scientific collaboration between Mexico and the USA.

Photo 11. ***L. kempii* ovipositing in its major nesting habitat in Rancho Nuevo**
(© D. Grelin)

Playón Mexiquillo (# 1350) in Michoacán State (18°07'N 102°52'W) is the most important nesting site for *D. coriacea* in the Mesoamerican Pacific (Pritchard, 1982). Since 1966, the nesting population at Playón Mexiquillo is considered to be in decline (Sarti *et al.*, 1994; Sarti *et al.*, 1996). The Mexican population of female *D. coriacea* was considered in 1980 to comprise about 65% of the world breeding population, with about 91,000 adult females. The decline between 1982 and 2004 is estimated at 90% (Santidrián Tomillo *et al.*, 2012; Spotila *et al.*, 2000).

[10] Defined goals were to: I) Obtain data on distribution and abundance of deep-water snapper, grouper, and tilefish stocks; and 2) obtain data on biomass and faunal components of trawl caught species off the Yucatan Peninsula. (Source: https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/MFR/mfr491/mfr4915.pdf).

Photo 12. Escobilla beach, Pacific coast of Mexico
(© J. Fretey)

It is important to note the presence on these Mexican sites of two forms of the genus *Chelonia*, the nominal form *mydas* of Linnaeus of 1758 in the Gulf of Mexico, and the black form *agassizii* of Bocourt, 1868 (whose holotype, originating from Rio Nagualate in Guatemala is kept in the zoological collections of the Muséum national d'Histoire naturelle in Paris - cf. Photo 12) (Fretey, 2003), considered by some to be a species, on the whole Pacific coast and in the Sea of Cortés. In 1962, Caldwell considered that the *Chelonia* frequenting the waters and beaches of Baja California, in particular Magdalena Bay, would have the upper parts of the head and the legs blacker than the *agassizii* form figured and described in Duméril *et al.* (1870) and Angel (1949), and described *Chelonia mydas carrinegra*.

It is certainly by mistake that *C. mydas* is listed as present in sympatry with *C. agassizii* in the estuarine Ramsar site n° 1866 (Humedales de Bahia Adair). *C. mydas* is also erroneously listed on the coastline of site n° 2154.

Photo 13. *Chelonia agassizii* Bocourt holotype (MNHN-RA-0.9537), 1868, kept at the Muséum national d'Histoire naturelle - National Museum of Natural History (MNHN) de Paris
(© J. Fretey)

Main *C. agassizii* nesting sites of in the Pacific Ocean are the eastern Pacific beaches of Maruata Bay and Colola in Michoacán. In the late 1960s during the peak season, between 500 and 1,000 females nested nightly at Colola, and the total flock for all Michoacan beaches was 25,000 females (Cliffton *et al*., 1982). In 1981, the breeding stock of *C. agassizii* nesting on 15 beaches of this state along 60 km was estimated at 5,586 females (Alvarado & Figueroa, 1986). Black turtles have experienced extreme decline over the past 30 years and are classified as endangered throughout their range.
C. agassizii breeding stocks in Colola and the Galapagos are the largest in the entire eastern Pacific, hosting approximately 71% of all females clutches in the region each year (Seminoff *et al*., 2015).

On the Mexican Pacific coast of the state of Oaxaca, two beaches are known for massive egg-laying by *L. olivacea*: La Escobilla and Morro Ayuta. In 1975, during six arribadas, 295,000 nests were counted at La Escobilla (Márquez *et al.,* 1996). For the 1990-1991 season, Lopez Reyes & Bautista Huerta (1991) reported an arribada of 60,046 females from 11 to 14 September, and another of 75,132 females from 12 to 16 October. Peñaflores *et al*. (2000) calculated that during the period 1973-1997, this beach produced about 169 million hatchlings, which ranks it among the global breeding hotspots of the species.
The beach of San Juan, in the Lagunas de Chacahua National Park, is 17 km long and in 1976 hosted 10,000 *L. olivacea* and 2,000 *D. coriacea*. During the 1982-1983 season, Ruiz & Cruz Wilson (1983) observed only 375 nests of the first species, and 3,335 nests of the second species. A decline of the Olive Ridley certainly due to the intensive exploitation of Olive Ridley skins and meat in this region.

Photo 14. Black Turtle ovipositing on a Michoacan beach
(© P.C.H. Pritchard)

Photo 15. Beach of San Juan in the Chacahua lagoon area
(© J. Fretey)

Photo 16. On the beach of Chacahua lagoon, a female L. olivacea wounded in the oviduct by poachers, and going back to the sea
(© J. Fretey/G. Ruiz)

Hawksbill nests sporadically along the Mexican Pacific coast in the states of Jalisco and Nayarit (Chavez, 1989). The main clutch activity of the species appears to be on the Tres Marías Islands, 600 km south of the Baja California Peninsula (Parsons, 1962; Marquez, 1990).

Seminoff *et al.*'s (2003) study of juvenile *E. imbricata* shows the presence of nursery areas in the Sea of Cortez and on the western coastline of Baja California on the Pacific Ocean in the regions of 5 existing Ramsar sites: Infiernillo Channel (Nos. 2154 and 1359), Bahía de los Angeles (No. 1595), Cabo Pulmo (No. 1778), Laguna San Ignacio (No. 1341) and Laguna Ojo de Liebre (No. 1339). Individuals of two distinct size classes were observed there: 34.4-45 cm and 50-74.2 cm. Since Seminoff *et al.* (2003) also made observations of juvenile and subadult Hawksbills on the coast of the city of Loreto and in Bahía Magdalena, these two stations may also merit a classification.

Cabo Pulmo National Park has the largest coral reef in the Gulf of California and represents the limit of the northern distribution of these coral systems in the eastern Pacific and Gulf. This makes them prime habitats for *E. imbricata*. This extremity of Baja California represents the northernmost nesting habitat for *L. olivacea*. Monitoring of Las Barracas beach from August to November 2000 yielded a total of 55 nests (López-Castro *et al.*, 2004).

The Yucatan Peninsula is home to the largest populations of *E. imbricata* in the western Atlantic and one of the five most important breeding stocks of *C. mydas* in the Greater Caribbean. For the latter species, feeding habitats extend over 25 km^2 in Celestún and Les Petenes. 140 km off the peninsula, the Parque Nacional Arrecife Alacranes y Cayo Arcas (No. 1820) is a semicircular platform of about 300 km^2 whose interior lagoon includes five sandy islands: Isla Pájaros or Blanca, Isla Chica, Isla Islapérez, Isla Muertos or Desertora and Isla Desterrada. On average, Isla Blanca has a density of about

38 nests of *Chelonia mydas* per 100 m, Isla Chica of 36 nests, Isla Muertos of 34 nests, Isla Banni of 21 nests and Isla Pérez of 14 nests. Female Green Turtles, after laying their eggs, remain in feeding habitats in the Yucatan Peninsula or migrate to other feeding habitats in Florida.

González-Sánchez *et al.* (2017) state that the only species found in the waters around the Alacranes reefs and not recorded around Laguna de Términos Island is *D. coriacea*.

Pacific coast of Baja California Peninsula (BCP), specifically the Gulf of Ulloa, is strategic foraging and developmental habitat for adult *Caretta caretta* breeding in Japan or originating from Japanese nesting beaches. The average annual abundance is 43,226 Loggerheads (15,017 to 100,444), with age classes ranging from 3 to 24 years old (Wingfield *et al.*, 2011, Seminoff *et al.*, 2014).

In the Gulf of California, between the mainland of Sonora State and Isla Tiburón, the Canal del Infiernillo (site no. 1891) has muddy bottoms between 3 and 5 m and *Zostera marina* beds. Approximately from November to March, immature and adult Black Turtles winter there. Such hibernacula habitats have also been observed off San Esteban Island, southwest of Tiburón Island (Felger *et al.*, 1976).

France owns a small territory 1,081 kilometers off the coast of the Mexican state of Michoacán: Clipperton. This atoll includes an EEZ [11] of 435,612 km^2 and a large freshwater lagoon surrounded by mud flats of 7.2 km2. It is the only emerged land for hundreds of kilometers and represents an important stopover for seabirds. Morrell (1832) reported marine turtle nests on Clipperton in August 1825, probably *Chelonia agassizii*. During a herpetological mission in December 2004 - January 2005, only strandings of 9 corpses of *Lepidochelys olivácea* were observed (Lorvelec *et al.*, 2009; Lorvelec *et al.*, 2011).

The atoll is heavily polluted with plastic waste, and Mexican industrial fishing vessels have entered the EEZ. An agreement was signed on 29 March 2007 *"on the fishing activities of Mexican vessels in the 200 nautical miles surrounding Clipperton Island"*.

It is important to underline the interesting project of Clipperton's classification by UNESCO as a World Heritage Site with a group of other Pacific islands: Galapagos, Coco, Coiba, Malpelo, Gorgona.

[11] Exclusive Economic Zone.

Photo 17. Stranded body of a Black turtle on Clipperton, victim of industrial fisheries
(© O. Lorvelec)

In addition, in 1994, a recommendation was made by the Oceania Program of the Asian Wetland Bureau for the Clipperton Atoll to be classified as a Ramsar site. The atoll is regularly on the list of French wetlands likely to be designated under the Ramsar Convention. We invite France to initiate this classification in order to complete the protection of the habitats. The permanent installation of a scientific station and a military marine base would ensure the control of the respect of the biotope decree and the monitoring of the coral environment and of the key animal species and their migrations.

One of us (Jacques Fretey) was consulted during the drafting of the Biotope protection Decree (published on 7 September 2011 under the n° HC 1350 SG). In this regulatory text, in order to guarantee the biological balance of natural marine environments, are considered as protected animal species: *C. mydas, L. olivacea*, *E. imbricata* and *D.s coriacea*. The administration did not accept our request to indicate *agassizii* as a recognized taxon or subspecies of the form *mydas*.

Proposed actions by the experts J. Fretey and P. Triplet

The long peninsula of Florida and its satellite islands, both engaged in the Caribbean Sea and closing the northern Gulf of Mexico, has interesting habitats for the life cycle of marine turtles. Various designations could be considered, particularly Hutchinson Island and Crystal River.

Mexico, with approximately 9,330 km of coastline, is probably the state with the greatest variety of habitats for 7 species of marine turtles. Its Ramsar sites network is already remarkable. It could be judiciously completed by various sites along the Baja California peninsula for *Caretta caretta* and the Yucatan peninsula for *Eretmochelys imbricata*.

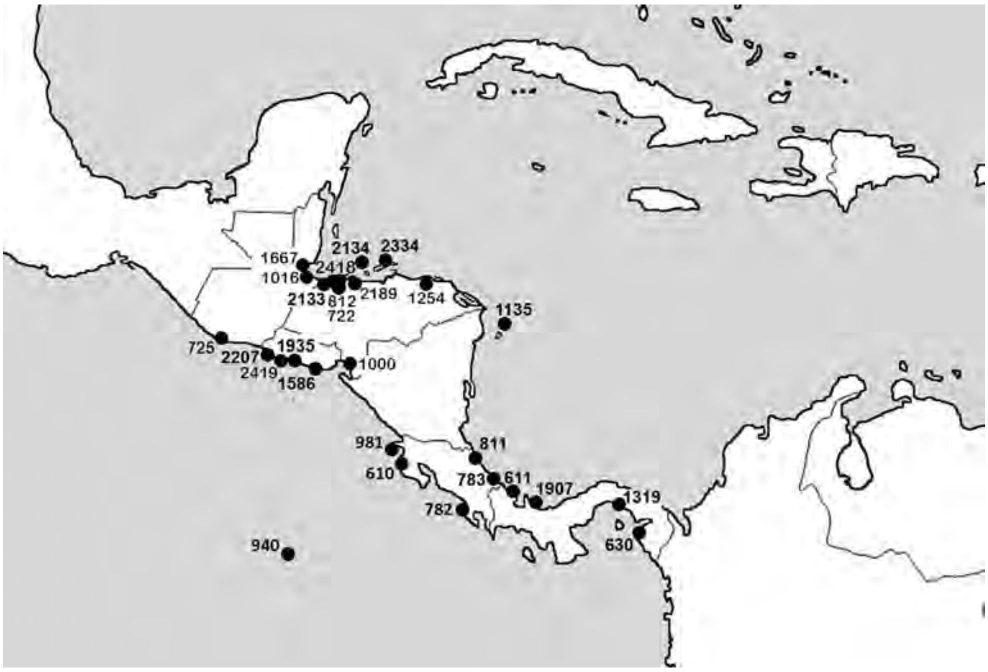
The Mexican coast opening to the Caribbean Sea presents important and numerous feeding habitats for juvenile and subadult Green turtles. For example, Akumal Bay (20°24'00"N/ 87°19'16"W), about 35 kilometres south of Playa del Carmen and 25 kilometres north of Tulum, has a juxtaposition of seagrass beds and coral reefs, which favors a small ecotourism project that allows for easy turtle viewing. The size (CCL) of these turtles ranges from 27.8 to 81.0 cm (Labrada-Martagón *et al.*, 2017). A Ramsar classification would be a perfect fit for Akumal Bay and would promote the integration of ecotourism into a suitable management plan.

Photo 18. Subadult Green turtle resting between coral branches, Akumal Bay
(© J. Morrisson)

Chelonia mydas rare hibernation habitats in Isla Tiburón, and in the Canal del Infiernillo deserve special attention, and a management plan in the context of Ramsar Resolution XIII-24 seems necessary.

We urge France to finalize the classification of Clipperton Atoll and to encourage and monitor the return of clutches there.

Central America.



Map 3. Location of Ramsar sites in Central America.

Table III. Inventory of Central American sites

Site number	Contracting Parties	Administrative region	Site name	Species present
2133	Honduras (Republic of Honduras) Affiliation: 23/06/1993	Departamento de Cortés	Sistema de Humedales Cuyamel-Omoa	Ei, Dc
2134	Honduras (Republic of Honduras)	Departamento de Islas de la Bahía	Sistema de Humedales de la Isla de Utila	Cc, Ei Cm
2189	Honduras (Republic of Honduras)	Departamento de Atlántica	Sistema de Humelades Laguna de Zambucco	Dc, Ei
2334	Honduras (Republic of Honduras)	Departamento de Islas de la Bahía	Sistema de Humedales de Santa Elena	Cm, Ei
2418	Honduras (Republic of Honduras)	Departamento de Cortes	Sistema de Humeral Laguna de Alvarado	Cm, Lk
812	Honduras (Republic of Honduras)	Departamento de Atlántica	Refugio de Vida Silvestre Punta Izopo	Cm, Cc, Ei, Dc
722	Honduras (Republic of Honduras)	Departamento de Atlántica	Parque Nacional de Jeanette Kawas	Cm, Cc, Ei, Dc
1000	Honduras (Republic of Honduras)	Departamento de Tegucigalpa	Sistema de Humedales de la Zona Sur de Honduras	Lo, Ei, Ca
1254	Honduras (Republic of Honduras)	Departamento de Gracias a Dios	Laguna de Bacalar	Cm, Cc, Dc
725	Guatemala (Republico of Guatemala) Affiliation: 26/06/1990	Departamento de Retalhuleu, Departamento de San Marcos	Zona de Protección Especial Manchón-Guamuchal (incluye la Reserva Natural Privada La Chorrera)	Lo, Ca, Dc
1016	Guatemala (Republic of Guatemala)	Departamento de Izabal	Punta de Manabique	Cc, Cm, Ei, Dc
1667	Guatemala (Republic of Guatemala)	Departamento de Izabal	Reserva de Usos Múltiples Río Sarstún	Cc, Cm, Ei, Lo
1135	Nicaragua (Republic of Nicaragua) Affiliation: 30/07/1997	Atlántico Norte	Cayos Miskitos y Franja Costera Immediata	Cm, Ei
1586	El Salvador (Republic of El Salvador) Ratification: 22/01/1999	Usulutan	Complejo Bahía de Jiquilisco	Ca, Dc, Ei, Lo
1935	El Salvador (Republic of El Salvador)	La Paz y San Vicente	Complejo Jaltepeque	Cm, Dc, Lo, Ei
2207	El Salvador (Republic of El Salvador)	Ahuachapán and Sonsonate	Complejo Barra de Santiago	Ca, Dc, Ei, Lo
2419	El Salvador (Republic of El Salvador)	Sonsonate	Complejo Los Cobanos	Dc, Ei
611	Panamá (Republic of Panamá) Affiliation: 26/11/1990	Bocas del Toro	San San - Pond Sak	Dc, Cc, Cm, Ei
630	Panamá (Republic of Panamá)	Darién	Punta Patiño	Dc, Ei
1319	Panamá (Republic of Panamá)	Panamá	Bahía de Panamá	Cc

1907	Panamá (Republic of Panamá)	Comarca Ngöble Buglé	Humedal de Importancia Internacional Damani-Guariviara	Cc, Cm, Ei, Dc
783	Costa Rica (Republic of Costa Rica) Ratification: 27/12/1991	Limón	Gandoca-Manzanillo	Cm, Dc, Ei
811	Costa Rica (Republic of Costa Rica)	Limón y Heredia	Humedal Caribe Noreste	Cm, Dc, Ei
981	Costa Rica (Republic of Costa Rica)	Guanacaste	Potrero Grande	Ca, Lo
610	Costa Rica (Republic of Costa Rica)	Guanacaste	Refugio de fauna silvestre Tamarindo (Las Baulas)	Ca, Dc
782	Costa Rica (Republic of Costa Rica)	Puntarenas	Humedal Nacional Térraba-Sierpe	Ca, Lo
940	Costa Rica (Republic of Costa Rica)	Puntarenas	Parque Nacional Isla de Coco	Ca, Ei, Lo

Notes:

In Honduras, marine turtle nesting has been monitored since 1992 at 12 habitats on Utila Island (#2134): Turtle Harbour, Rock Harbour, Pumpkin Hill, East End, Big Bight, Green House, Bando Beach, Pretty Bush, Jack Neil, Sandy Cay, Morgan's Cay, Water Cay. According to Araujo Cruz (2018), nests are 94% *E. imbricata* and for 5% *C. caretta* (1% unidentified nests).

Photo 19. Female *L. olivacea* returning to the sea after laying eggs in the Gulf of Fonseca
(© S. G. Dunbar)

Carr (1948) was the first to report the nesting of *L. olivacea* on the Pacific beaches in Honduras, at Isla Ratones (now Punta Ratón). This species, which is the most common, lays in the Gulf of Fonseca from May to February. In addition, Gaos *et al.* (2012), Dunbar *et al.* (2012) showed that Hawksbill turtles, after nesting in this area moved to mangrove estuaries where they established vital coastal feeding habitats, which are also nursery habitats for juveniles.

Black turtles have been reported in the El Salvador portion of the Gulf of Fonseca (Hasbún & Vásquez, 1999), and Cruz et *al.* *(*1987*)* provided a report confirming that *Chelonia agassizii nested* on the Pacific coast of Honduras. There was no evidence of egg-laying around Punta Ratón and El Venado, other than the presence of foraging habitat along this coast (Dunbar *et al.*, 2020). It should be checked that Ramsar Site #1000 includes the outstanding habitats in this region of the Honduras "Corredor Biológico Mesoamericano Pacífico".

Photo 20. Nesting habitat of *E. imbricata* from Pumpkin Hill, Utila, Honduras
(© S. G. Dunbar)

Photo 21. Adult Hawksbill turtle in its feeding habitat in St. Elena, Honduras
(© S. G. Dunbar)

It has been estimated that more than 21,000 *L. olivacea* have nested along the 254 km of Guatemalan coastline (Ramboux, 1982; Rosales Loessener & Ramboux, 1982). On the beaches of Manchón-Guamuchal (# 725) *L. olivacea*, *D. coriacea* and *C. agassizii* laid eggs.

It is established that the population of Hawksbill turtles nesting in Punta de Manabique (# 1016) is a unit partially isolated from the rest of the populations in the Gulf of Mexico (Giron Arana, 2006).

Ariano-Sánchez *et al.* (2010) predict that with climate variability and El Niño Southern Oscillation (ENSO), this will lead to a disruption of phenological cycles and that *L. olivacea* will be more abundant on Central American beaches in the future, especially on the Pacific coast of Guatemala.

Lighthouse Reef Atoll (LRA), located about 70 km off the mainland of Belize, has five cays and two marine protected areas (Blue Hole Natural Monument, Half Moon Caye Natural Monument). This atoll is a regionally important developmental habitat of Hawksbill (mean length: 43.9 ± 6.7 cm) and is considered as feeding point for breeding females from the Mesoamerican Reef (MAR) (Scales *et al.*, 2011; Graham *et al.*, 2015; Chevis *et al.*, 2017).

Tortuguero Conservation Area (ACTo) (Ramsar Site # 811; N 10°35’51”/W83°31’40” to N10°21’463/W83°23’41”), Costa Rica, is the largest *Chelonia mydas* nest concentration *hospot* for the entire Atlantic and one of the largest in the world, with an annual average of 104,411 nests (Seminoff, 2004; Troëng and Rankin, 2005).

The *Thalassia testudinum* beds of the vast Nicaraguan continental shelf are the main feeding area for nesting female Green turtles 500 km further south on the long beach of Tortuguero (Mortimer, 1981). It has been estimated that more than 10,000 adult and especially immature turtles were captured in the migratory corridors leading them from Tortuguero to the Nicaraguan grass beds (Lagueux, 1998; Hays *et al.,* 2002).

It is interesting to note that a developmental habitat of *E. imbricata* exists in the estuary of the Rio Tortuguero, off the Costa Rica-Nicaragua border area at the rocky place called Tortuguero Bank (Pritchard & Trebbau, 1984).

Photo 22. Green turtle mating near the coast of Tortuguero
(© A. Hell)

Photo 23. Aerial view of the Tortuguero Black Beach
(© J. Fretey)

Photo 24. Female Green turtle returning to the sea after laying eggs on Tortuguero beach
(© J. Fretey)

Monitoring from 1990 to 2004 of 8.85 km of Gandoca Beach (9°59.972 N, 82°60.530 W), located in the Gandoca-Manzanillo National Wildlife Refuge, on the extreme southern Caribbean coast of Costa Rica, resulted in 8,766 nests of *D. coriacea* (Chacón-Chaverri, 1999; Chacón-Chaverri & Eckert, 2007).

When the arribada phenomenon was first discovered in Costa Rica in 1970, 288,000 females had arrived in three successive waves at the isolated 1.3 km long site of Playa Nancite, within Santa Rosa National Park (Hughes & Richard, 1974). These arribadas at Playa Nancite declined by 42% between 1971 and 1984, 84% between 1971 and 1992, and 90% between 1971 and 2007, respectively (Fonseca *et al.*, 2009).

Abreu-Grobois and Plotkin (2008) once estimated the breeding stock of *L. olivacea* nesting along the 7 km between Playa Ostional and Nosara on the Nicoya Peninsula to be approximately 134,400 females. The Ostional National Wildlife Refuge (ONWR) was created in 1983 for the protection of these turtles and their nests, and a highly contested but necessary village-based community management of the eggs was established. In the 1980s, arribadas at this site numbered between 35,000 and 180,000 females (Cornelius and Robinson, 1983). More recent estimates indicate that this subpopulation may be as high as 470,000 females (Valverde *et al.*, 2012).

Photo 25. Spectacular arribada of thousands of Olive Ridley in the Ostional National Wildlife Refuge, Costa Rica (© I. Arndt)

Photo 26. Departure of a solitary Olive Ridley after laying eggs on the Costa Rican beach of Ostional. Predation rates between solitary and arribada nests vary considerably: 50.9% in the former, 7.6% in the latter (Eckrich & Owens, 1995)
(© Roderic Mast / Oceanic Society and SWOT: Strengths - Weaknesses - Opportunities - Threats)

Historically Leatherbacks nested on several Guanacaste beaches, including Playa Grande, Playa Langosta, Playa Naranjo, Playa Flamingo, Playa Tamarindo, and Playa Cabuyal. Development has eliminated nesting from Playas Flamingo and Tamarindo (Chaves *et al.*, 1996). Playa Grande is the main beach, with a length of 3.6 km, of the Marino Las Baulas National Park, bounded on each side by Playa Ventanas (1 km), the mouth of the Tamarindo River and Playa Langosta (1.3 km). Between September 1991 and February 1992, 703 nests were found in Playa Langosta (Chaves *et al.*, 1996).

Estimates indicated in the late 1980s a breeding stock of about 1,500 female Leatherbacks for the entire Las Baulas area, reduced to about 1,000 in the early 1990s and only about 100 in the early 2000s (Tomillo *et al.*, 2007). Piedra-Chacón *et al.* (2019) report for the period between 2014-2018, an average of 206 annual Leatherback nests in the entire Costa Rican Pacific.

In recent years, at least five important feeding areas have been identified for juvenile, subadult, and adult Hawksbill turtle individuals on the Pacific coasts of Costa Rica: Golfo Dulce, Cabo Blanco, Punta Coyote, Punta Pargos, and Bahía Matapalito (Carrión-Cortés *et. al.*, 2013; Chacón-Chaverri *et. al.*, 2014b; Heidemeyer *et. al.*, 2014). At Bahia Matapalito (10°56’06”N, 85°47’42”W), a bay with an opening of approximately 1 km incorporates a large coral reef community extending into nearby Santa Elena Bay, with a portion included in Santa Rosa National Park. This site appears to be an important developmental habitat (Piedra-Chacón *et al.*, 2019). The average size of juveniles at this site is 42.46 cm (CCL) with a minimum of 31.0 cm. To the south, habitats are located in Golfo Dulce (Chacón-Chaverrí, *et al.*, 2015 a, b) and to the north, in Punta Coyote (Carrión-Cortez, Canales-Cerro, Arauz and Riosmena-Rodriguez, 2013). Other developmental habitats have been identified along this Pacific Costa Rican coast at Cabo Blanco, Punta Argentina, and Punta Pargos (Heidemeyer *et al.*, 2014).

The Golfo Dulce, in Costa Rica, is one of the few tropical fjords in the world. This bay separates the Osa Peninsula from the mainland. To the northeast of this gulf ends the Piedras Blancas National Park, an extension of the Corcovado National Park. The Golfo Dulce has been declared a Marine Responsible Fishing Area (RMA). It is home to the largest mangrove ecosystems (*Rhizophora mangrove*, *R. racemosa*, *Avicennia germinans*) in all of Central America Pacific, coral reefs and seagrass beds (*Halophyla sp.*, *Halodule sp.*) that are outstanding habitats between 3 and 10 m depth for marine turtles, especially subadults and adults of the species *C. agassizii* (Chacón-Chaverri *et al.,* 2015). As in Colombia, the Black turtle seems to find here a diet composed in part of fleshy mangrove fruits. Monitoring by satellite transmitters showed that this bay was an important biological and migratory corridor for Black turtles nesting in, for example, the Galapagos Archipelago before reaching feeding habitats in Nicaragua and Panama (Seminoff *et al.*, 2008). The Osa Peninsula rookery annually hosts about 7.5% of the clutches of the entire eastern Pacific Ocean (Gaos *et al.*, 2017).

Abreu-Grobois (2000) demonstrated that *E. imbricata* fed on mangrove fruits, making these exceptional mangroves a remarkable feeding habitat.

We have little information on the presence of *L. olivacea*, *E. imbricata* and *C. agassizii* adults in the Cocos Island National Park (# 940), located 550 km off Costa Rica’s Pacific coast and designed a World Heritage Site by UNESCO in 1997 (MINAE/SINAC-UICN/ORMA, 1998).

In the Térraba-Sierpe wetland (# 782), monitoring of Playa Tortuga, a total of 233 nests of *L. olivacea* were recorded (Brenes Arias et al., 2015) from 2010 to 2012 in Ojochal de Osa (83°40'3.36" W - 9°4'32.16" N).

The species is also very present around Caño Island ((8º39'31.7" N - 83º56'4.1" W) off the Canton of Osa; this may be an important mating habitat (Venegas-Li *et al.,* 2014). Nests are reportedly observed on this island (A. Chaves, pers. comm.).

The important nesting area of Padre Ramos Estuary Natural Reserve in Nicaragua hosts 213 ± 47 nests of *E. imbricata* each season, which represents about 50% of the entire breeding stock of the species for the entire eastern Pacific. Quantitatively, the beach of Aserradores (12°36'41.01 "N/ 87°20'22.62" W) is second with 100 ± 24 nests per year. This mangrove estuary in Padre Ramos is also an exceptional foraging habitat for the Hawksbill turtle (Gaos *et al.*, 2017). A study (by Torres Gago *et al.*, 2019) conducted in these developmental estuarine habitats counted a faithful presence of 80% immature Hawksbill turtles (juveniles and subadults) at Estero Padre Ramos (Padre Ramos) of 44.0-52.9 cm in length.

The Cayos Perlas archipelago (Pearl Cays), composed of 36 islets covering some 280 km^2, has the largest breeding population of *E. imbricata* in the mid-western Caribbean, with a maximum of nests on Wild Cane, Crawl, Columbilla, Grape and Baboon (Lagueux *et al.*, 2003). Five distinct populations feed on the coral reefs (Lagueux *et al.*, 2001). These islands are classified since 2010 as "Refugio de Vida Silvestre". This classification seems insufficient to protect the terrestrial beach and back beach habitat for Hawksbill nesting, as well as the coral reefs. The island's human population is increasing, as is tourism. Beach sand is extracted for the construction of cement buildings on the coast and the shrubby vegetation of the backshore dunes is removed. This vegetation is essential for *E. imbricata* whose females sneak underneath to nest. The voluntary or accidental introduction of dogs, cats, pigs and rats on these islets has become a threat for hatchlings. Pollution of fragile coral ecosystems by pesticides has been observed (Lagueux *et al.*, 2006).

Also in Nicaragua, there are two areas of *L. olivacea* arribadas, one in the La Flor Wildlife Refuge and the other in the Wildlife Refuge Escalante River-Chacocente. Between five and seven arribadas per year are observed in La Flor (Hope, 2002). Honarvar *et al.* (2016) report that landings were increasing between 1998 and 2006 to 60,816 females.

D. coriacea nests in the Wildlife Refuge Escalante River-Chacocente, in Veracruz and Salamina.

Photo 27. Disoriented locomotion of a female Olive Ridley marine turtle on the beach of Refugio de Vida Silvestre La Flor
(© R. Brittain)

Bahía de Jiquilisco-Xiriualtique (# 1586): located along the El Salvador South-central coast, the Bahía (13° 13'N, 88°32'W) was designated Ramsar wetland in 2005 and named a UNESCO Biosphere Reserve in 2007. It includes numerous brackish water estuaries and a complex of lagoons. *E. imbricata* nesting habitat in this region extends over 37 km, with four island beaches. Gaos *et al*. (2017) record 168.5 ± 46.7 nests per season there. The Punta Amapala shoreline, about 30 km to the east, includes six beaches over 6.5 km. The density is 41.9 nests per km from Lasflores to Menéndez, and 11.4 nests per km from La Pulgosa to El Faro. Bahía de Jiquilisco mangroves are important developmental and feeding habitats; the large juveniles living there are 50.9 + 13.1 cm long (Liles *et al*., 2011; Torres Gago *et al*., 2019). In the Area Natural Protegida Complejo Los Cóbanos (# 2419), the number of nests per season reported by Liles *et al.* (2019) is 1,255 for *L. olivacea* and 51 for *E. imbricata*.

In Site # 611 in Panama, in the very insular province of Bocas del Toro, the mainland beach of Chiriquí is considered one of the main nesting habitats of *E. imbricata* in the Caribbean. A decline of 98% was noted in the 1980s and 1990s compared to what Archie Carr noted in the 1950s. There has been an increase in female landings since 2008: around 800. This site is also very important for *D. coriacea* with an average of around 6,600 nests. Recent surveys indicate that nearby beaches such as, for example, on Isla Escudo de Veraguas in the Mosquito Gulf and Playa Bluff on Isla Colón, also host significant nesting of Hawksbill turtles and Leatherbacks (Meylan *et al*., 2013).

Islands of Gulf of Panama and the surrounding waters of the eastern central Pacific are one of the most biologically diverse geographic areas in the world.

Marine ecosystems interdependence makes it virtually impossible for any one country alone to maintain marine ecological balance and vitality, especially in the case of wide-ranging species such as marine turtles.

Proposed actions by experts J. Fretey and P. Triplet

We believe that it is necessary to carry out an inventory of the primary terrestrial and coastal habitats of marine turtles throughout the "Corredor Biológico Mesoamericano Pacífico" in order to create a relevant network of Ramsar sites.

The Lighthouse Reef Atoll in Belize seems to us to deserve a Ramsar classification because of its regional importance for its development and feeding habitats for *Eretmochelys imbricata*.

IUCN Red List gives *L. olivacea* the status of "vulnerable". Studies indicate that *L. olivacea* is still abundant in the eastern tropical Pacific, but that its populations are dramatically declining in the Atlantic Ocean. We recommend that the Republic of Costa Rica use the new Ramsar Resolution XIII-24 to propose three sites of international interest for the conservation of *Lepidochelys olivacea* on its Pacific coast: Playa Nancite, Playa Ostional and Playa Grande.

We recommend that the outstanding habitats of the Corcovado National Park-MPA region of Costa Rica be nominated for Ramsar designation as vital habitat for *Chelonia agassizii*.

Ramsar classification of the development habitats of the Golfo Dulce, in Costa Rica, also seems to us to be a suitable measure for the regional status of the two species *C. agassizii* and *E. imbricata*: Playa Ventanas and Playa Langosta.

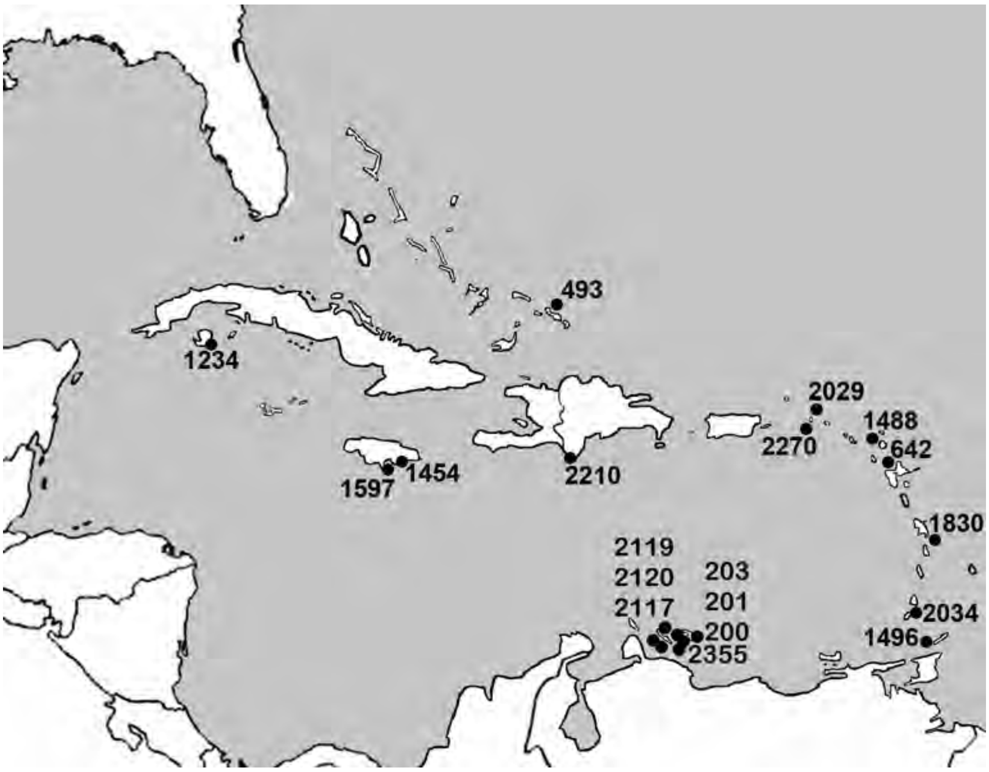
Nicaragua has only one coastal continental Ramsar site (# 1135). The Río Indio Maíz Biological Reserve, in spite of the conservation difficulties of its forest massif, would be very interested in having its coasts classified as a Ramsar site so that the sea grass beds necessary for the survival of the Tortuguero breeding stock could have an adequate management plan. This example shows that for the preservation of an endangered species, it is in a regional network that habitats must be managed in a sustainable way.

In addition to site # 1135, it would be wise for Nicaragua to also propose the Cayos Perlas archipelago for Ramsar classification.

In El Salvador, Liles *et al.* (2019) report 1,036 Olive Ridley sea turtle nests on Tasajera Island, which would certainly merit consideration for Ramsar classification.

REGION 3

Caribbean Island.



Map 4. Location of Ramsar sites in the insular Caribbean.

Table IV. Inventory of sites in the insular Caribbean.

Site number	Contracting Parties	Administrative region	Site name	Species present
642	France (French Republic) Ratification: 01/12/1986	Guadeloupe Department	Grand-Cul-de-Sac-Marin	Ei, Cm
1830	France (French Republic)	Martinique Department	Etang des Salines	Ei
2029	France (French Republic)	Saint-Martin Collectivity	Zones humides et marines	Ei, Cm, Dc
493	United Kingdom of Great Britain and Northern Ireland Ratification: 05/01/1976	Turks and Caicos Islands territory	North, Middle and East	Ei
2117	Netherlands (Kingdom of the Netherlands) Membership: 05/23/1980	Curaçao Government	Malpais/Sint Michiel	Ei, Dc
2119	Netherlands (Kingdom of the Netherlands)	Curaçao Government	Northwest	Ei, Dc
2120	Netherlands (Kingdom of the Netherlands)	Curaçao Government	Rif-Sint Marie	Dc, Ei, Cc, Cm, Lo
2355	Netherlands (Kingdom of the Netherlands)	Curaçao Government	Klein Curaçao	Ei, Cm
201	Netherlands (Kingdom of the Netherlands)	Bonaire	Klein Bonaire Island and adjacent sea	Ei, Cm
200	Netherlands (Kingdom of the Netherlands)	Bonaire	Het Pekelmeer	Ei, Cm Cc?
203	Netherlands (Kingdom of the Netherlands)	Bonaire	De Slagbaai	Ei Cm Dc
2270	Netherlands (Kingdom of the Netherlands)	St Maarten	Mullet Pond	Dc, Cm, Ei
1496	Trinidad and Tobago (Republic of Trinidad and Tobago) Accession: 21/12/1992	Autonomous Region of Tobago/ Tobago Island	Buccoo Reef – Bon Accord Lagoon Complex	Ei, Dc, Cm
1234	Cuba (Republic of Cuba) Ratification: 12/04/2001	Isla de la Juventud	Ciénaga de Lanier y Sur	Cm, Cc
2210	Dominican Republic Accession: 15/05/2002	Pedernales	Humedales de Jaragua	Ei, Cc, Cm, Dc
1454	Jamaica Accession: 07/10/1997	Kingston	Palasadoes – Port Royal	Cm, Ei
1597	Jamaica	St Catherine, Clarendon	Portland Bight Wetlands and Cays	Cm, EI
1488	Antigua-and-Barbuda Accession: 02/06/2005	Barbuda	Codrington Lagoon	Dc, Ei, Cm
2034	Grenada Accession: 22/05/2012	St. Patrick	Levera Wetland	Dc, Ei, Cc, Cm

Notes:

Meylan (1999) estimated that a maximum of 5,000 female *Eretmochelys imbricata* nested in the entire Greater Caribbean, with the exception of the three Guianas and Brazil. More recently, it has been shown that the Caribbean holds about 40% of the global breeding population of *E. imbricata* (Dow *et al.*, 2007). It is estimated that populations are declining in 22 of the 26 geopolitical units in this region. However, not all beaches are monitored, so it is difficult to estimate the number of nesting Hawksbill turtles each year (Meylan, 1999). Caribbean nesting, nursery and feeding habitats are therefore to be considered as crucial for the global survival of this species.

This species nests solitarily, sometimes in very coarse substrates, and large concentrations of females on a single beach are not known. In this region, Cuba hosts the most females with a total of 1,700 to 3,400 nests per season on 47 beaches.

Photo 28. ***Es imbricata*** **in its coral habitat**
(© Association Évasion Tropicale - Tropical Escape Association)

Cuba has only one Ramsar site (#1234), identified as having marine turtles. In addition to this site, the Jardines de la Reina archipelago, made up of the Doce Leguas Cayos and Labyrinth, is located about 50 km from the southeast coast of Cuba in the eastern part of the Sabana-Camagüey archipelago, in the Gulf of Ana Maria; it extends for about 150 km and includes 661 cays. This archipelago is not only important for its Hawksbill nesting habitats (Moncada *et al.,* 1999; 2010), but also for its feeding areas for the species. Genetic studies have shown that these habitats host turtles from Belize, Mexico, Puerto Rico, the U.S. Virgin Islands, and Antigua (Bass, 1999).

The coral reefs around Little Cayman and Grand Cayman are good developmental habitats for *E. imbricata*. Their size varies, respectively on the two islands, from 33.7 ± 8.6 cm and 31.4 ± 7.4 cm, with a minimum size of 20.5 cm. They feed mainly on the sponge species *Geodia neptuni* (Blumenthal *et al.*, 2009).

Three other Caribbean areas are well frequented by the species: Mona Island (66 km west of Puerto Rico), Long Island (Antigua) and Barbados. The small island of Mona is considered an important egg-laying site for the Hawksbill turtle (Thurston & Wiewandt, 1976; Pritchard & Trebbau, 1984), with a number of nests between 308 and 537 during the 1994 to 1998 egg-laying seasons (Diez et al., *1998)*. There are also juveniles and breeding adults feeding aggregations in the immediate coral environs of this island, including individuals from *rookeries* in Cuba, Yucatan, U.S. Virgin Islands, Barbados, Antigua, and Tortuguero, Costa Rica (Velez-Zuazo *et al.,* 2008).

Photo 29. Aerial view of Billy Point, Barbuda
(© J. Fretey)

Pasture Bay beach, 475 m long, is located on Long Island, a small private island (Jumby Bay Resort) a few kilometres off the northeast coast of the main island of Antigua. John Füller and one of us (Jacques Fretey) discovered in 1983 that *E. imbricata* nested there regularly with some frequency. After 11 seasons of monitoring nesting on this islet, Richardson *et al*. (1999) identified a breeding population of 126 females with an average annual arrival of 29 females, or some 145 nests.

Photo 30. Typical nesting habitat of *E. imbricata* on Long Island
(© J. Fretey)

Photo 31. *E. imbricata* nesting on Pasture Bay beach
(© J. Fretey)

Barbados records a breeding stock of about 1,250 female Hawksbill turtles with more than 250 females on Needham's Point beach alone in the southwest of the island (Beggs *et al.*, 2007). This is the third largest Caribbean stock after the Mexican states of Campeche, Yucatán and Quintana Roo, which had a total of 4,522 nests in 1996 (Garduño Andrade *et al.*, 1999) and Cuba.

In the Bahamas archipelago, Cay Sal Bank, located between Florida and Cuba, is bordered by about twenty islets and cays over an area of 4,000 km^2. Six nesting habitats have been identified in the northwest of this island group. *C. caretta* is the only species to lay eggs there. For the 1995 season, 216 females were counted on Cotton Cay and 297 on Anguilla Cays (Addison & Morford, 1996).

In St. Maarten, *C. mydas* and *E. imbricata* nesting is reported by Meylan (1983) in Guana Bay, Oyster Pond, Long Bay and on Flat Island. Mating habitat for both species is known off Oyster Pond. *D. coriacea* has laid eggs in the past at Long Bay and Simpson Bay.

On the Dutch island of St. Eustatius, five nesting habitats have been inventoried: Zeelandia Beach, Turtle Beach and Lynch Bay on the Atlantic side of the island, and Oranje Bay and Kay Bay - Crooks Castle on the Caribbean side. *Chelonia mydas* and *E. imbricata* nesting was recorded on Lynch Bay. On the beach of Zeelandia, *Dermochelys coriacea* and *Caretta caretta* are also nesting. At the latter site, 100 nests of both species were counted in 2010 (Berkel, 2010).

Photo 32. *C. mydas* grazing on the Malendure meadow, in Guadeloupe. Note the presence of two large commensal Remoras attached to its carapace
(© Association Évasion Tropicale)

In Guadeloupe, the islands of Petite Terre (commune of Désirade) have been a nature reserve since September 3, 1998. Between April and September of 2001 and 2002, 157 and 122 marine turtle tracks were counted on the two islets; 60% of the tracks were attributed to *E. imbricata* in each of the two years and 33-40% to *C. mydas* (Lorvelec *et al.*, 2004). In 2008, 35 nests of *E. imbricata* and 127 of *C. mydas* were counted in Terre-de-Bas (Office National de la Chasse et de la Faune Sauvage (ONCFS) & Kap Natirel, 2011). It should be noted that the lagoon and the pass between Terre-de-Haut and Terre-de-Bas have seagrass with *Syringodium filiforme* and *Thalassia testudinum* at a depth of 0.50 to 3 m. They are frequented by numerous immatures to adults *C. mydas* depending on the depth (Lea Lange, pers. comm.). According to old fishermen, more turtles used to come there to lay eggs in the past, including perhaps *L. olivacea* (Pritchard, 1984; Fretey, 1997; Fretey & Lescure, 1999; Lorvelec & Fretey, 1999).

The site of Trois Ilets - Folle Anse west of Marie-Galante, which has long gone unnoticed by the scientific community, is remarkable for the nesting of *E. imbricata*. The estimate for the 2000 and 2001 seasons was about 200 nests (Chevalier *et al.*, 2003). During the 2005 season, 651 nests were counted, of which 6.0% were on open beaches, 31.8% under low vegetation, 36.6% on forest& edges and 25.6% under forest (Kamel & Delcroix, 2009).

The small island of Aves (15º40'30"N, 63º36'26"W), a dependency of Venezuela, is located 230 km from Guadeloupe. Pritchard & Trebbau (1984), as well as Guada & Buitrago (2008) estimated that 300 to 500 females nested there each season. For the period 1979-1997**,** Peñaloza (2000) estimated the population of breeding females to be between 347 and 1,439. More recently, Vera & Buitrago (2012) obtained for the seasons 2001-2008 an estimate of 373 to 1,669 females. In 2015, García-Cruz *et al.* estimated the breeding stock of the Refugio de Fauna Silvestre Isla de Aves at 767 females per season. Aves thus quantitatively possesses the second largest nesting colony in the Caribbean. After decades of exploitation by Guadeloupean fishermen, and despite its relatively low survival rate, this population, like others in the Caribbean, appears to be slowly recovering following protective management.

In Martinique coastal waters, the current hypothesis is that juvenile *C. mydas* originate from nesting habitats in the Guianas and Brazil. Some migrate to join adults on feeding habitats in eastern Brazil (Chambault *et al.*, 2018).

Photo 33. Juvenile *C. mydas* on its feeding and developmental habitat in Anses d'Arlet
(© D. Chevallier)

A study conducted in Anses d'Arlet showed long-term fidelity of immature Green turtles on a home range of 3.4 km^2. Some large specimens equipped with Argos transmitters migrated to various locations in the Caribbean and to the African coast (Chambault *et al.*, 2019). Migrating turtles have crossed more than 25 Exclusive Economic Zones, further demonstrating the compelling need for international agreements.

Note that site 2210 in the Dominican Republic has offshore coral reefs that are known to be one of the most important juvenile Hawksbill turtle nursery habitats in the entire Caribbean (León y Diez 1999).

In the Republic of Trinidad and Tobago, *D. coriacea* is *the* predominant nesting species with concentrations at Grande Riviere, Matura, Fishing Pond, Madamas and Tacaribe. On Tobago, nesting is low and mainly along the southwest coast at Rocky Point - Mt. Irvine Back Bay, Grafton Beach - Stone Haven Bay and Turtle Beach - Great Courland Bay. In the entire sub-region, the most important nesting site for *D. coriacea* is the 5 km long Matura Bay beach in Trinidad. A total of 67 female Leatherbacks were recorded north of Matura Bay in 1982 and 54 in 1983 (Chu Cheong, 1990). The overall estimate for Trinidad in the 1980s was 500-900 nesting female Leatherbacks each season (Nathai-Gyan *et al.,* 1987). In 2007-2008, this Trinidad breeding stock was considered stable, with an annual nest count of 48,240-52,797 individuals. As poaching, once very important, has been suppressed, it is erosion that has become a serious threat (Godley *et al.*, 2001).

C. mydas and *E. imbricata* are few in number on the northeast coast of Tobago, at L'Anse Fourmi, Hermitage and Cambleton. On Trinidad, nesting of *C. mydas* is reported along the northern coasts and is mainly concentrated in Manzanilla Bay (Bacon, 1981). Green turtles of all age classes feed throughout the seagrass beds in Trinidad and Tobago waters, with a somewhat greater concentration in the Matelot and Toco areas (Forestry Division, 2010).

On Tobago, it should be noted that important egg-laying activities of *E. imbricata* were reported on the beaches of Hermitage Bay and Campbleton, which host more than 100 nests of *E. imbricata* each season (Walker *et al.*, 2015), and in the islands off Boca del Dragon (Bacon, 1973; Pritchard, 1984). Manzanilla Bank in Trinidad appears to be a nursery area worthy of special monitoring as a feeding area for immature and adult Hawksbill turtles (Forestry Division, 2010). Juvenile Hawksbill turtles of various sizes feed around the islands throughout the year. Developmental and feeding habitats for the species are known at Saut D'eau, Grande Riviere, Mayaro, Soldado Rock, Chacachacare, Paria Bay, Morne Poui, but the sites at Matelot and Toco are clearly the most important (Forestry Division, 2010).

In Buccoo Reef lagoon (site # 1496), especially in the southwest, the turtle grass *Thalassia testudinum* is 80% dominant and often less than one meter deep. The seagrass beds in the Bon Accord coastal area (north and south of Sheerbird's Point, southeast of Pigeon Point) cover an area of 53 ha and go to a maximum depth of 6 m.

On Curaçao, the seagrass beds of Boca Ascension and Wacana are considered important feeding areas for subadult individuals of *C. mydas* (Christianne, 2015). The northwestern coasts (site # 2119) include lagoons with seagrass beds, mangroves, and are more than 80% covered by coral reefs, preferred habitats of *E. imbricata*. Both *D. coriaea* and *L. olivacea* appear to be occasional visitors, especially around Klein Curaçao (Dilrosun *et al.*, 2012). The seagrass beds around this small island are valuable feeding habitats for *C. mydas*, especially in the inner bays (Oostpunt, Ascension Bay, Bokabartol, St. Jorisbaai, Awa di Oostpunt, Fuik, Spanish Water Bay). Three species nest on the beaches of Curaçao (Shete National Park, Boka Mansaliña, Boka Braun) and Klein Curaçao: *Chelonia mydas*, *Eretmochelys imbricata* and *Caretta caretta* (Sybesma, 1992; Hoetjes, 2006; Dilrosun *et al.*, 2012). The Loggerhead is reported to nest only about 3 times per year on Klein Curaçao and also a few sporadic nests on Curaçao on the north coast at Boca Manzaliña and East Point Bay (Van Buurt, 1984). Nesting of Loggerhead, Hawkbill and Green turtles on a few beaches on Curaçao (Un Boka, Boka Mansaliña, Boka Braun) is very low (Debrot & Pors, 1995).

C. caretta has been reported nesting in the past on a number of Bonaire beaches: Washikemba (Washikemoa or Lagoen), Playa Grandi, Saliña, Sorobon (Van Buurt, 1984). This nesting would deserve confirmation today. A developmental habitat for this species might exist in Lake Bay.

The British Turks and Caicos Islands (TCI) consists of eight large islands and about forty small cays located at the southern end of the Bahamas archipelago. The archipelago is spread over 950 km^2 between the Caicos Bank and the Turks Bank. This entire area is comprised of shallow water (568 km^2 of which is Ramsar site #493), beaches, seagrass beds, and mangroves that provide developmental, feeding, and nesting habitats for *C. mydas* and *E. imbricata* (Carr *et al.*, 1982; Fletemeyer, 1984; Richardson *et al.*, 2009). The grass beds on these large sandy banks support a colony of sub-adult Green turtles (63-81 cm) for extended periods of time. Some of these turtles make migratory movements in the Caribbean-Atlantic basin through nine geopolitical zones (Doherty *et al.*, 2020).

Genetic studies of juvenile Green turtles along the coast of Barbados show mixed and sometimes geographically distant origins: Ascension (25.0%), Aves Is. and Suriname (23.0%), Costa Rica (19.0%), Florida (18.5%), Mexico (10.3%) (Luke *et al.*, 2004). The island of Culebra and its satellite islets and cays (Luis Peña, Carlos Rosario, Tiburón, Punta Soldado, Tamarindo Grande, Puerto Manglar, Culebrita, etc.), which are administratively attached to Puerto Rico, from which it is located to the east, have the status of a national wildlife refuge. The presence of rich seagrass beds with *Thalassia testudinum* and *Synringodium filiforme*, as well as macroalgal zones, in Mosquito Bay, Puerto Manglar and Tamarindo Grande explains the concentrations of juvenile and subadult *C. mydas* with an average length of 46.34 cm (Boulon & Frazer, 1990; Collazo et *al.,* 1992). Puerto Manglar (18.30°N/65.25°W) and Tortuga Bay (18.22°N/65.22°W) present nursery habitats where young juveniles remain for many years before leaving at the onset of sexual maturity (Diez *et al.*, 2010).

Nearby, between Puerto Rico and the Dominican Republic, Mona Island (18°05'N/67°54'W) has 7.2 km of nesting habitat in 18 separate beaches, all to the south. For the 1990 season, 196 nests of *E. imbricata were* counted there (Van Dam *et al.*, 1990).

These different Caribbean examples concerning immature *C. mydas* highlight once again the need for coordination of species conservation in a regional network.

Proposed actions by experts J. Fretey and P. Triplet

Eretmochelys imbricata is the flagship and symbolic species of this Caribbean region. Many of the habitats would require classification under Resolution XIII.24 of the Ramsar Convention.

The State of Puerto Rico is encouraged to propose Mona Island for listing, as well as Cuba with the Jardines de la Reina archipelago, since these islands contain nesting and feeding habitats of regional interest for the species.

We also encourage the Republic of Antigua and Barbuda to propose the Pastura Bay site for listing in addition to site # 1488 on its nearby island of Barbuda, which is well frequented by *D. coriacea*.

In our inventory, we did not identify any Ramsar sites in the U.S. Virgin Islands (USVI). Note that a recent genetic study (Hill *et al.*, 2018) showed a demographic difference on St. Croix between the breeding flock of *E. imbricata* nesting on Sandy Point National Wildlife Refuge beach and Buck Island Reef National Monument, 40 km apart. Genetically, the Buck Island Reef flock is similar to that of the 750km distant Barbados Island (LeRoux *et al.*, 2012). This demonstrates the value of a Ramsar classification of sites grouped in a network.

Of a total of 817 Caribbean beaches inventoried as hosting nesting *E. imbricata*, only 4.4% are known to have more than 100 nests per year (Dow Piniak & Eckert, 2011). Certainly, Mexico, Cuba, and Barbados must prioritize proper management of egg-laying habitats and their coral reefs, the species' preferred marine habitat, but we encourage all Caribbean Arc states to a comprehensive and common strategy of creating an extensive Caribbean network of Ramsar sites of *E. imbricata* terrestrial and marine habitats.

On the island of St Eustatius, a classification of the site of Zeelandia Beach could be considered by the Netherlands.

Some cays and satellite islets of the Puerto Rican Island of Culebra are regionally important developmental habitats for *Chelonia mydas* and should be classified for this reason.

Our study demonstrated significant demographic differentiation between Buck Island and Sandy Point, the two main Hawksbill rookeries on St. Croix.

We recommend that France nominate Islet Tintamarre, a satellite of St. Martin, for listing. The beaches of Lagon and Baie blanche are habitats of *E. imbricata* (Chalifour, 2015) to be preserved.

In the Guadeloupe archipelago *sensu stricto*, we advocate two classifications: the islands of Petite-Terre and two beaches of Marie-Galante. Classifying the islands of Petite-Terre as a Ramsar site would allow the management of three habitats: nesting beaches of *C. mydas* and *E. imbricata*, nursery area and feeding area of *C. mydas*. The increase in the number of nests in recent years on the site of Trois Ilets - Folle Anse. On Marie Galante Island, the concentration of turtle nests, comparable to that of Long Island (Antigua), also deserves a Ramsar classification.

In Martinique, the importance of the development habitat for *C. mydas* in Anses d'Arlet requires their classification as a marine protected area and Ramsar site.

Major nesting site of *C. mydas* in the Caribbean Sea, the Venezuelan island of Aves deserves a Ramsar classification.

As for Trinidad and Tobago, the Ramsar classification of Matura Bay beach would be an international recognition of this Caribbean nesting habitat of the Leatherback, and would be relevant since we know that females identified in French Guiana sometimes come to lay eggs there.

On Tobago, the beaches of Hermitage Bay and Campbleton would merit Ramsar classification along with the marine and terrestrial habitats on 12.87 km^2 of Buccoo Reef - Bon Accord Lagoon (site # 1496).

The feeding and nursery habitats of *C. mydas* along the Barbados coastline at Puerto Manglar and Tortuga Bay would require Ramsar designation.

If *C. caretta* developmental habitat is confirmed at Lake Bay on Bonaire Island, this would merit a Ramsar listing.

Five major adult feeding habitats of *C. mydas* have been identified in the Caribbean (Van der Zanden *et al.*, 2013) and to which many adult females converge from nesting sites sometimes thousands of kilometres away: Inagua and Long Island (Bahamas), St. Joe Bay (Florida), North Atlantic Autonomous Region (NAAR) and South Atlantic Autonomous Region (SAAR, Nicaragua). These habitats, which are essential for the life cycle of important breeding stocks such as the Tortuguero in Costa Rica, deserve a classification that allows for proper management.

Very juvenile Loggerhead, probably sick and not very moveable, because covered with algae
(© J. Fretey)

REGION 4

South America.

Map 5. Location of Ramsar sites in South America.

Table V: Inventory of South American sites

Site number	Contracting Parties	Administrative region	Site name	Species present
883	Peru (Republic of Peru) Ratification: 03/30/1992	Tumbes	Santuario Nacional Los Manglares de Tumbes	Ca, Lo, Ei, Dc
545	Peru (Republic of Peru)	Ica	Reserva Nacional de Paracas	Cm, Lo, Dc
951	Colombia (Republic of Colombia) Accession: 18/06/1998	Magdalena	Sistema Delta Estuarino del Río Magdalena, Ciénaga Grande de Santa Marta	Dc? Ei? Cm? Cc?
1387	Colombia (Republic of Colombia)	Chocó	Delta del Río Baudó	Cc, Lo, Dc, Ei, Cm, Ca
414	Venezuela (Bolivarian Republic of Venezuela) Accession: 23/11/1988	Falcón	Refugio de Fauna Silvestre de Cuare	Cm, Ei, Dc
856	Venezuela (Bolivarian Republic of Venezuela)	Federal District	Parce Nacional Archipiélago Los Roques	Ei, Cm, Dc, Cc
857	Venezuela (Bolivarian Republic of Venezuela)	Nueva Esparta	Laguna de la Restinga	Cc, Ei, Cm, Dc
858	Venezuela (Bolivarian Republic of Venezuela)	Miranda	Laguna de Tacarigua	Cm, Ei, Cc, Dc
859	Venezuela (Bolivarian Republic of Venezuela)	Mzulia	Refugio de Fauna Silvestre y Reserva de Pesca Ciénaga de Los Olivitos	Cm, Ei, Cc, Lo
643	France (French Republic)	Département de la Guyane française	Basse-Mana	Dc, Cm, Lo
1828	France (French Republic)	Département de la Guyane française	Estuaire du fleuve Sinnamary	Cm
640	Brazil (Federative Republic of Brazil) Accession: 24/05/1993	Estado do Maranhão, Amazon Province	Reentrancias Maranhenses Environnemental Protection Area	Dc, Lo, Cm, Ei
1021	Brazil (Federative Republic of Brazil)	Estado do Maranhão	Parque Estadual Marinho do Parcel de Manuel Luís	Ei
1902	Brazil (Federative Republic of Brazil)	Estado do Bahía	Abrolhos Marine National Park (Timbebas reefs, Abrolhos Archipelago, Parcel dos Abrolhos)	Cc, Dc, Ei, Cm, Lo

2259	Brazil (Federative Republic of Brazil)	Rio Grande do Norte	Atol das Rocas Biological Reserve	Cm, Cc, Ei
2298	Brazil (Federative Republic of Brazil)	Rio Grande do Sul	Taim Ecological Station	Cc, Dc, Cm, Ei, Lo
2305	Brazil (Federative Republic of Brazil)	Estado do Paraná	Guaraqueçaba Ecological Station	Cm, Ei, Dc, Lo, Cc
2310	Brazil (Federative Republic of Brazil)	Estados de São Paulo e do Paraná	Environmental Protection Area of Cananéia-Iguape-Peruíbe	Cm
2317	Brazil (Federative Republic of Brazil)	Estado do Paraná	Guaratuba	Cm
2333	Brazil (Federative Republic of Brazil)	Estado do Pernambuco	Fernando de Noronha Archipelago	Ei, Cm, Lo, Cc, Dc
2337	Brazil (Federative Republic of Brazil)	Estados de Pará, Amapá e do Maranhão	Amazon Estuary and its Mangroves	Dc, Cc, Ei, Cm, Lo
2190	Brazil (Federative Republic of Brazil)	Estado do Amapá	Parque Nacional do Cabo Orange - Cabo Orange National Park	Cm, Dc
503	Ecuador (Republic of Ecuador) Accession: 07/09/1990	Provincia de Manabí	Área Marina del Parque Nacional Machalilla	Ei Ca? Lo? Dc?
502	Ecuador (Republic of Ecuador)	Provincia del Guayas	Manglares Churute	Ca
1142	Ecuador (Republic of Ecuador)	Provincia de El Oro	Refugio de Vida Silvestre Isla Santa Clara	Ca ?
1202	Ecuador (Republic of Ecuador)	Provincia de las Islas Galápagos	Humedales del Sur de Isabela	Ca
1292	Ecuador (Republic of Ecuador)	Provincia de Esmeraldas	Reserva Ecológica de Manglares Cayapas-Mataje	Ei
2098	Ecuador (Republic of Ecuador)	Provincia de Guayas	Manglares del Estuario Interior del Golfo de Guayaquil “Don Goyo”	Ca, Lo, Cm, Dc
885	Argentina (Republic of Argentina) Ratification: 04/05/1992	Buenos Aires	Bahía de Samborombón	Cm, Cc, Dc
290	Uruguay (Eastern Republic of the Uruguay) Accession: 22/05/1984	Departamentos de Rocha, Treinta y Tres	Bañados del Este y Franja Costera	Lo, Cm; Cc; Dc

Notes:

Of the 1,650 km of Colombian Caribbean coastline, a total of 181 beaches representing 729 km (or 44.2%) represent important known or potential habitat for nesting marine turtles (Mortimer, 1995). Rosario and San Bernardo Islands host not only *Eretmochelys imbricata* nesting but also development habitats for the species on a surface of coral reefs reaching 219.5 km^2 (Diaz *et al.*, 2000).

Colombia has only two Ramsar sites of interest here: one on its Caribbean coast (# 951) and one on the Pacific coast (# 1387). We did not detect any relevant information indicating the presence of marine turtle habitats for site # 951, nor were we able to verify the list of species present indicated by the Colombian State. Regarding the Delta del Río Baudó, an undated anonymous study (Estructura ecológica principal de la región del Chocó biogeográfico colombiano) mentions the presence of six species, including the two *Chelonia* taxons. This presence is explained by the existence in the bays of Trigana and Sapzurro of large meadows with *Thalassia testudinum*. The authors define corridors with a great variety of ecosystems composed of mangrove formations and coral reefs; the corridor between Cape Mars and Cape Corriente would include nesting habitats suitable for five species (without specifying these species); the Buenaventura-Tumaco corridor is indicated as a habitat (feeding habitat? breeding habitat?) of *C. agassizii*.

L. olivacea is the most common marine turtle in the Pacific region of Colombia. El Valle River Beach (6°04'21, 00'N, 77°24'04, 62"W) in the north is considered the most important nesting beach for this species on the Pacific coast of South America (Barrientos & Ramirez, 2008; Barrientos-Muñoz et *al.,* 2014). This beach, 8.2 km long is unfortunately not entirely within the Parque Nacional Natural Utría in the Chocó region. Also worth mentioning in the south of the country are the beaches of the Parque Nacional Natural Sanquianga, Amarales, Mulatos and Vigia with more than 100 females per beach and season (Amorocho *et al.*, 1992).

Gorgona National Natural Park (2° 55' to 3° 00' N, 78° 09' to 78° 14' W) is a volcanic island located 56 km off the mainland south coast of Colombia Pacific. This island and its satellite islet of Gorgonilla are surrounded by coral reefs and sandy bottoms without sea grass. Three species are present in this protected area (Rueda, 1988): *L. olivacea*, the only one to come to the beaches on the southwest side to nest; the coral reefs are an excellent nursery for juvenile *E. imbricata*; a large colony of *Chelonia* feeds in these waters.

Juvenile and large immature *Chelonia* feeding in these habitats at depths less than 6 m belong to several genetic stocks (Amorocho & Reina, 2007; Amorocho et *al.,* 2012). A study (Sampson *et al.*, 2015) done on 995 turtles from this site shows that some (SCL = 43.0-71.0 cm) have the *agassizii* morphotype, and others (SCL = 44.1-65.9 cm) the *mydas* morphotype. According to Amorocho *et al*. (2012), 55-96% of the Chelonia in Gorgona come from nesting beaches in the Galapagos Archipelago, and between 2-38% from rookeries in the state of Michoacan, Mexico.

The oesophageal lavage of 84 captured Black turtles showed a diet composed of 65.95% Tunicates, 13.20% mangrove fruits (*Rhizophora mangle*), 3.70% algae, 1.37% *Ficus* spp. leaves, and the rest Crustacea and Molluscs. Note that *E. imbricata* is very present in the fifteen coral reefs of the Gorgona island, which is exceptional in the Pacific Ocean region. Undoubtedly, the species finds a suitable feeding habitat there (Gómez *et al*., 2002). Loggerheads, another rare species in the Colombian Pacific, were also observed there (Amorocho *et al.,* 1992). With all of this, it would seem relevant to us to classify Gorgona National Park as a Ramsar site. Garcia (2018) reports that it has feeding and nesting habitats for *L. olivacea*, *E. imbricata*, *C. mydas* and *D. coriacea*.

There are exceptional habitats for marine turtles all along the Colombian coast. In the Caribbean waters, the Phanerogam meadows cover a total area of 43,219 hectares along the mainland coast and the archipelago of San Andrés, Providencia and Santa Catalina. 80.23% of these grasslands are on the coast of La Guajira and 15.13% between Tayrona and the Gulf of Urabá. The meadows with *Halodule wrightii*, *Thalassia testudinum* and *Syringodium filiforme* run along the coastline at a depth of 1 to 3 m. The surface area of the living coral beds is 1,090 km^2, of which 75% is in the archipelago of San Andrés, Providencia and Santa Catalina, 12% around the islands of San Bernardo, 6% around the islands of Rosario and the Barú peninsula, and the remaining 7% distributed along the coast between La Guajira and the Gulf of Urabá.

Information on the use of these environments by the different species is scattered and rather in ministerial reports on biodiversity conservation than in scientific publications. The data mainly concern catches by fishermen by department, and if nesting beaches are mentioned, the importance of the frequentation by species is rarely indicated. Of the 1,650 km of Caribbean coastline, 729.7 km are considered to offer habitats for mating, nesting (127 active nesting beaches recorded for a total of 534.58 km), nursery or feeding for marine turtles (Ceballos Fonseca *et al.*, 2002). It should be noted that of these 729.7 km, 157 km are within protected areas. It was calculated that Hawksbill turtle uses 470 linear km of beaches for nesting, Green turtle 401 km, Loggerhead turtle 360 km and Leatherback turtle 309 km (Ceballos Fonseca *et al.*, 2002).

Eggs of *E. imbricata* are observed on the cays at the northern end of the archipelago of San Andrés, Providencia and Santa Catalina, particularly at Cayo Serranilla (McCormick, 1998). Ogren (1983) confirmed that *C. mydas* feeds on the grasslands of the Upper Guajira. For 45 km, this region also includes many wetlands with mangroves and the beaches of Puerto López, Puerto Inglés, Parajimarú and Puerto Espada where *C. mydas* and *E. imbricata* nest.

Between Castilletes and Punta Espada, Acandi and La Playona beaches, in the Gulf of Urabá, host one of the most important breeding colonies of *D. coriacea* in the non-Guyanese Caribbean, estimated at 250-300 females (Rueda, 1987; Gómez *et al.*, 2002). *E. imbricata* nesting is observed in other beaches of the Gulf of Urabá such as Cerro del Águila.

Nesting is noted especially in Playa de Buritaca for *Caretta caretta* (Kaufmann, 1975) where the breeding stock was estimated at 600 females. Marrugo & Vasquez (2001) note the dramatic decrease in the number of nests on the beaches of Don Diego, Buritaca and Guachaca, but indicate those of Quintana and Mendiguaca as being well frequented.

In Bolivar department, feeding and nesting habitats for *E. imbricata* are significant in and around the islands of Rosario, Baru and Fuerte (Ogren, 1983). The approaches to San Martín de Pajarale Island are nursery habitats for Green and Hawksbill turtles. In Sucre department, Rueda (1987) mentions the abundance of individuals of the species *Chelonia mydas*, *Caretta caretta* and *Eretmochelys imbricata* in the juvenile, pre-adult and adult stages in the marine environments of Pajarito, Blanco, Punta de Piedra Minarta and Bajo Nuevo. This author also notes significant nesting habitats of *E. imbricata* in the Gulf of Morrosquillo (beaches of Francés and Punta Seca on the islands of Salamanquilla and Palma).

Venezuela, with 2,000 km of mainland coastline, its island system including the remote island of Aves, offers a wide range for the developmental, feeding, breeding, refuge and nesting habitats of *C. mydas* (Guada & Solé, 2000).

The shallow bathymetry in the Gulf of Venezuela, in the northwest of the country, provides sufficient resources to support the feeding of marine turtle populations throughout the year (Barrios-Garrido *et al.*, 2017). Along with the Cays Miskitos in Nicaragua, the Gulf of Venezuela appears to be the most important foraging habitat in the Caribbean for *C. mydas* (Montiel- Villalobos, 2012). It is a preferred foraging habitat for adult turtles nesting at Tortuguero (Costa Rica) and Aves Island, turtles migrating from Puerto Rico, Turks and Caicos, Colombia, as well as juveniles and subadults from Bermuda (Barrios-Garrido *et al.*, 2020).

The Venezuelan National Park of Los Roques Archipelago (Site No. 856) includes about 50 islands and some 290 cays. It is considered as the most important nesting area for *E. imbricata* in the region. Most of the turtles, adults and juveniles, present in the archipelago, inhabit exceptional coral reefs hosting 61 species of corals and 60 species of sponges, here in good conservation status. The concentration of nests is on Dos Mosquises and Cayo Bequeve. Cayo de Aqua and Cayo Bequeve are the main feeding areas (Hunt, 2009).

In Ecuador, the Reserva Nacional de Paracas (site # 545) is recognized as a feeding area for marine turtles (Hays Brown & Brown, 1982). This area hosts immature individuals of *L. olivacea* between 30 and 60 cm in size (de Paz *et al.*, 2002) and could be a nursery habitat for this species.

The Ramsar card of the site Área Marina del Parque Nacional Machalilla (#503) indicates the presence of the species: *"Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivácea* and *Dermochlys imbricata"* (sic). These data seem doubtful to us. We only grant validity to *E. imbricata* for which Vallejo & Campos (2000) and Baquero et *al.* (2008) report nesting and emphasize the importance of the sites La Playita and Los Frailes. The Gulf of Guayaquil is the largest estuary along the Pacific coast of South America; the estuarine mangroves of this gulf are a preferred developmental habitat for Hawksbill hatchlings and foraging habitat for adults (Álava & Barragán Paladines, 2019). Other foraging habitats for this species are observed on the Ecuadorian coast by Baquero (*in:* Ministerio del Ambiente del Ecuador, 2014). The Ecuadorian government, which realized the importance of these nesting habitats of *E. imbricata*, declared them as a protected area of El Pelado on 12 August 2012.

The presence of *E. imbricata* inside the marine part of the Reserva Ecológica de Manglares Cayapas Mataje is only sporadic (Ministerio del Ambiente, 2014).

Galapagos archipelago has, after Mexico Pacific coasts, the largest breeding stock of *C. agassizii*.

From 1979 to 1982, the average cumulative abundance for the four indicator beaches (Quinta Playa and Barahona on Isabela Island, Las Bachas on Santa Cruz Island, and Las Salinas on Baltras Island) was 1,284 females per year (Green, 1981; Hurtado, 1984). Although there are no recent data for these four beaches, there are data for Quinta Playa alone, the most visited in the archipelago, which shows an average of 863 females per year from 2012 to 2015 (IAC, 2020).

Part of this population is resident and takes advantage of the seagrass beds in the coastal waters of the islands, while migratory individuals go to feed along Central America and the South American mainland (Seminoff *et al.*, 2007). Genetic analysis of immature to adult turtles (between 42.7 and 77.6 cm) feeding on the seagrass beds of the Gorgona Island Marine Protected Area (2°56'-3°02'N/78°10'-78°13'W) shows that 80% of them originate from the Galapagos rookeries (Amorocho *et al.*, 2012).

The Galapagos is a sanctuary, but the increase in anthropic activities is a threat to the habitats and to the turtles themselves: collisions with the numerous tourist boats, interactions with fisheries, pollution, etc. (Zárate, 2009). Quinta Playa, on the island of Isabela (site # 1202) is the most important nesting beach of the entire archipelago. A study by the Charles Darwin Foundation (CDF) and WWF-Ecuador (Parra *et al.* 2015) reveals that out of 366 turtles examined, 12% had injuries due to propellers and impacts with the hull of boats. This study makes recommendations to the management of the Galapagos National Park regarding speed and navigation areas to be imposed on boats and measures to be taken during the egg-laying period from November to May.

Photo 34. Female Black turtle climbing the sandy bank of one of the beaches of Santa Cruz Island (Indefatigable), Galapagos Archipelago, to nest
(© P. C. H. Pritchard)

The entire Brazilian region of the Amazon estuary (sites #2337 and # 640) is frequented by *Dermochelys coriacea*, *Lepidochelys olivacea*, *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricata*. Only the nesting of *E. imbricata* is noted at the extreme north of Curupu Island, in the municipality of Raposa (Ribeiro *et al.*, 2014).

The surroundings of the islands Guarita and Sueste in the Biosphere Reserve of Abrolhos (Ramsar site #1902) are said to have breeding habitats of *C. caretta*. Between November and February, Loggerhead and Green turtles nest on the beaches of these islands. *E. imbricata* finds in the very rich reef communities of the Abrolhos archipelago many invertebrate prey (De Andrade Nery Leão, 1999).

Marcovaldi *et al.* (2011) indicate the presence of the species *E. imbricata* in the Parque Estadual Marinho do Parcel de Manuel Luís (# 1021) very rich in Cnidaria.

Trindade Island is the main Brazilian oceanic nesting habitat (Moreira *et al.*, 1995; Almeida *et al.*, 2011), followed by Atoll das Rocas (Atol das Rocas) (Bellini *et al.*, 1996) and, in smaller numbers, on the Fernando de Noronha Archipelago (Bellini & Sanches,1996).

The small archipelago of Trindade e Martim Vaz, attached to the State of Espirito Santo, is located off the mainland, about 1,170 km from the coastal city of Vitória. *C. mydas* nests on the main island of Trindade. This nesting is not anecdotal since with sometimes more than 5,000 nests per season, it is one of the most important nesting sites of the species for the Atlantic (Moreira *et al.*, 1995; De Padua Ameida *et al.*, 2011). Therefore, it would be coherent that, in addition to the Brazilian sites 2333 and 2259, the Trindade e Martim Vaz archipelago be classified as a Ramsar site.

The protected volcanic archipelago of Fernando de Noronha (Ramsar Site # 2333) (3° 51′ S, 32° 25′ W), is located about 345 km from the northeast mainland coast of Brazil. It includes a large main island and 20 volcanic islets. It is with the atoll of das Rocas (# 2259) and the small archipelago of Trindade e Martim Vaz an significant place of oceanic oviposition of *C. mydas*. It should also be noted here that the grass beds around the islet Chapéu do Sueste south of the main island Fernando de Noronha attract many Green turtles, mainly immature (Sanches & Bellini, 1999). The size distribution at first capture ranges from 27 to 87 cm (47.9 ± 11.3 cm) and individuals show some site fidelity in the archipelago (Colman *et al.*, 2019).

A major developmental habitat of *E. imbricata* extends in the archipelago of Fernando de Noronha and around the atoll of das Rocas (Sanches & Bellini, 1999). These juvenile Hawksbill turtles are thought to originate from nesting sites in northeastern Brazil (Bahia and Rio Grande do Norte states), and possibly from Caribbean and Central African sites (Vilaça *et al.*, 2013; Santos *et al.*, 2019; Bellini *et al.*, 2000; Grossman *et al.*, 2007). Hatchlings evolve between 0.5 and 30 m depth.

Proietti *et al.* (2012) state that in the developmental habitats of Abrolhos Marine Park, São Pedro e São Paulo (which is offshore more than 1,000 km from the coast of the state of Rio Grande do Norte) and Arvoredo Marine Reserve, Hawksbill turtles are 24.5-63.0 cm CCL (mean = 37.9 cm), 30-75 cm (mean = 53.7 cm) and 30-59.5 cm (mean = 41.3 cm), respectively.

The Brazilian administration indicates the presence of *D. coriacea* in the record of this Ramsar site. This species is only occasional in these waters and this presence is only confirmed by accidental captures by fishing boats (Barata *et al.*, 2004).

Photo 35. Female *C. caretta* returning to the sea after nesting at Farol de Sao Tome beach
(© Fondation Pro-Tamar)

Atoll das Rocas (# 2259), approximately 240 km off Cape St. Roque, Rio Grande do Norte State and 145 km west of Fernando de Noronha is a UNESCO World Heritage Site. The average annual number of *C. mydas* nests on this atoll is 335 (136-563) (Bellini *et al.*, 2013).

Photo 36. Aerial view of Las Rocas atoll
(© Fondation Pro-Tamar)

Photo 37. Nesting beach of Praia do Forte
(© J. Fretey)

Photo 38. A female Loggerhead emerging from the waves on the beach of Praia do Forte
(©Pro-Tamar Fondation)

Photo 39. Climbing the beach of Praia do Forte by a female *E. imbricata*
(©Pro-Tamar Fondation)

Photo 40. Juvenile *E. imbricata* in a resting habitat in the middle of the coral reefs of Fernando de Noronha
(©Pro-Tamar Fondation)

Photo 41. Female *C. mydas* on the nesting beach of Trindade
(©Pro-Tamar Fondation)

Photos 42 and 43. Juvenile *C. mydas* in their developmental habitat in Fernando de Noronha
(© Fondation Pro-Tamar)

The Brazilian northeast coast, between Caiçara do Norte in Rio Grande do Norte State and Icapuí, Ceará State, is for some 300 km considered as an important feeding area for Green turtles. 71% of the turtles in the Potiguar Basin are prepubescent juveniles less than 60 cm, with a large majority of females (Gavilan-Leandro *et al.*, 2016; Farias *et al.*, 2019). This feeding habitat is of regional interest as it hosts not only Brazilian turtles, but also adults and juveniles from the West Indies and the Guianas (Jordao *et al.*, 2015; Chambault *et al.,* 2018).

The Iguape-Cananéia-Paranaguá estuary lagoon complex (CIELC) (Site # 2310), which has a great diversity of ecosystems and associated biodiversity, is considered as one of the largest marine species growth areas in the South Atlantic. For this reason, this complex is classified as an Atlantic Rainforest Biosphere Reserve and is a UNESCO Natural World Heritage Site. It is worth mentioning that the CIELC represents an important feeding and developmental habitat area for juvenile Green turtles of different origins, including from the British island of Ascension in the South Atlantic and Suriname (Bondioli, 2008).

Pirambu beaches, located in the northern part of Sergipe state host nests of Loggerheads, Hawksbills turtles, more sporadically Green turtles, but are especially important for *L. olivacea* (Silva *et al.*, 2007).

One of the world's largest breeding colonies of the *C. caretta* species nests along the Brazilian mainland coast between the states of Sergipe and Rio de Janeiro (Marcovaldi & Chaloupka, 2007). Monitoring of nesting in the north of Sergipe State and Rio de Janeiro State, in the municipal districts of Campos dos Goytacazes, São João de Barra and São Francisco do Itabapoana, during the 2004-2005 to 2010-2011 seasons, showed an average annual number of 1021 nests (Paes e Lima *et al.*, 2012). High oil and gas production in this region, destruction of terrestrial and marine turtle habitats by coastal development, and pollution are worrisome threats to this genetically distinct population of *C. caretta* from other Atlantic populations.

In Brazil, the only area where Leatherbacks regularly nest is Comboios beach, about 90 km north of Vitoria, the capital of Espírito Santo State, at about 19°S latitude. Between the 1988-1989 season and the 2003-2004 season, 527 nests were counted. Between 1995-1996 and 2003-2004, the annual number of nests increased by about 20.4% per year (Barata & Fabiano, 2002; Thomé et *al.,* 2007). This area is a Federal Biological Reserve and includes a 15 km stretch of Comboios beach south of the Doce River; the 22 km of beach further south is in Amerindian lands, under special legal status (Thomé *et al.,* 2007).

This area was affected by a large-scale mining disaster caused by the collapse of a tailings dam at an iron ore mine in Minas Gerais State, Brazil, in November 2015. The collapse of the dam released tens of millions of m^3 of mining waste into the Doce River (Marta-Almeida *et al,* 2016), which reached the Atlantic Ocean in Espírito Santo, in the middle of the main nesting beach of Leatherback turtles.

Juvenile and adult individuals resulting from hybridization between *E. imbricata* and *C. caretta* are now common in coastal waters and beaches of the state of Bahia. Studies have shown that 42% of nesting females with *E. imbricata* morphology had mitochondrial mtDNA typical of *C. caretta* (Lara-Ruiz *et al.*, 2006). These Bahia hybrids appear to have behaviors and frequent the feeding habitats of the Loggerhead and not those of the Hawksbill turtle (Proiett *et al.*, 2014).

Basse-Mana beaches and marshes, in the northwest of French Guiana, rich with an avifauna of 286 species, of which 70 are classified CITES, were designated as a Ramsar site (# 643) in December 1993 because of their worldwide importance for the nesting of *D. coriacea* and on the basis of a technical file prepared by one of us (JF). This was thus the first time a coastal site was registered by the Ramsar Convention, not because of its interest for waterbirds, but to protect a habitat of a marine turtle species, *D. coriacea*, which foreshadowed the spirit of Resolution XIII.24 of October 2018.

French Guiana beaches, particularly Yalimapo, were home to the highest concentration of nests in the world for *D. coriacea* in the 1980s and 1990s (Girondot & Fretey, 1996; Fretey & Lescure, 1998). Nesting activity reached peaks of more than 65,000 annual nests in 1988 and 1992. In 1996, Spotila *et al*. estimated that the beaches on either side of the Maroni River estuary hosted 50% of the world's breeding population of the species. In 2001, this breeding stock was estimated at 40% of the world female stock. Due to the cyclical silting of the mouth of the Mana River, the number of Yalimapo - Bois Tombé beach nesting has dropped considerably since 2009, with a partial transfer of the climbing to the beaches of the Cayenne peninsula. The Guianese breeding stock of leatherbacks now represents only about 10% of the global population (Chevallier *et al*., 2020).

Photo 44. Amana River marshes, beach and clay banks near the Aztec place, French Guiana
(© J. Fretey)

Photo 45. Nearby female Leatherback turtle nests on Yalimapo-Awala beach at the Suriname/French Guiana border
(© J. Fretey)

Photo 46. Female Leatherback turtle nesting on Yalimapo-Awala beach
(© J. Fretey)

Photo 47. Female Leatherback turtle returning to the sea after nesting on Yalimapo beach
(© J. Fretey)

Rémire-Montjoly beach, in the urban area of Cayenne peninsula, is cyclically (silting - de-silting) a remarkable nesting place for *L. olivacea* and *D. coriacea*. In 2005, a total of 2,246 Leatherback nests (with sometimes about 60 ascents per night) and 1,864 Olive Ridley nests were counted. Sporadic egg-laying by *C. mydas* and *E. imbricata* is also observed (Kwata Association, 2005). In 2013, 1,644 females *L. olivacea* were counted on this beach for 1,125 in 2015. Many villas are illegally located on the public maritime domain, as well as restaurants, which causes light pollution disorienting female turtles and newborns.

A population of immature and adult *C. mydas* resides around the Salvation Islands where it seems to find suitable plant food (Fretey, 1987).

Cyclical changes in the coastline lead the turtles to move to nest either in Suriname (or even Guyana) and French Guiana (Fretey & Girondot, 1989; Kelle *et al.*, 2007; Girondot *et al.*, 2007). For *L. olivacea*, this is the largest breeding population in the Atlantic. According to Kelle *et al*. (2009), between 2002 and 2007, 1,716 to 3,257 females nested in French Guiana, mainly in the Cayenne peninsula. These numbers, which have never been recorded before in French Guiana, are reminiscent of those in Suriname some 40 years ago, with sometimes more than 500 nests in one night on a beach (Schulz, 1975).

Recent studies (Plot *et al.,* 2015; Chambault *et al.*, 2017) show that between emergences female Olive Ridley nesting remain not far from the coast in turbid sedimentary waters with low salinity rich in Crustacea for which they can feed. Such habitats, with a coastal depth of less than 6 m, need to be identified along the Guyanese coast.

Suriname is a Contracting Party to the Ramsar Convention, Guyana is not, and this is unfortunate because the beaches of this country close to Venezuela have significant habitats for marine turtles. The Surinamese coast, from Bigisanti to the estuary of the Maroni River, is a world hotspot for the Green turtle and one of the most important world sites for the Leatherback. In the 2002 season, the number of *D. coriacea* nests was estimated at 12,750 (Hilterman & Goverse, 2003). Monitoring of these beaches since 1964 shows, as in Guyana and French Guiana, great annual variations due to infidelity to the sites but also to their evolutionary morphology. To show the quantitative importance of *C. mydas* nesting in this country, let us take for example the year 1973 with a total of 17,596 nests. For the period 1976-79, Schulz (1975) estimated a breeding stock of about 5,000 females. An important mating area of the species is located off the Maroni estuary (Schulz, 1975). These adult Green turtles migrate along the Brazilian coast, mainly to feeding habitats in the states of Ceará, Piauí, Rio Grande do Norte, Paraiba, Pernambuco and Alagoãs (Schulz, 1964, 1981; Ferreira, 1968).

In Peru, *E. imbricata* is present from the central coast (Ica) to the northern regions (Piura and Tumbes) where concentrations are highest in developmental and feeding habitats. The average length of individuals is 40.0 cm (23 to 75.5 cm). Main aggregations are located in 3 areas: From Quebrada Verde to Máncora, Canoas de Punta Sal and Zorritos (Gaos *et al.,* 2017). To this must be added, in the fusion zone between the tropical sea and the current in Humboldt, Sechura Bay, which hosts an important development area.

The shallow waters of Paracas Bay are a significant growth habitat for *C. agassizii* (Luschi *et al.*, 2003). On the border with Ecuador, a large mangrove ecosystem is proving to be a remarkable feeding habitat for the very rare Eastern Pacific *E. imbricata*. Part of this ecosystem, the Santuario Nacional Manglares de Tumbes, is a protected natural area and classified as a Ramsar site (# 883).

Some 98% of *C. agassizii* specimens caught by fishermen in this area are subadults (64.2 ± 5.4 cm). Considered as an area with food habitats of regional interest for marine turtles, this sector of Tumbes is unfortunately characterized by numerous accidental captures by gillnets (Rosales *et al.*, 2010).

Pajuejo *et al*. (2010) hypothesize the existence in Peruvian waters (between 5°-22°S and 71°-81°W) of outstanding developmental and feeding habitats for *Caretta caretta*. These juvenile, subadult and adult turtles have sizes from 35.9 to 86.3 cm. Genetic studies indicate that these Loggerheads originate from populations in eastern Australia and New Caledonia (Boyle *et al.*, 2009; Dutton *et al*., 2019).

The presence of three species in Chilean waters is more or less occasional: *C. agassizii*, *D. coriacea* and *L. olivacea*. Their presence off the Chilean coast extend to the latitude of Punta Arenas, for the Black turtle and for the others, the confirmed observations are attested only until the Gulf of Arauco. The presence of *C. caretta* is common in the north (Donoso-Barros, 1966). Donoso-Barros (1970) indicated the presence of *Dermochelys* (including *Sphargis angusta* Philippi, 1899) up to Chiloé Island (42°40'36S/73°59'36W), making it the southernmost point of its range, but this information has not been confirmed. The presence of *Chelonia* around Isla Desolación (52°57'S) is probably the southernmost record for any marine turtle (Frazier & Salas, 1983).

Frazier & Salas (1982) made an analysis of all the available data and concluded that *Dermochelys* adults, *Caretta* juveniles, and *Lepidochelys* and *Chelonia* juveniles, subadults and adults are found in Chilean waters.

Observations of juveniles and adults of the species *C. agassizii* were made off the beach of Chinchorro in northern Chile: Port of Arica, Chipana Bay, ports of Antofagasta and Mejillones, Antofagasta region and Salado Bay, Atacama region. These individuals had a length (CCL) of 47 to 75.7 cm. It is assumed that these Black turtles originated from nesting habitats in the Galapagos Islands (Veliz *et al.*, 2014). Three feeding habitats with large aggregations of Black turtles are also noted in the Península de Mejillones: waters of Bahía Mejillones del Sur heated by discharges from a thermoelectric plant; Caleta Constitución in the coastal complex of Santa María Island, Caleta o Poza Histórica de Antofagasta. The individuals examined measure between 40 and 82 cm and are 69% juveniles and 16% subadults (Bolados Díaz *et al.*, 2007). These development and feeding habitats are composed of algae such as *Gracilaria* and *Ulva* sp. (Silva *et al.*, 2007; Salinas Cisternas *et al.*, 2019). Bahia Salado, with its seagrass beds composed of *Zostera chilensis*, is the southernmost known foraging habitat for *C. agassizii* (Contardo *et al.*, 2019).

For the Argentine site of Bahía de Samborombón (No. 885), the report of the Convención Interamericana para la Protección y Conservación De Las Tortugas Marinas (CIT, 2014) indicates the presence of *E. imbricata*, a species not reported by the Ramsar information sheet, as having feeding habitat there. Regarding *C. caretta*, Bruno *et al.* (2019) define immature develpment habitat in the estuarine area of the Rio de la Plata, at the edge of the species' range in the temperate southwest Atlantic. They show high site fidelity, either remaining in the same 8,000 km² area for 60% of their feeding time (7-8 months) or returning to the same habitat in subsequent years (inter-annual site fidelity). Some of these turtles winter in warmer coastal waters off Brazil and Uruguay, as well as in oceanic areas.

More than 85% of the juvenile Green turtles present in the coastal waters of Uruguay and Argentina are mixed stocks that originate from the Ascension Island breeding colony (Caraccio, 2008; Prosdocimi *et al.*, 2012), the rest from Suriname, Aves and Trindade Islands (Vélez-Rubio *et al.*, 2019). The interplay of the Falkland Current during the austral winter and the Brazilian Current during the austral summer causes thermal variations of about 15°C. When sea temperature decreases, seasonal movements lead 40-45 cm juveniles and subadults from Uruguayan to South Brazilian waters, and then they return to spend the summer in the Rio de La Plata estuary, mainly in the rocky outcrops of Canelones, Maldonado, and Rocha, at depths less than 5 m (Gonzalez Carman *et al.*, 2012; Vélez-Rubio *et al.*, 2018).

Proposed actions by experts J. Fretey and P. Triplet

We believe that the El Valle River beach in northern Pacific Colombia, considered the most important nesting habitat for *L. olivacea* on the entire Pacific coast of South America, would merit Ramsar designation. We have focused on Colombia at length here because we believe that many of the wetlands in that country, both on the Pacific and Caribbean sides, would require Ramsar designation and management appropriate to the conservation challenges.

The nesting habitat of *D. coriacea at* Comboios Beach, Espírito Santo State, is the southernmost in the western Atlantic and Brazil could consider its listing.

The Fernando de Noronha Marine National Park could be complemented by a Ramsar designation of some areas to a depth of 6 m.

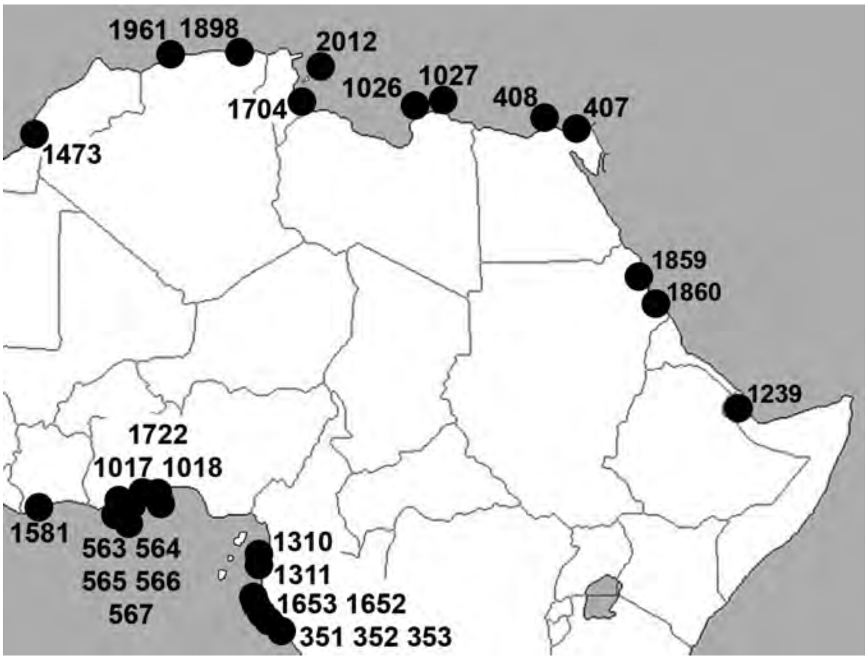
In the Suriname region bordering French Guiana, the entire unstable coastline and adjacent marshes from Bigisanti (Wia Wia Nature Reserve) to Pruimenboom-Galibi (Galibi Nature Reserve), an uninhabited stretch of about 90 km, would be classified as exceptional nesting habitat for *Chelonia mydas*, *Lepidochelys olivacea* and *Dermochelys coriacea in the Maroni River estuary*.

We recommend for French Guiana, the Ramsar classification for two sites: the beach and coastal surroundings of Rémire-Montjoly, and the islands of Salut as a growth habitat of regional interest for *C. mydas*.

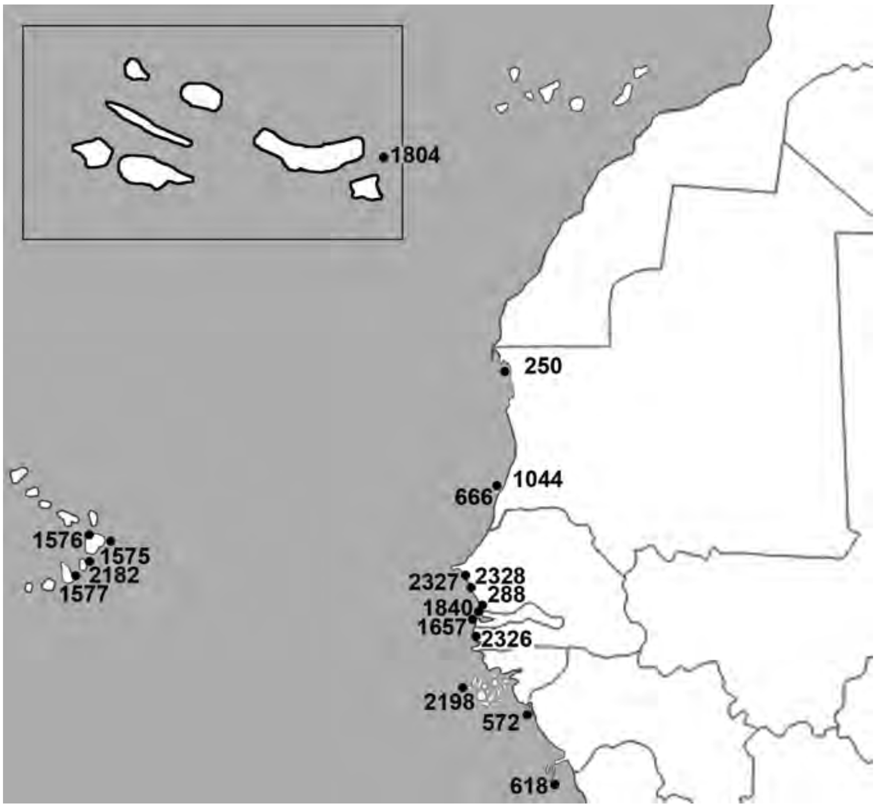
We believe that the inclusion of the prime habitats of the Rio de La Plata Estuary for the recruitment of the breeding colony of the *C. mydas* nesting hotspot of Ascension Island should be considered. Growth and feeding habitats of *C. caretta* in Peruvian waters also deserve special attention.

REGION 5

North, Central and East Africa.



Map 6. Location of Ramsar sites in North Africa, Red Sea and Gulf of Guinea.



Map 7. Localisation des sites Ramsar en Afrique de l'Ouest *sensu stricto*.

Table VI. Inventory of sites in North Africa, the Red Sea and the Gulf of Guinea

Site number	Contracting Parties	Administrative region	Site name	Species present
1804	Sudão República do Sudão Ratification: 24/11/1980	Azores archipelago	Ilhéus das Formigas e Recife Dollabarat	Cc
1473, 1961, 1898, 1704, 2012, 1026, 1027, 408, 407	Morocco Algeria Algeria Tunisia Tunisia Libya Libya Egypt Egypt	Sites d'Afrique du Nord:	Cf. Méditerranée	-
1859	Sudan (Republic of the Sudan) Accession: 07/01/2005	Red Sea State	Dongonab Bay-Marsa Waiai	Cm, Ei, Cc
1860	Sudan (Republic of the Sudan)	Red Sea State	Suakin-Gulf of Agig	Cm, Ei
1239	Djibouti (Republic of Djibouti) Accession: 22/11/2002	Djibouti	Haramous-Loyada	Cc, Cm
1581	Côte d'Ivoire (Republic of Côte d'Ivoire) Accession: 27/02/1996	Bas-Sassandra	Complexe Sassandra-Dagbego	Dc, Lo, Cm
563	Ghana (Republic of Ghana) Accession: 22/02/1988	Central Region	Muni-Pomadze Ramsar Site	Cm
564	Ghana (Republic of Ghana)	Greater Accra Region	Densu Delta Ramsar Site	Lo, Dc, Cm
565	Ghana (Republic of Ghana)	Greater Accra Region	Sakumo Ramsar Site	Dc, Lo, Cm
566	Ghana (Republic of Ghana)	Greater Accra Region	Songor Ramsar Site	Lo, Cm, Dc
567	Ghana (Republic of Ghana)	Volta Region	Keta Lagoon Complex Ramsar Site	Dc, Lo, Cm
1722	Togo (Togolese Republic) Accession: 04/07/1995	Région maritime	Zones Humides du Littoral	Dc Lo, Cm
1017	Benin (Republic of Benin) Accession: 24/01/2000	Départements de l'Atlantique, du Mono, du Couffo et de Zou	Basse Vallée du Couffo, Lagune Côtiere, Chenal Aho, Lac Ahémé	Cm, Lo, Ei, Dc
1018	Benin (Republic of Benin)	Départements du littoral, de l'Atlantique, d'Ouémé, du Plateau de de Zou	Basse Vallée de l'Ouémé, Lagune de Porto-Novo, Lac Nokoué	Cm, Lo, Ei, Dc

1310	Equatorial Guinea (Republic of Equatorial Guinea) Accession: 02/06/2003	Bata-Litoral	Río Ntem o Campo	Cm, Lo
1311	Equatorial Guinea (Republic of Equatorial Guinea)	Bata-Litoral	Reserva Natural del Estuario del Muni	Cm, Lo
351	Gabon (Gabonese Republic) Signature: 30/12/1986	Estuaire / Moyen Ogooué / Ogooué Maritime provinces	Wonga-Wongué	Dc
352	Gabon (Gabonese Republic)	Ogooué-Maritime Provinces	Petit Loango	Dc, Cm, Ei
353	Gabon (Gabonese Republic)	Ogooué-Maritime Provinces	Setté Cama	Dc, Cm, Ei
1652	Gabon (Gabonese Republic)	Estuaire province	Parc National Akanda	Ei? Cm? Dc? Lo ?
1653	Gabon (Gabonese Republic)	Estuaire province	Parc National Pongara	Dc, Cm, Ei, Lo

Table VII. Inventory of West African sites

Site number	Contracting Parties	Administrative region	Site name	Species present
250	Mauritania (Islamic Republic of Mauritania) Accession: 22/10/1982	Wilayat Dakhlet Nouadhibou	Banc d'Arguin National Park	Cm, Cc
666	Mauritania (Islamic Republic of Mauritania)	Wilayat Al Trarza	Diawling National Park	Cm, Cc
1044	Mauritania (Islamic Republic of Mauritania)	Keur-Masséne, Wilayat Al Trarza	Chat Tboul	Cm, Cc
288	Senegal (Republic of Senegal) Accession: 11/07/1977	Kaolack and Fatick regions	Saloum Delta National Park	Cm
2326	Senegal (Republic of Senegal)	Ziguinchor Basse-Casamance region	Kalissaye	Cm
2327	Senegal (Republic of Senegal)	Kaolack and Fatick regions	Somone Nature Reserve Community Interest	Cm
2328	Senegal (Republic of Senegal)	Fatick region	Community Nature Reserve of Palmarin (RNCP)	Dc, Cm
1575	Cape Verde (Republic of Cape Verde) Accession: 18/07/2005	Isla de Boa Vista	Curral Velho	Cc
1576	Cape Verde (Republic of Cape Verde)	Isla de Boa Vista	Lagoa de Rabil	Cc
1577	Cape Verde (Republic of Cape Verde)	Isla de Santiago	Lagoa de Pedra Badejo	Cc

2182	Cape Verde (Republic of Cape Verde)	Isla de Maio	Salinas of the English Port (Salinas de Porto Inglês)	Cc
1657	Gambia (République of the Gambia) Ratification: 16/09/1996	West Coast Division: Brikama, Kanifing District, Greater Banjul Division: Banjul	Tanbi Wetlands Complex	Cm
1840	Gambia (République of the Gambia)	Lower Niumi District, North Bank Region	Niumi National Park	Cm
2198	Guinea-Bissau (Republic of Guinea-Bissau) Accession: 14/05/1990	Bolama Region	Archipel Bolama-Bijagós	Cm, Dc, Lo, Cc, Ei
572	Guinea (Republic of Guinea) Accession: 18/11/1992	Districts des îles Tristao, prefecture de Boké	Iles Tristao	Cm, Lo, Ei
618	Guinea (Republic of Guinea)	Los Islands	Ile Blanche	Ei

Notes:

The Algerian Basin is considered as a critical feeding habitat for *Caretta caretta* (immature and adult) and *D. coriacea* populations throughout the Mediterranean (Clusa *et al.*, 2014; Casale *et al.*, 2003).

The main nesting beach for Green turtles along the entire Egyptian Mediterranean coast is a 22 km stretch of sandy coastline west of the city of El Arish. Small populations of Loggerhead and Green turtles nesting in the northern Sinai Peninsula are under intense pressure from human activities (Clarke *et al.*, 2000).

In the Red Sea, 25 km off the coast of Sudan, Sanganeb Marine National Park and Dungonab Bay Marine National Park (Ramsar site # 1859) include Sanganeb, an isolated coral reef structure, and Mukkawar Island (Mesgarsam). *Chelonia mydas* and *Eretmochelys imbricata* have feeding habitats here. There are also nesting sites for these species and for *Caretta caretta*. The beach on the eastern shore of Mukkawar Island is one of the most important nesting sites in the entire Red Sea region, the importance of which was only relatively recently recognized during a monitoring in 2001 (Rees *et al.*, 2019).

In Mauritania, a concentration of *C. mydas* nests can be noted between the capital Nouakchott and the Ramsar site (# 1044) of Chatt Boul, with the number of nests then decreasing all along the coastline of Diawling National Park (site # 666) (Hama *et al.*, 2018).
The entire coastal marine area of Imraguen country, between the village of Lemcid and the north of the Banc d'Arguin National Park (site # 250) includes seagrass beds where not only resident adult and immature *C. mydas* congregate, but also adult individuals from the important Bissau-Guinean nesting site of Poilão Island in the Bijagos Archipelago (Godley *et al.*, 2003), and certainly other Atlantic origins.

C. caretta nests, in small numbers, have been observed at various points along the Mauritanian coastline (Arvy *et al*., 2000; Hama *et al*., 2018), both within and outside the three Ramsar sites. The distribution of *C. mydas* nests is somewhat different, spreading from Mouily in the south (on the coastal fringe of Diawling National Park) to about 20 km north of Nouakchott (18°16'30.78 "N, 16°02'11.94"W). Between August and October 2014, a total of 127 nesting events of *C. mydas* were recorded, with a concentration between 28 and 65 km south of Nouakchott (Hama *et al*., 2018).

Photo 48. Mauritanian beach near Jreif
(© J. Fretey)

Photo 49. North of Nouakchott (18°17'24.30 "N, 16°02'20.58" W), one of the most northerly *C. mydas* nests known in the southeast Atlantic, with 95 eggs
(© J. Fretey)

Photo 50. Loggerhead having nest in the bay of Tânit in Mauritania
(© C. Arvy)

The Ramsar record of the Senegalese site of Palmarin (n°2328) indicates the presence of *Chelonia mydas*. Without wishing to contest the presence of Green turtles all along the coast of this region, especially immatures, we wish to specify that the beach of Palmarin and its surroundings sporadically host nests of *D. coriacea* (Maigret, 1977; Fretey, 1991).

The data sheet for the Saloum Delta (Ramsar site # 288) as a UNESCO World Heritage Site indicates the presence of six species of marine turtles in these waters, including *Lepidochelys kempii*. To indicate this more northern species is for us an error. This record states that four species are nesting. Cadenat (1949) reports nests of *D. coriacea* on the tip of Sangomar. Maigret (1983) writes that *C. mydas* is abundant in the channels of the Saloum Delta and that eggs, supposedly of *C. mydas*, have been observed at the entrance to the Saloum *bolon*. T. Diagne (pers. comm. *in* Fretey, 2001) notes the presence of 15 nests of *C. mydas* on the beach of Fandiong and of egg-laying of the same species on Ile aux Oiseaux.

The entire Cape Verde archipelago hosts about 95% of the *Caretta caretta* breeding stock in the entire eastern Atlantic, with a concentration of 80-85% of nests (about 10,000 nests per season) on approximately 50 km of beaches on Boavista Island (Marco *et al.* 2010). Some adult individuals from the Cape Verde archipelago migrate to shallow water feeding areas off the coasts of Guinea-Bissau, Senegal, and Mauritania, while immatures remain in pelagic habitats instead (Varo-Cruz *et al.* 2013).

Most adult females nesting in the Cape Verde archipelago feed in jellyfish-rich pelagic habitats between Cape Verde and the African continental shelf, with others of larger size migrating to feeding habitats in the Gulf of Guinea where turtles have a more diverse diet (Eder *et al.*, 2012).

Photo 51. Nesting habitat of *C. caretta* at Praia Curral Velho, on the island of Boavista, Cape Verde Archipelago (© J. Fretey)

The Bolama-Bijagós archipelago (# 2198), in Guinea-Bissau, recognized as a UNESCO Biosphere Reserve since 1996, with its 88 islands and islets, is a remarkable Atlantic *hotspot* for marine turtles.

The small island of Poilão (10°52′N/15°43′W), with an area of 0.43 km^2, is part of the "Parque Nacional Marinho João Vieira e Poilão". It is the major nesting site of *Chelonia mydas* in West Africa and one of the largest in the entire Atlantic. In 2000, a season-long track survey was conducted to assess the extent of nesting, and it was estimated that the number of nests excavated annually is between 7,000 and 29,000 (Catry *et al.*, 2002; Catry *et al.*, 2009). This Poilão Island breeding population is genetically different from all other Atlantic rookeries. Two aggregations of juveniles from the Poilão site are known locally in the Guinea-Bissau archipelago: in the Unhocomo and Unhocomozinho islands located some 100 km from the hotspot, and towards Varela beach 200 km to the northeast (Patricio *et al.*, 2017).

Genetic analyses suggest that most juveniles from the beaches of the Bijagos Archipelago disperse to the Brazilian coast or along Senegal, the Cape Verde Archipelago and Mauritania (Monzón Argüello *et al.*, 2010). They also showed that the growing areas around the Cape Verde Islands also hosted juvenile Green turtles from the Caribbean. Ongoing genetic studies on juvenile *C. mydas* killed on the Mauritanian coastline will undoubtedly reach the same conclusions.

Photo 52. Female Loggerhead slaughtered during oviposition in the 2000 season on Praia Canto, Boavista Island, Cape Verde Archipelago
(© J. Fretey)

The Bijagos archipelago also presents excellent nesting habitats for *E. imbricata*, especially in the Orango Group, with an average of 550 nests per year, and *L. olivacea* with more than 600 nests (Catry *et al.*, 2010). This exceptional island group has an exemplary management of its biodiversity that could serve as an example to neighboring countries.

Photo 53. Mating of Green turtles in shallow water near Poilão Island
(© C. Barbosa)

Photo 54. Female Green turtles close oviposition of on Poilão Island.
Note the eggs unearthed during digging on a previous nest
(© C. Barbosa)

Photo 55. Entrapment of female Green turtles on the island of Poilão in the puddles of the beach-rocks. Voluntary or involuntary basking?
(© C. Barbosa)

The Ramsar record of the Ile Blanche (# 618), in Guinea, indicates: "*The last substantial refuge in Guinea for Lepidochelys olivacea, which reproduces here.* "There is no evidence of nesting of *L. olivacea* in the islands of Loos (formerly the islands of Kaloum) and a single uppershell found by one of us, in front of a hut, proves the only presence of the species around these islands. The White Island extends on approximately one kilometre and ends by the islet Cabri, submerged at high tide. To our knowledge, only *E. imbricata* nests sporadically on this double island whose substrate is too coarse and the space insufficient for the other species.

More interesting seems to be the Tristao archipelago (site # 572), at the northern border with Guinea-Bissau. The long 20 km beach of Katrack Island hosts nesting of *C. mydas*, *E. imbricata* and *L. olivacea* according to a still quantitatively unknown attendance (Fretey *et al.*, 2015). The numerous catches of juvenile, subadult and adult Green turtles at sea by artisanal fishermen suggest the existence around the islands of nursery and feeding habitats.

In Sierra Leone, the mainland area bounded by Lumley Beach in the north and Baw-Baw Beach in the south appears to have developing habitats for *Chelonia mydas*, *Eretmochelys imbricata* and *Caretta caretta* (Aruna, 2001). *D. coriacea* nest for about 105 km from Turners Peninsula to Sulima, and in greater numbers on Sherbro Island. The eight Turtle Islands, in the Southern Province, are nesting habitats for *C. mydas* and *L. olivacea*, although their importance is unknown (Fretey & Malaussena, 1991).

Photo 56. Importance of *E. imbricata* nesting on Ile Blanche - Islet Cabri (# 618) is unknown until now because of a lack of seasonal monitoring
(© J. Fretey)

Photo 57. Departure of a Green turtle hatchling from its developmental habitat on Katrack Island, in the Guinean Tristao Archipelago
(© J. Fretey)

In Côte d'Ivoire, in the region of site # 1581, three species nest and not two as indicated in the Ramsar information sheet. They are: *D. coriacea*, *C. mydas* and *L. olivacea*. Many turtles are caught at sea and on land for meat consumption and the use of fat in traditional pharmacopoeia (mouth ulcers, rheumatism, etc.) (Fretey, 2001; Gómez Peñate *et al.*, 2007). The area of highest nesting density extends along 90 km of coastline from Taki (4°42'N, 6°43'W) to Bliéron, with three important nesting beaches: Mani (4°32'N, 7°01'W), Pitiké (4°31'N, 7°10'W) and Soublaké (4°22'N, 7°27'W) (Gómez Peñate *et al.*, 2007).

Photo 58. Dodo beach, east of Abidjan, Côte d'Ivoire
(© J. Fretey)

The short coasts of Togo and Benin have three Ramsar sites (# 1722, # 1017, # 1018) whose marine waters are frequented by four species: *C. mydas*, *E. imbricata*, *L. olivacea* and *D. coriacea*. Of the four species present in this region, only *L. olivacea* and *D. coriacea* nest on the beaches. However, juvenile *C. mydas* and *E. imbricata* are present in coastal development habitats in both countries (Ségniagbeto *et al.*, 2013).

The beaches south of Bioko Island are considered as the second most important rookery for *C. mydas in* Atlantic Africa (Tomás *et al.*, 1999). It is estimated that more than 1,680 females may nest in this area. On these same beaches, about 250 *D. coriacea*, about 20 *L. olivacea* and up to 10 *E. imbricata* also lay eggs per season (Tomás *et al.*, 2010).

In Cameroon, the estuary region of the Nyong and Sanaga Rivers, within the Douala-Edea National Park, has significant nesting concentrations of *L. olivacea* (Fretey *et al.*, 2020). The sporadic capture of juvenile *L. olivacea* by artisanal fishermen suggests that there is a development habitat in these muddy estuarine environments.

The average number of Hawksbill nests per year in Príncipe (Ponta Marmita, Sundy, Mocotó, Ribeira Izé, Bom-Bom, Santa Rita, Banana, Macaco, Boi, Grande, Grande do Infante, Sêca, Rio São Tomé) is estimated to 175. These are important feeding habitats of the species for juveniles, subadults and adults of both sexes around Príncipe (Dontaine and Neves *in:* Fretey, 2001). This population is relatively isolated genetically (Monzón-Argüello *et al.*, 2011).

Little is not known of the development habitats for *D. coriacea*. In March 1999, four juvenile Leatherbacks of 17 to 21 cm in carapace length were caught southeast of Príncipe, in the vicinity of the islet Boné de Jóquei (Fretey *et al.*, 1999). The existence of an exceptional developmental habitat for the Leatherback in this region of the Gulf of Guinea remains to be confirmed.

C. mydas lays on the main island of São Tomé on 26 beaches from north to south on the eastern side. *L. olivacea* frequents 22 beaches in the northeast of the island, with a concentration between the beaches of Tamarindos and Micoló. Immatures of both species are observed and suggest nursery habitats (Fretey, 2001; Fretey *et al.*, 2001). A total of 460 nests of L. *olivacea* were recorded for the 2012-2013 and 2013-2014 seasons (Hancock *et al.*, 2015). Breeding is observed off the coast (Fretey *et al.*, 2001). Praia Grande beach, northeast of Príncipe Island, hosted 219 *C. mydas* nests during the 2007-2008 season and 315 in 2009-2010 (Loureiro *et al.,* 2011).

Hancock *et al.* (2018)'s study of three Santomean feeding and developmental habitats of Green turtle, Ilhéu das Cabras (0° 21.802' N, 6° 45.402'E), Praia Cabana (0° 1.310' N, 6° 31.407'E) and Ponta Santo António (0° 0.408' N, 6° 31.622'E), with depths between 4 and 15 m, show that São Tomé may host, on a regional scale, both omnivorous juveniles (34-45 cm) likely to arrive from an oceanic stage and large immatures (53-87 cm) almost completely herbivorous and resident.

Photo 59. Praia Inhame, São Tomé
(© J. Fretey)

In Gabon, the long beach of about 120 km beginning at the town of Mayumba and extending into Congo at Conkouati-Douli (# 1741) is one of the major nesting sites of *D. coriacea* in the world and was discovered to be so by one of us (Fretey, 1984; Fretey & Girardin, 1988). Extrapolations from field monitoring have estimated the number of nests deposited on the Gabonese coastline from Mayumba to the border to be between 30 and 50,000 nests (Billes *et al.*, 2003; Fretey *et al.,* 2007). For the 2006-2007 season, Formia (2007) noted 13,744 emergences by Leatherbacks. With the current reduction in nesting activity in the Guianas and despite a decline in Gabon, the Mayumba area is still of high importance for the global breeding of the species.

Further north in the country, the 17.3 km stretch from Point Denis to the entire Pongara National Park (# 1653) hosted 7,861 nests during the 2006-2007 season (Formia, 2007).

Photo 60. In the foreground, the nesting area of a Leatherback, on the long Gabonese beach of Mayumba
(© J. Fretey)

Photo 61. Female *D. coriacea* at the end of the oviposition at daybreak on the long beach of Mayumba
(© A. Billes)

Photo 62. Emerging hatchling *D. coriacea* from embryonic developmental habitat at Setté-Cama Beach into frenzy habitat
(© A. Billes)

We lack information for Mondah Bay (# 1652). The Ramsar record lists the four species *C. mydas*, *D. coriacea*, *L. olivacea* and *E. imbricata*, but Christy *et al.* (2008) do not report any marine turtles in the National Park. We can assume that Hawksbill and Green turtles frequent Mondah Bay permanently or sporadically because Benga fishermen catch both species in this area.

Photo 63. At Cape Esterias (Gabon), live Green turtles captured in the feeding habitat of Corisco Bay by Benga fishermen are held in a dry pirogue
(© J. Fretey)

Photo 64. Okoumé logs washed up on beaches are death traps for female Leatherbacks. Here on Pongara beach, even though it is a Ramsar site
(© A. Billes)

The breeding stock of *C. mydas* on the British island of Ascension (7°57'S/14°22'W) is the second largest in the entire Atlantic Ocean after Tortuguero (Costa Rica). This island of 97 km^2 in the middle of the South Atlantic is 1,535 km from Liberia in the north and 1,304 km from St. Helena in the south. Out of a total of 32 beaches, 45 to 55% of the nesting is concentrated in three sites: Long Beach, Southwest Bay, and Northeast Bay. In the 1976/77 and 1977/78 nesting seasons, Mortimer & Carr (1987) estimated the number of nests at 7,910 - 10,764 and 5,257 - 7,154 respectively. For the 1998/1999 and 1999/2000 seasons they were estimated at 13,882 and 13,053 nests (Godley *et al.*, 2001). It should be noted that large aggregations of adults of both sexes are observed off these three beaches, especially from November to March for mating.

C. mydas nesting on this island at the end of June and some females then migrate 2,200 km to feeding areas in Brazilian waters in 33 to 47 days (Mortimer & Carr, 1987; Luschi *et al.*, 1996, 1999) and apparently also 40% to the seagrass beds of Corisco Bay (Bolker *et al.*, 2007).

Post-pelagic juvenile and adult *E. imbricata* (33.5 to 85 cm) appear to be present year-round in feeding habitats along the 65 km of Ascension Island coastline. These turtles are thought to be over 85% native to nesting sites in the western Atlantic, particularly northeastern Brazil (Weber *et al.*, 2014).

Proposed actions by experts J. Fretey and P. Triplet

In Mauritania, an inventory of Green turtles and immature feeding areas north of Nouakchott, on seagrass or rocky areas up to the north of Ramsar site # 1044, seems absolutely necessary in order to consider a better protection of these habitats and turtles. A management plan will then have to be prepared in order to better conserve these feeding habitats of regional and Atlantic interest.

The existence of the two Ramsar sites # 1044 and # 666, which are biogeographically important for Atlantic nesting of *Chelonia mydas*, unfortunately did not prevent the recent construction of a port, without a prior impact assessment study regarding marine turtle nesting. To compensate for this environmental degradation, we advocate an extension of site 666 northward to include the known concentration area (Hama *et al.*, 2018) of nesting and the implementation of a management plan taking into account the conservation of marine turtles according to the recommendations made by the CMS Abidjan Memorandum signed by the Islamic Republic of Mauritania on 29 May 1999.

In Senegal, a management plan for marine turtle habitats for the entire Saloum Delta (# 288) seems necessary.

In Guinea, the capture at sea and on land of immature and adult turtles, as well as the poaching of all nests, despite the classification of the Tristao Islands as a marine protected area, make it imperative to draft and implement an action plan for marine turtles and their habitats. The current management plan for the Tristao and Alcatraz Islands Nature Reserve should be merged with a Ramsar management plan in order to take into account the terrestrial and marine habitats of marine turtles.

Turtle and Sherbro Island, Sierra Leone, would benefit from more in-depth research on their nesting use, potentially leading to a ranking.

Photo 65. *C. mydas* nest body pits on Sherbro Island, Sierra Leone
(© J.-P. Malaussena / J. Fretey)

As in a number of Ramsar sites in Africa, it is necessary that the management plan for the Ivorian site # 1581 takes into account traditional village uses and finds sustainable solutions with these communities. Other coastal habitats for marine turtles should be considered in this country.

We note the absence of coastal Ramsar sites between Côte d'Ivoire and Equatorial Guinea. We formulate hereafter some possible classifications related to marine turtle habitats.

Some of the developmental habitats of *C. mydas* and *E. imbricata* in Togo and Benin, in very shallow waters, could certainly be classified.

In addition to the fact that Cameroon has some regular nesting habitats of *L. olivacea* (a species whose populations are declining in the Atlantic Ocean), *C. mydas* and *D. coriacea* in the Douala-Edea National Park and south of the city of Kribi to the Equatorial Guinea border (Angoni *et al*, 2010; Fretey *et al.*, 2020), this region presents habitats for the growth of young individuals of the species *C. mydas* and *E. imbricata* likely originating from the island beaches of southern Bioko and Sao Tome and Principe. Green turtles nesting on Bioko migrate to seagrass beds around Mbanye Island in Corisco Bay (Gabon), southern Cameroon and Ada Seas, Kengen and Lekpongounor beach (Ghana) (Tomás *et al.*, 2001), all of which are critical habitats to conserve.

In Cameroon, this Douala-Edea National Park and the future Manyange na Elombo Campo National Marine Park, also rich in African manatees, deserve a Ramsar designation. It seems essential to us to create a large transboundary Ramsar site that would include the existing Equatorial Guinean site of Río Ntem o Campo (# 1310) and the Cameroonian National Marine Park of Manyange na Elombo Campo and the island of Bioko. We believe that the beaches of Bioko, a hotspot in the Gulf of Guinea for the nesting of *C. mydas*, should be recognized as such by the Ramsar Convention.

Photo 66. Cameroonian nesting habitat of *L. olivacea*, at Bekolobe, within the Marine National Park of Manyange na Elombo Campo
(© J. Fretey)

Photo 67. *L. olivacea* in oviposition on Likodo beach, Cameroon
(© J. Fretey)

The Democratic Republic of São Tome and Príncipe, holding various remarkable habitats of nesting and developmental of several species, would be wise to propose the Ramsar designation of several sites.

It would be desirable that, in addition to site # 1311, Equatorial Guinea and Gabon join together to design transboundary and protect the nesting habitats and feeding areas of *C. mydas* throughout Corisco Bay (Fretey, 2001).

The Conkouati-Douli National Park was created in 1999 and the Mayumba National Park in 2002. The two parks form a transboundary protected area covering about 2,000 km^2 of forests, floodplains, rivers and lagoons.

Note the absence of coastal Ramsar sites in Angola. In this country, we consider the beach of Palmeirinhas, south of Luanda, with a seasonal average of 32 nests/km of *L. olivacea* (Weir *et al.*, 2007) as an important site.

This entire region of Central Africa already has nine Ramsar sites. Ramsar classification of Corisco Bay and the lagoons and beaches of Mayumba would provide a remarkable set of outstanding habitats of international interest, from the Rio Muni to Angola through four states.

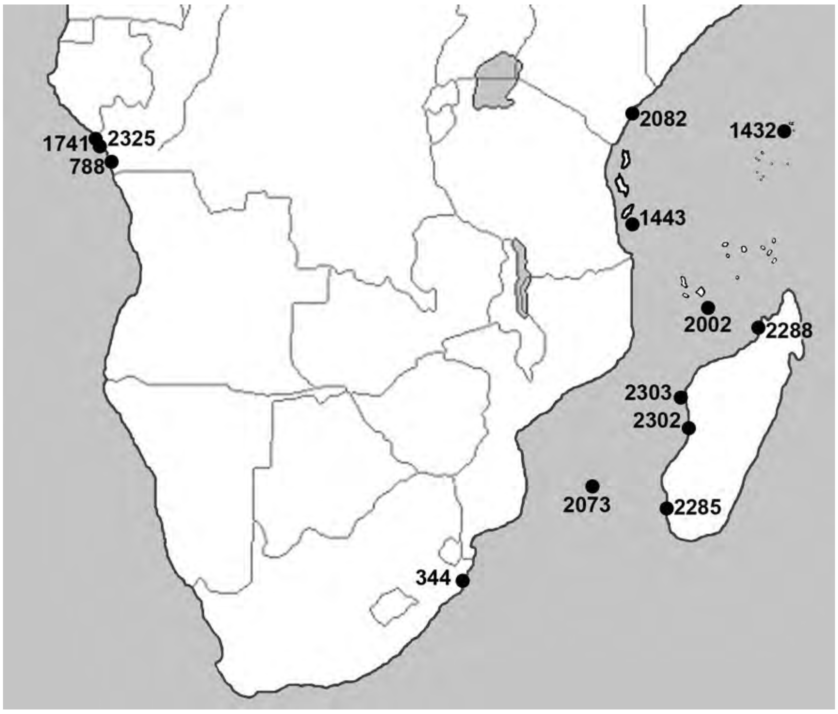
Nearly 20 years after a global assessment of the status of the species throughout the coastline and islands of Atlantic Africa (Fretey *et al.*, 2000; Fretey, 2001), it is still premature to make an estimate of the breeding flocks of *E. imbricata*, and it can be assumed that the number is higher than currently imagined. Monzón-Argüello *et al.* (2011) estimate the number of females

currently nesting there at 100, and they state that the largest breeding stock is linked, in the Gulf of Guinea, to the islands of Príncipe and São Tome with the equivalent of some 175 nests per season. These authors seem to have been unaware of the nests estimated by Catry *et al*. (2009; 2010) in the Bijagos Archipelago (Guinea Bissau), particularly on Poilão Island and in the Orango Group. Spotila (2004) states that 200 females nest in this area. The Bijagos archipelago includes 88 islands and islets, and monitoring of egg laying is carried out in very few sites. One of us (Jacques Fretey) discovered a nest of *E. imbricata* with Castro Barbosa of the Instituto da Biodiversidade e das Áreas Protegidas (IBAP) on the small islet Salum-Porcos, northeast of Roxa Island, where egg-laying of the species had never been noted (Fretey, 2012). South of this archipelago, the Hawksbill turtle nests with certainty but unquantified on Katrack Island in the Tristao Archipelago, Guinea (Fretey *et al*., 2015).

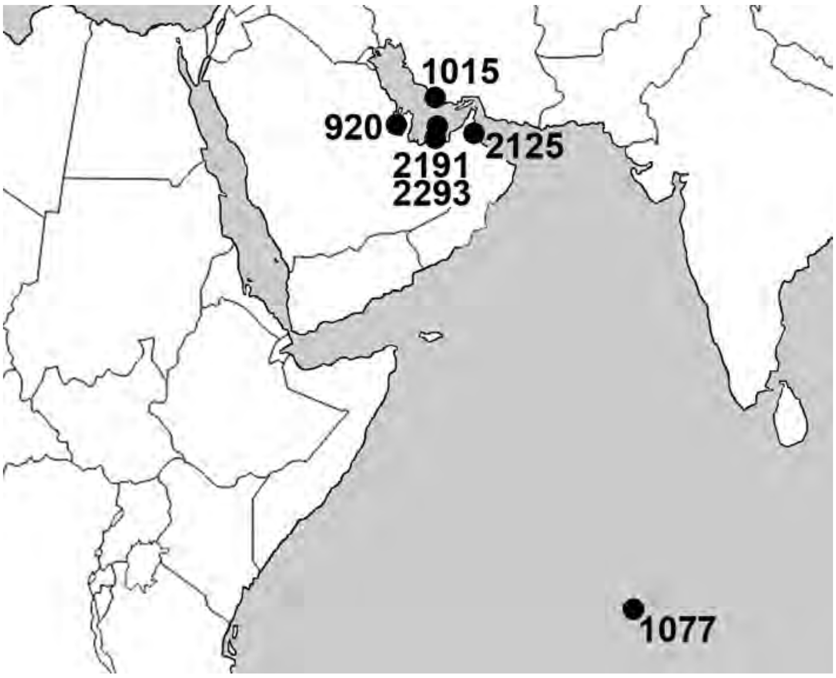
It is imperative that the West African sites hosting the nests of this critically endangered species be classified.

REGION 6

Southern region of Central Africa, Indian Ocean and Arabian Sea.



Map 8. Location of Ramsar sites in the western Indian Ocean.



Map 9. Location of Ramsar sites in the Arabian and Red Seas.

Table VIII. Inventory of sites in the western Indian Ocean, Arabian Sea and Red Sea

Site number	Contracting Parties	Administrative region	Site name	Species present
1741	Congo (Republic of Congo) Accession: 18/06/1998	Kouilou department	Conkouati-Douli	Dc, Cm, Lo
2325	Congo (Republic of Congo)	Kouilou department	Bas-Kouilou-Yombo	Dc, Lo
788	Democratic Republic of the Congo Accession: 18/01/1996	Bas Zaïre	Parc marin des Mangroves	Lo
2082	Kenya Accession: 05/06/1990	Coast Province, Tana Delta and Lamu Districts	Tana River Delta	Ei, Cm, Lo, Cc, Dc
1443	Tanzania (United Republic of Tanzania) Accession: 13/04/2000	Coast Region, Lindi Region	Rufiji-Mafia-Kilwa Marine Ramsar Site	Ei, Cm, Dc, Cc, Lo
344	South Africa (Republic of South Africa - RSA) Signature: 12/03/1975	Kwazulu Natal	Turtle Beaches – Coral Reefs of Tongaland	Cc, Dc
1432	Seychelles (Republic of Seychelles) Accession: 22/11/2004	Port Glaud District	Port Launay Coastal Wetlands	Ei
1887	Seychelles (Republic of Seychelles)	Aldabra Group	Aldabra Atoll	Ei, Cm
2002	France (French Republic)	Mayotte department	Vasière des Badamiers	Ei, Cm
2073	France (French Republic)	French Southern and Antarctic Lands	Ile Europa	Cm, Ei
2285	Madagascar (Republic of Madagascar) Accession: 25/09/1998	Région de Atsimo-Andrefana Districts de Toliary II et d'Ampanihy	Barrière de Corail Nosy Ve-Androka	Ei, Cm
2288	Madagascar (Republic of Madagascar)	Atsimo-Andrefana region, Toliary II and Ampanihy districts	Zones Humides de Sahamalaza	Ei, Cm
2302	Madagascar (Republic of Madagascar)	Region of Menabe, District of Belo on Tsiribihina	Mangroves de Tsiribihina	Ei, Cm
2303	Madagascar (Republic of Madagascar)	Melaky region, Maintirano and Antsalova districts	Iles Barren	Dc, Cc, Ei, Cm, Lo
1744	Mauritius (Republic of Mauritius) Ratification: 30/05/2001	Grand Port District	Blue Bay Marine Park	Cm
1077	United Kingdom of Great Britain and Northern Ireland	British Indian Ocean Territory	Diego Garcia	Ei, Cm
1859	Sudan (Republic of the Sudan)	Red Sea State	Dongonab Bay-Marsa Waiai	Cm, Ei
1860	Sudan (Republic of the Sudan)	Red Sea State	Suakin-Gulf of Agig	Ei, Cm
1015	Iran (Islamic Republic of Iran) Ratification: 23/06/1975	Hormozgan Province, Central Persian Gulf	Sheedvar Island (ou Shidvar Island)	Ei, Cm

920	Bahrain (Kingdom of Bahrain) Accession: 27/10/1997	Gulf of Bahrain	Hawar Islands	Cc, Cm, Ei, Dc
2191	United Arab Emirates Accession: 29/08/2007	Sharjah Emirate	Sir Bu Nair Island Protected Area	Ei, Cm
2125	United Arab Emirates	Sharjah Emirate	Mangroves and Alhafeya Protected Area in Khor Kalba	Ei, Cm
2293	United Arab Emirates	Abu Dhabi Emirate	Bul Syayeef	Ei, Cm

Notes:

About 60 km north of Congo, Conkouati-Douli National Park (# 1741), which extends the long beach of Mayumba, is an exceptional nesting habitat for *Dermochelys coriacea* (Fretey & Girardin, 1988). During the 2005-2006 season, a total of 402 Leatherback nests and 302 Olive Ridley nests were counted on only 37 of beach (Bitsindou, 2006).

Within this protected area, Kondi Bay appears to provide valuable developmental habitat of regional interest for *Chelonia mydas* (juveniles and subadults) and *Eretmochelys imbricata* (29.0-32.7 cm in length) (Mianseko *et al.*, 2020).

South of the park, the beaches of Belleto (10 km long), Tchissaou (10 km), Bas-Kouilou Sud (8.9 km), Mvassa (10 km), Djeno at the Cabinda border (14.5 km) hosted 479 nests of *Lepidochelys olivacea* and 421 nests of *D. coriacea* during the 2004-2005 season, and 439 nests of *L. olivacea* and 497 nests of *D. coriacea* during the 2005-2006 season (Godgenger *et al.*, 2009).

Photo 68. Erosion of part of the nesting beach in Conkouati-Douli National Park, Congo
(© J. Fretey)

On the Indian side of South Africa, the Maputaland region is located in the northern part of the province of KwaZulu-Natal, which includes the south of present-day Mozambique. The South African part, in the political sense, of Maputaland is known to marine turtle specialists through the important publications of George Hughes as Tongaland. Nesting frequency is relatively low. However, it is here that in the late 1960s - early 1970s the pioneering studies on Loggerhead and Leatherback turtles were conducted. Hughes (1974) reported 217 (1968-1969) to 502 nests (1971-1972) for *Caretta caretta*, and five (1966-1967) to 55 (1971-1972) for *D. coriacea*. He also indicated that the breeding habitat for Loggerheads as located off Tongaland about 1-2 km offshore in 15-20 m of water. A developmental habitat for *C. mydas* is cited at Bhanga Nek.

Photo 69. View of the extensive nesting habitat of *C. caretta* and *D. coriacea* south of Mabibi on the Maputaland coast (© G. Hughes)

Photo 70. Bhanga Nek beach, Tongaland
(© G. Hughes)

Photo 71. Female *C. caretta* ovipositing on one of the Tongaland long beaches
(© J. Fretey)

In Mozambique, the coastal part from the Rovuma River in the north to Pebane in the south (17° 20'S) over 770 km, includes nesting and feeding habitats for *Chelonia mydas* and *Eretmochelys imbricata*. The chain of coral islands (32 in the Quirimbas archipelago or Querimbes, classified as a national park, 5 Segundas islands, 5 islands of the Primeiras chain in the south) hosts nests of *L. olivacea*, *Chelonia mydas* and *Caretta caretta* (Costa *et al.*, 2007). The island of Vamizi hosts about 120 (78-157) *C. mydas* nests per season. This is the largest nesting colony in Mozambique (Garnier *et al.*, 2012; Louro & Fernandes, 2012). The coral reefs near this island are a developmental habitat for *E. imbricata*. Female Green turtles, after egg laying, migrate to feeding habitats in marine protected areas in Bazaruto Archipelago National Park (BANP) (Williams *et al.*, 2017), Kenya (Watamu National Park, Kiunga National Reserve), Tanzania (Rufiji/Mafia/Kilwa Marine Protected Area) and northwestern Madagascar (Garnier *et al.*, 2012). This is a good example of a regional network of protected habitats.

In the central part of Mozambique, over 950 km, in the islands of Pebane and Bazaruto, as well as on some coral reefs, nests of *C. mydas*, *E. imbricata* and *D. coriacea* are reported (Louro *et al.*, 2006). In the north, the nesting habitat of *C. mydas* on Vamizi Island was monitored for 12 years: 2,000 nests were counted there with an incubation success of 90% and a production of about 190,000 hatchlings (Nascimento Trindade, 2019).

For 850 km south of the Bazaruto archipelago to Ponta do Ouro extend extensive beaches edged at the back by very high dunes that prove to be an important nesting area for Loggerheads and Leatherbacks (Gove & Magane 1996; Magane & João 2003; Louro et al., *2006)*. During the 2016-2017 season, 931 Loggerhead nests and 64 Leatherback nests were counted in this area (Fernandes *et al.*, 2017).

The coastal waters of this region are also known to be excellent feeding habitats for *E. imbricata* (WWF, 2005).

Photo 72. Remarkable fidelity to its nesting habitat by this protected Green turtle named Mama Mayai for 17 years by the Maasai warriors, in Watamu Marine National Park, Kenya
(© Justin Beswick /Local Ocean Conservation)

Kenya fronts the Indian Ocean with 536 km of coastline including beaches, coral reefs, mangroves and seagrass beds rich in marine turtle habitats, including off the migration corridors. Only 8.7% of this coastline is classified as marine protected areas and the country has only one coastal Ramsar site (# 2082).

The Federal Republic of Somalia has 3,025 km of coastline. *C. mydas* and *E. imbricata* nesting is reported along Somaliland. The mainland nesting beaches were found between Raas Xaatib and Raas Cuuda (10° 39.80'N / 45° 90'70E; 10° 26.55'N / 45° 58.60'E). The largest rookery of the species in Somalia is believed to be on Juani Island, southeast of Mafia Island Marine Park (West, 2014).

Green turtles are said to feed on the grass beds west of Berbera, east of Raas Khansir and near Buyuni (Temeke District).

Photo 73. Turtle cleaning station for *E. imbricata* on Diani Reef, Kenya
(© Olive Ridley Project - Kenya)

Photo 74. Communication "dance" of two adult Green turtles in a coral habitat in Diani-Chale National Marine Reserve, Kenya
(© Olive Ridley Project - Kenya)

In Madagascar, *E. imbricata* nests in the Nosy Hara region (up to 500 nests per season), as well as at a lower level in the Redama, Barren (Nosy Abohazo, Nosy Andrano, Nosy Dondosy), Nosy Iranja Kely, and Beheloka-Besambay islands (Bourjea *et al.*, 2006; Metcalf *et al.*, 2007; Humber *et al.*, 2017).

Beyond the interest of Madagascar, many of the surrounding islands, up to the Seychelles in the north, present exceptional habitats for all stages of the life cycle of marine turtles.

In this region of the southwestern Indian Ocean, the Green turtle is the most common species, with a wide distribution; its nesting habitats are scattered on many small islands and along the coasts of East Africa and Madagascar (Frazier, 1975).

In this region, immature Green turtles frequent coral habitats (lagoons and reef drop-offs) like *E. imbricata*, but also mangroves.

In the Mozambique Channel, the island of Europa (no. 2073) has the largest regional breeding stock of *C. mydas*. This is estimated by Le Gall (1988) to be between 3,000 and 11,000 females annually and is increasing (Bourjea *et al.*, 2015). It would be desirable that a real Ramsar management plan be made for this exceptional site and that it would be provided with the human, logistical and financial means necessary for a global monitoring of nests on the whole island, which has never been the case.

Photo 75. Aerial view of the island of Europa
(© R. Kerjouan)

Photo 76. Diurnal scanning phase of a Green turtle in the Indian Ocean hotspot on Europa Island
(© B. Marie)

Photo 77. Emergence of Green turtle hatchlings on Europa Island
(© B. Marie)

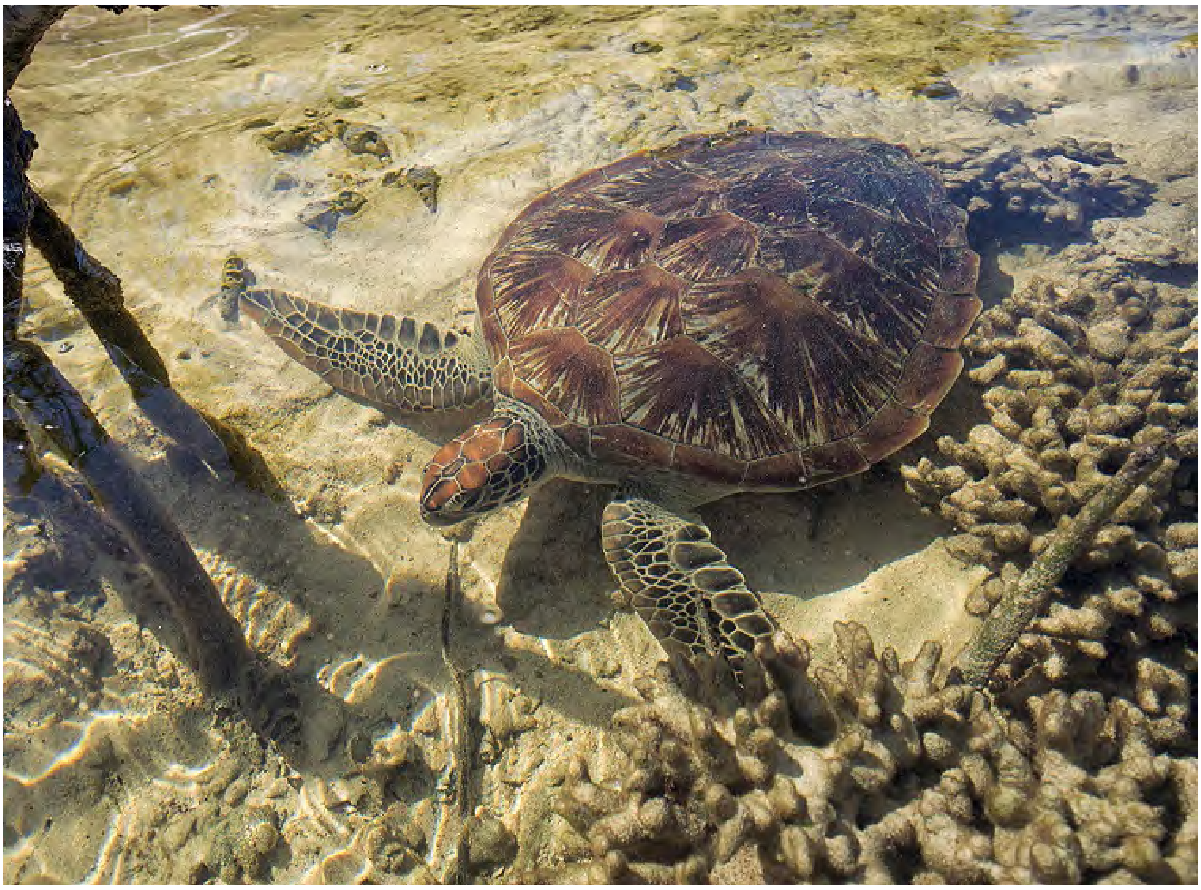


Photo 78. Developmental habitat of *C. mydas* in the mangrove of Europa Island
(© B. Marie)

The Glorieuses is a French archipelago composed of four islands, two of which (Grande Glorieuse and Le Lys) host *Chelonia mydas* and *Eretmochelys imbricata* nests. Extrapolation of monitoring on only 26% of the beaches to the entire island suggests that the rise of marine turtles on Grande Glorieuse is on the order of 1,500 to 2,500 females per year, with a large predominance of Green turtles and about 50 Hawksbill turtles per year (Frazier, 1975; Lauret-Stepler *et al.,* 2007; Bourjea *et al.*, 2015).

Photo 79. Overview of the nesting habitat on Grande Glorieuse
(© J. Fretey)

Photo 80. Nocturnal clutch of a Green turtle on Grande Glorieuse
(© J. Fretey)

The coral reefs of Europa, Glorieuses and Juan de Nova cover a total area of 493 km^2. The permanent presence of Hawksbills turtles of various ages on these flats suggests significant feeding and developmental habitats. The mangroves of the Eparses Islands, in particular the lagoon of Europa, are, moreover, regional developmental habitats for immature Green turtles of about 20 cm in length (Hughes, 1974), and also, with a lesser importance, for juvenile *E. imbricata*, except on Europa where they find abundant sea anemones (*Actinia* sp.) which they feed on (Bourjea *et al.*, 2006, 2007; Bourjea & Benhamo, 2008; Bourjea et *al.,* 2009).

Mating habitats are permanent around Europa, Tromelin and Grande Glorieuse islands. It is not uncommon for turtles to be washed ashore on the beaches of the Glorieuses by the waves. Around Europa, turtles mate on clear coral seabeds of 3 m (Hughes, 1974).

According to Mortimer *et al.* (2011), the Aldabra stock is estimated to be between 3,100 and 5,225 female *C. mydas*.

In Seychelles, there are 115 islands and atolls on a surface of 1,300,000 km^2, and the nesting sites of *E. imbricata* in this archipelago are among the most important in the world, in particular in the group of Seychelles Bank, Amirantes, Alphonse, Desroches, Coetivy and Platte islands. Only the egg-laying in some islands have been monitored since 1973: Cousin, Curieuse, Aride, Aldabra, Bird, etc. (Mortimer, 1984, 1998). It is estimated that 1,230 to 1,740 females nest each year in all these islands (Mortimer & Bresson, 1999). On seven beaches on Curieuse Island (Grand Anse, Anse Papaie, Baie Laraie, Anse Mandarin, Anse St. Jose, Anse Cimitier-Caiman, Anse Badamier), the annual average from 2010 to 2014 was only 186 nests. It is estimated that the Seychelles population of the tortoiseshell has lost 80% of its numbers in the last two centuries due to overexploitation (Mortimer & Donnelly, 2008). On Cousin Island, however, nesting activity has nearly quadrupled since 1972, and 807 nests were counted for the 2014-2015 season (Sanchez *et al.*, 2015).

A juvenile Hawksbill turtle identified on a feeding habitat in the Australian Cocos (Keeling) Atoll (12°11.528'E/96°54.910'S) was re-sighted 6,100 km away in a developmental habitat off the Lindi District in Tanzania (9°50'S/39°54'E) (Whiting *et al.*, 2010).

Frazier (1984) reports observations of numerous feeding habitats of *E. imbricata* in the archipelago, mainly in the Granitic Islands. He notes that the species is common in the shallow lagoon of Aldabra Atoll (site #1887).

In the southeast of Moheli (Mwali), one of the islands of the Federated State of the Union of the Comoros, 36 beaches host abundant *C. mydas* nesting. Around the village of Itsamia, 5 beaches (Itsamia, M'tsanga nyamba, Bwelamanga, Miangoni 1, Miangoni 2) are frequented each season by a number of females approaching 5,000 to 5,700 (Bourjea *et al.*, 2010, 2015), making it the largest population in the SWIO region after Europa.

In Mayotte, 53 beaches have been identified as hosting *E. imbricata* nests (Frazier, 1985; Fretey, 1997; Quillard, 2011) out of a total of 172 beaches hosting marine turtle nests. It seems that the beaches of Gouéla, Boudrouni, Charifou, Apondra and Mbouéanatsa are the most frequented by the species. Quillard (2011) estimates that about 100 females lay eggs each year on these beaches.

C. mydas is the most abundant to come and lay eggs in this French territory, and it is estimated that 1,545 ± 439 females come to nest each year, with the main sites being the beaches of Moya and Saziley (Fretey & Fourmy, 1997; Bourjea *et al.*, 2007).

A total of 11 species of Phanerogams have been recorded in Mayotte (Loricourt, 2005; Ballorain, 2010), and the majority of the seagrasses, less than 5 m deep, cover an area of 760 ha and are frequented by migratory or resident juvenile, subadult and adult Green turtles, except for the monospecific *Thalassodendron ciliatum* formations of the barrier reef. The seagrass of the bay of N'Gouja has an area of about 140 ha and is 1.4 km long. This seagrass is composed predominantly of *Cymodocae* sp., *Halodule* sp., *Syringodium isoetifolium*, with patches *of Halophila ovalis* and algae (*Dictyota* sp. and *Padina* sp.) (Taquet *et al.,* 2006). It is estimated that 150 km^2 of coral reefs in Mayotte with a total linear length of 353 km is inhabited by *C. mydas* and *E. imbricata*. Aerial surveys conducted since 2008 estimate that 2,000 turtles inhabit the lagoon of Mayotte, making this area a regional feeding hotspot for *C. mydas*.

Photo 81. Saziley beach, main nesting habitat of *C. mydas* in Mayotte
(© J. Fretey)

Photo 82. Adult Green turtle grazing on the grass bed in N'Gouja Bay, Mayotte. The very large Remora fixed on its carapace will probably be satisfied with blades of grass cut during this meal
(© K. Ballorain)

The island of Juan-de-Nova (Jean-de-Noves), 140 km from the Malagasy coast in the Mozambique Channel and located north of Europa, hosts 10 to 30 females *E. imbricata* each year, the most southern site for the species in the entire region (Lauret-Stepler *et al.*, 2010).
Located 436 km east of the coast of Madagascar, Tromelin Island, where *C. mydas* nesting has been monitored since 1987, hosts 1,430 ± 430 females each year (Le Gall, 1988; Lauret-Stepler *et al.*, 2010; Bourjea *et al.*, 2010).

In northwestern Madagascar, in the Iranja Archipelago, Bourjea *et al.* (2006) recorded 345 nests of *C. mydas* and 76 of *E. imbricata* on the small island of Nosy Iranja Kely.

The Southwest Indian Ocean (SWIO) populations could, according to Bourjea *et al.* (2015), be genetically divided into two stocks: one in the southern Mozambique Channel with two substocks at Europa and Juan de Nova, and a northern SWIO stock with a substock at the Seychelles (Farquhar group, Les Amirantes, Granitic group), and another with the more northern rookeries.

Chagos Archipelago, comprising seven atolls and 67 islands, is located between the Maldives to the north, the Seychelles to the west and the Mascarene Islands to the southeast. Mortimer *et al.* (2020) report a total of 6,308 *E. imbricata* nests and 20,487 *C. mydas* nests for the entire archipelago for the period 2011-2018. Diego Garcia lagoons (# 1077) play an important role as a regional feeding area for immatures and adults of *E. imbricata* and *C. mydas*. Adult individuals remain there for many years before migrating to nesting sites in various parts of the western Indian Ocean where they were born. Some may thus migrate 3,980 km to the coast of Somalia (Hays *et al.*, 2014; Esteban & Hays, 2017).

The most important nesting sites of *E. imbricata* in the Persian Gulf are located in three marine protected areas of the Islamic Republic of Iran. A fourth important site is Jana Island in Saudi Arabia with ~500 nests per year (Al-Merghani *et al.*, 2000). The estimated average nesting density is 131 nests/km in Nakhiloo Island, 76 nests/km in Ommolgorm, 7 nests/km in Kharko, and 15 nests/km in Naiband Marine-Coastal National Park (NMCNP) (Hesni *et al.*, 2019).

Despite their geographic proximity in the Persian Gulf, the two Hawksbill turtle nesting aggregations in Iran are genetically distinct, but not from the breeding stock in Saudi Arabia (Fitzsimmons & Limpus, 2014). Hawksbill turtle feeding habitats are known in coastal waters and coral reef-lined islands in the United Arab Emirates, Qatar, Bahrain, Kuwait, and Saudi Arabia (Pilcher *et al.*, 2014b).

In the Persian Gulf, Shidvar Island (Hormozgan Province) in the Islamic Republic of Iran, which is classified as a wildlife refuge, has two stretches of beach that are 1 and 2 km long. In 2006, 54 nests of *E. imbricata* were counted there (Zare *et al.*, 2012). Hendourabi, Nakhiloo, Ommolkaram, Queshm, Faror, Lavan, Khark, Kish, Tahmadon, Omolgorm, Larak, Hormuz and Hengam islands also present significant nesting beaches for *E. imbricata* in the Persian Gulf (Mobaraki, 2004; Nabavi *et al.*, 2012; Hensi *et al.*, 2016). Ross & Barwani (1981) estimate the number of *nesting* E. *imbricata* females in this region to be around 1,000.
Shidvar island, in the Islamic Republic of Iran, has been reported as one of the most important Hawksbill nesting sites in Iran and has been designated a wildlife refuge in 1971 (Davis 1994).

In the United Arab Emirates and Saudi Arabia, *E. imbricata* nests on the mainland and on several islands (Karan, Kurayn, Jana, Jurayd, Jarnain, Bu Tinah, Ghantoot, Sir Bu Nair, Quernain, Zirqu). The number of *C. mydas* females nesting on these islands is estimated to be 17.8% of the total island clutches, ranging from 450 to 1,100 per season (Miller, 1989; Pilcher, 1999). Sir Bu Nair Island (Sir Bu Na'air Island Protected Area, # 2191) has 21 beaches where *E. imbricata* nests, with a 59% preference for the north coast (Loughland, 1999). It is the most important nesting site in the Emirate Sharjah with a total of 376 *E. imbricata* nests in 2011. The 2.5 km^2 of coral reefs around this island are an important feeding area for *E. imbricata* and *C. mydas*. Nesting of the species has been noted in Saudi Arabia in the islands of Karan, Kurayn, Jana, Harqus, Arabiyah and Jurayd. This entire region and its marine biodiversity suffered from oil pollution during the Gulf War (Sadiq & McCain, 1993). In Qatar, 100-200 Hawksbills turtles come to nest annually in Fuwairit, Ras Laffan, and Halul islands (Pilcher *et al.*, 2014; Chatting *et al.*, 2018).
It is worth noting that the main nesting destination for Green turtles feeding at Bu Tinah in the UAE is Ras al Hadd in Oman (Pilcher *et al.*, 2021).

Oman main nesting beaches are Ras al Hadd, Ashkara, Ras Jibsh, Ras Madraka, Bandr Jisr, Dimanyat, Ras Zafarnat and Ras Ani. This state has only one Ramsar site, the mangrove of Qurm Nature Reserve (# 2144). In this inventory, if there is one major Ramsar site that is missing, it is Masirah Island (Wilāyat Maṣīrah). This 70 km long island is located 8 km off the mainland coast of Oman. Located in the eastern part, the beach of Ras Zafarnat hosts on 34 km for three months the largest breeding colony of *Caretta caretta in* the Indian Ocean. This colony, historically estimated to be between 20,000 and 40,000 females nesting annually, represents one third of the world stocks of the species (Salm, 1991; Ross & Barwani, 1995; Ross, 1998). Monitoring of egg-laying between 2008 and 2016 indicates a 70% decline (Tucker *et al.*, 2017). Approximately 200 *Chelonia mydas* also nest annually on Ras Zafarnat beach at the far western tip of the Arabian Peninsula. The largest breeding colony of *C. mydas* in this region is associated with Ras al Hadd beach, with the arrival of approximately 6,000 females each season (Ross & Barwani, 1982).

Between 1,000 and 3,000 resident juvenile to adult Green turtles feed year-round on seagrass beds at a depth of about 3 m in the Masimah Channel, northwest (Jazirat, Dawah) and north (Bayd, El Ager) of the island, with densities up to 900 individuals per km^2 (Ross, 1985).

On Masirah Island (Wilāyat Maṣīrah) two other species also nest. The annual breeding stock of *E. imbricata is* estimated at 92-124 females (Ross, 1981) and that of *L. olivacea* at about 150 females (Ross & Barwani, 1982).

Photo 83. Hawksbill turtle nesting on Sir Bu Nair Island in Sharjah, United Arab Emirates, in 2010 (© N. Pilcher)

The Masirah Island (Wilāyat Maṣīrah) nesting area is subject to numerous anthropogenic disturbances and there is a phenomenon of 11% abandonment and return to the sea without laying eggs. Mendonça *et al* (2010) rightly ask the question whether the announced decline of this population of Loggerheads is a true decline of the population or whether it was initially overestimated. They suggest that the females may have moved to mainland beaches less disturbed by humans, or even 500 km further south, to the Al Hallaniyat archipelago.

Appropriate recommendations for better management of the site to mitigate threats had been sent by Florida Fish and Wildlife Conservation Commission (Witherington & Possardt, 2004) to Oman's Ministry of Environment. Oman's decline in Loggerheads (Willson *et al.*, 2020). According to Dethmers (2020), the regional importance of Barr Al Hikman as foraging habitat is underestimated.

The Red Sea covers 437 900 km². An extension of the tropical Indian Ocean, it is rich in beaches, coral reefs, mangroves, sea grass beds, etc., all privileged habitats for marine turtles. On the Egyptian coasts (Gulf of Suez, Gulf of Aqaba) of the Red Sea, Frazier & Salas (1984) note nesting habitats of *E. imbricata* in the islands of Gubal el Kebir (laying of 100 females per year), islands of Baruda and Hamata (50 females) and Ras Banas (50 females), and estimate the total breeding stock of this region to 500 females. Note that Miller (1989) also reports on *E. imbricata* nesting in Saudi Arabia, and Green (1996) reports on Hawksbills in Yemen's Red Sea.

In Sudan, the Dongonab Bay-Marsa Waiai site (# 1859), which includes the Shuaab Rumi reefs and Sanaganeeb atoll, includes mangroves and extensive coral reefs. *E. imbricata* and *C. mydas* lay eggs there. *E. imbricata* also nests on most of the islands of the Suakin Archipelago (no. 1860), especially on the island of Seil Ada Kebir (37°50'E/19°14'N), with an attendance that was estimated at 330 females per season (Hirth & Abdel Latif, 1980; Moore & Balzarotti, 1977).

E. imbricata nesting is confirmed on Maskali Island, Republic of Djibouti, but there is no information on the presence of marine turtles in the Haramous-Loyada Ramsar site (11°35'N-43°09'E) which includes sandy coastal areas, and despite the Convention the assertion of the presence of *Chelonia mydas* and *Caretta caretta* (Fretey *et al.*, in press).

Approximately 100-200 *E. imbricata* nest each season on Sinafir, Shusha and Bargan islands, as well as on the islands of the Farasan Banks. In Eritrea, this species in the most widespread and nests on at least 110 islands and the mainland coastline. The main sites are Mojeidi, Dissei, Aucan (Teclemariam *et al.*, 2009). *C. mydas* has been reported to lay eggs on the Dahlak Archipelago (Urban, 1970).

The Al Hallaniyat Archipelago in the Arabian Sea has substantial egg-laying activity for *E. imbricata*. Counts for this species during the 1999 and 2000 seasons yielded 1,205 and 4,376 nests respectively (Mendonca *et al.*, 2001). In Yemen, the Hawksbill turtle nests mainly on the Perim and Jabal Aziz islands, and on the Kamaran islands along the Yemeni Red Sea coast. This breeding stock is estimated at about 500 females per season (Ross & Barwani, 1982; Mancini et *al.,* 2015).

Pilcher *et al.* (2014) identified two main feeding habitats of *E. imbricata* along the 500 km of Oman, in the Shannah and Quwayrah regions.

Proposed actions by experts J. Fretey and P. Triplet

In southern Kenya, between the Mwachema River and Kinondo Coves in the Diani-Chale National Marine Reserve, Hancock *et al.* (in press) note large aggregations of *Chelonia mydas* and *Eretmochelys imbricata* in nursery and feeding habitats, with high site fidelity. When data for these habitats will be better known, it would be desirable for Kenya to nominate these sites for listing.

Mozambique does not have any coastal Ramsar sites. All the Mozambican islands would require a Ramsar designation for the quality of their nesting and feeding habitats for several species, in biogeographic complement with the Malagasy western sites and the island of Europa.

All Seychelles islands are encircled by fringing reefs that are feeding areas where juvenile and adult Hawksbill turtles find Cnidaria, Sponges, with a predominance of Demosponges (von Brandis *et al.*, 2014). Some of these Seychelles islands would merit a listing for action under the design of Resolution XIII-24. Similarly, for this species, Ommolgorm (Iran) and the Gubal el Kebir Islands (Red Sea, Egypt) would benefit from listing.

We encourage the Union of the Comoros to consider the Ramsar classification of the concerned beaches of Moheli.

In Mayotte, the bay of N'Gouja (theoretically protected by prefectural decree) alone would deserve to be designated as a Ramsar site for its exceptional feeding habitat. Two sites should also be designated for their substantial nesting habitats of the Green turtle: the whole southern region of the main island (classified as a natural marine park of Grande-Terre with the white sand islet) and the beaches of Moya-Papani (in a biotope protection order assigned to the Conservatoire de l'Espace Littoral et des Rivages Lacustres).

If quantitatively the nesting of the Green turtle on the island of Nosy Iranja Kely is not exceptional in the west of the Indian Ocean, the not anecdotal nesting of the Hawksbill turtle in a region where the massacres for Hawksbill were numerous in the past, deserves an adapted management plan.

The Marawah Marine Biosphere Reserve in Abu Dhabi largely coincides with the feeding areas of *C. mydas*, thus providing important protection against fishing activities. The Ras Al Khaimah Marine Protected Area would be more effective in protecting *C. mydas* if it extended offshore and along the coast. These data could contribute to targeted and effective national and international management and conservation initiatives in the Arabian region (Pilcher *et al.*, 2021).

The large intertidal mudflats of Barr Al Hikman (Oman), covering more than 5,000 ha, have one of the highest productivity in the world and meet the feeding strategy of several species of marine turtles. This site deserves a Ramsar designation.

We note the existence of many growing areas of *E. imbricata* and *C. mydas* around the islands of the Persian Gulf. These islands would require a Ramsar designation.

We can only encourage the State of Eritrea to ratify the Ramsar Convention, and to designate the sites of Mojeidi, Dissei, Aucan and the nesting habitats of *C. mydas* on the Dahlak archipelago, as remarkable habitats for marine turtles.

In Djibouti, Maskari Island and the Raissâli-White Sands area deserve a Ramsar classification for their habitats concerning *E. imbricata* and *C. mydas*.

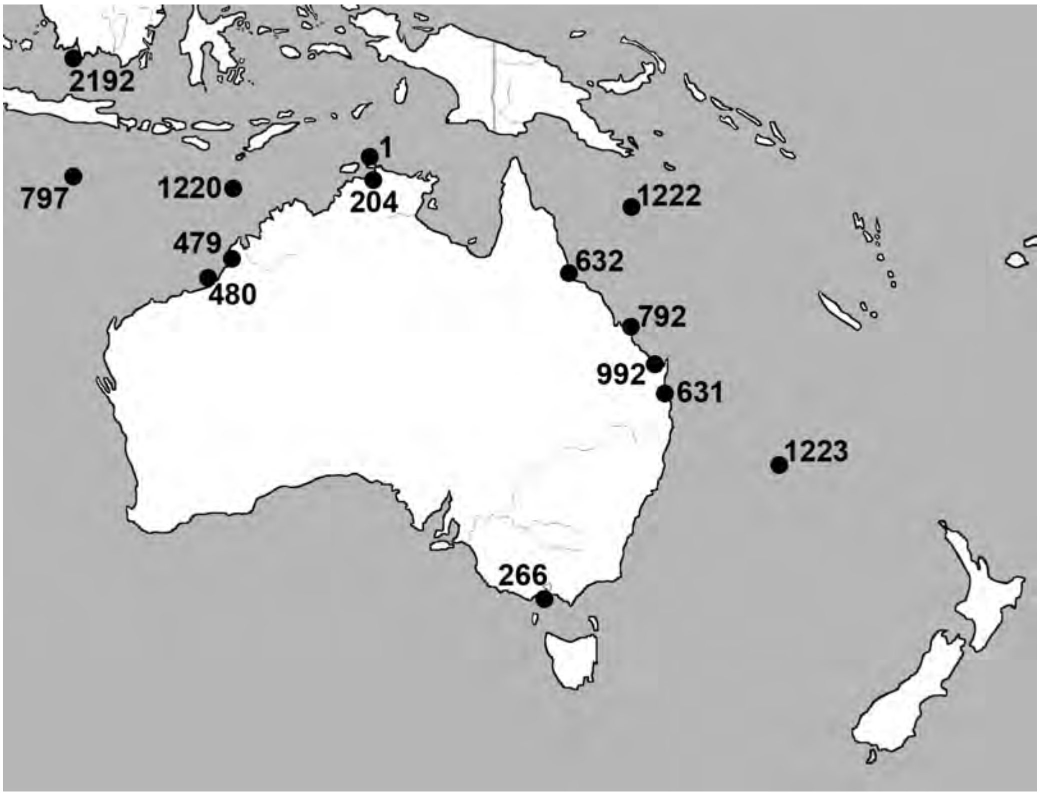
Bourjea *et al.* (2015) consider the Southwest Indian Ocean (SWIO) to be one of the most important regions in the world for *C. mydas* nesting.

With its ultramarine territories dispersed within immense EEZs[12] in the Indian Ocean, France has both a political responsibility towards the marine biodiversity of this region and the possibility of creating an exceptional Ramsar network by multiplying the classifications of vital habitats for several species of marine turtles, and thus setting a global example of implementation of Resolution XII-24 that it has carried.

[12] Total area: 1,004,062 km² (Mayotte: 63,176 km²; Glorieuses and Geyser Bank: 43,648 km²; Bassas da India: 123,700 km²; Juan de Nova: 61,050 km²; Europa: 127,300 km²; Reunion Island: 311,426 km²; Tromelin: 273,762 km² co-managed with Mauritius).

REGION 7

South Pacific and Oceania.



Map 10. Location of Ramsar sites in the South Pacific and Oceania.

Table IX. Inventory of South Pacific and Oceania sites

Site number	Contracting Parties	Administrative region	Site name	Species present
1	Australia (Commonwealth of Australia) Signature: 08/05/1974	Northern Territory	Cobourg Peninsula	Cm, Nd, Lo, Dc, Ei, Cc
204	Australia (Commonwealth of Australia)	Northern Territory	Kakadu National Park	Cm, Nd
266	Australia (Commonwealth of Australia)	State of Victoria	Port Phillip Bay and Bellarine Peninsula	Dc
479	Australia (Commonwealth of Australia)	State of Western Australia	Roebuck Bay	Nd
480	Australia (Commonwealth of Australia)	State of Western Australia	Eighty Mile Beach	Nd
631	Australia (Commonwealth of Australia)	State of Queensland	Moreton Bay	Ei, Cm, Cc
632	Australia (Commonwealth of Australia)	State of Queensland	Bowling Green Bay	Cm, Nd
792	Australia (Commonwealth of Australia)	Livingston Shire, State of Queensland	Shoalwater and Corio Bays Area	Cm, Nd
797	Australia (Commonwealth of Australia)	External Territory of the Cocos (Keeling) Islands	Pulu Keeling National Park	Cm, Ei, Lo, Cc, Dc
992	Australia (Commonwealth of Australia)	State of Queensland	Great Sandy Strait	Cm, Cc, Ei, Nd, Dc, Lo
1220	Australia (Commonwealth of Australia)	External Territory of Ashmore and Cartier Islands	Ashmore Reef Commonwealth Marine Reserve	Cm, Ei, Cc
1222	Australia (Commonwealth of Australia)	Coral Sea Islands Territory	Coral Sea Reserves	Cm, Ei
1223	Australia (Commonwealth of Australia)	Australia’s East Marine Region	Elizabeth and Middleton Reefs Marine National Nature Reserve	Cm, Dc
1971	United States of America	Pacific Region	Palmyra Atoll National Wildlife Refuge	Ei, Cm
2143	Kiribati (Republic of Kiribati) Accession: 03/04/2013	North Tarawa	Nooto-North Tarawa	Cm, Ei
2072	Marshall Islands (Républic of the Marshall Islands) Accession: 13/07/2004	Ralik Chain	Namdrik Atoll	Cm, Ei
1834	France	French Polynesia is an overseas collectivity of France	Moorea Lagoon	Ei, Cm
2331	Fiji (Republic of the Fiji Islands) Accession: 11/04/2006	Northern Division	Qoliqoli Cokovata	Ei, Cm, Dc, Cc

Notes:

The Commonwealth of Australia is very important for the future of marine turtles in the Pacific Ocean, as it includes six species (including the Flatback turtle, *Natator depressus,* which is strictly dependent on this area for nesting) with 22 distinct genetic stocks nesting and feeding there.

Nesting *N. depressus* is endemic to the Australian continental shelf and primarily abundant in northern Australia. The breeding range of Flatback turtles extends from the Cape Range to Cape Domett, including the islands of Thevenard and Barrow (Limpus, 2007). The largest concentrations of nests are found northeast of the Gulf of Carpentaria and west of Torres Strait, including Crab Island, Deliverance Island, Turu Cay, and Kerr Island (Limpus *et al.*, 1993; Sutherland & Sutherland, 2003). Limpus *et al.* (2001) cite Wild Duck and Avoid Islands as hosting several hundred females annually, 19 sites visited by only a few dozen females, and 25 outlying sites with less than 10 females nesting. Cape Domett, located in western tropical Australia, hosts an average of 3,250 females (1,431 to 7,757) each season, making it one of the major hotspots for the species (Whiting *et al.*, 2008).

Evidence of genetic connectivity among neighbouring rookeries led to the identification of seven genetic stocks. Geographic boundaries of rookeries used by genetic stocks varied widely (160-1,300 km) (Fitzsimmons *et al.,* 2020). Flatback turtles feed on the Australian continental shelf, but also off Indonesia and Papua New Guinea.

Photo 84. Female *Natator depressus* in the final phase of the oviposition protocol
(© T. Read)

Hatchling marine turtles leaving their terrestrial birth habitat almost all have a pelagic phase (Brongersma, 1972), except *N. depressus*. Walker (1991) considers the presence of juveniles of 14 to 24 cm around the islands (Arch Rock, Cullen Island, etc.) of the Great Barrier Reef as evidence of the absence of a pelagic phase in the cycle of this species. Eighty-five percent of these developmental habitats are located approximately 70 km from island nesting hotspots and 27% are located 15 km away (Whittock *et al.*, 2014). This size class appears to feed on macro zooplankton (Limpus, 2007).

Photo 85. Female *Natator depressus* descending to the sea on Crab Island beach, Queensland
(© P.C.H. Pritchard)

Ramsar site # 1 and the marine turtles that frequent the beaches, mangroves, and reefs of northern Australia are threatened by innumerable marine debris. The greatest threat is the entanglement of marine turtles in discarded fishing nets from Indonesian, Thai and Chinese trawlers (White 2005).

Main *Eretmochelys imbricata* nesting beaches are located in northern Queensland in the Arafura Sea and eastern Gulf of Carpentaria (Torres Strait and western Cape York Peninsula), and in the Coral Sea north of the Great Barrier Reef (Limpus *et al.*, 2008). The best nesting sites in Australia are in the Dampier and Montebello archipelagos. Rosemary Island in the Dampier Archipelago hosts approximately 1,000 females annually, making it one of the best sites in the world for this species (Limpus, 2009). The Sassie (Long Island) site also hosts 500-1000 females per year on a single beach. Small Milman Island, located about 23 km from the Australian mainland in the northernmost part of the Great Barrier Reef Marine Park, is excellent nesting habitat for *E. imbricata* along its 2.4 km sandy circumference. Analysis of 27 years of monitoring of nesting on Milman Island shows normal fluctuation from year to year, but with an overall decline with a maximum of 437 nests (422-451) in 1996 to an average of 141 nests (137-147) during the 2016 nesting season (Bell *et al.*, 2020).

Nesting concentrations are also observed in central and eastern Torres Strait on Long, Aukane, Mimi, Kabbikane, Johnson, Bet and Albany Islands. The size of the breeding stock associated with this entire Torres Strait/Northern Great Barrier Reef region is difficult to know precisely, but Miller & Limpus (1991) estimated it at over 3,000 females.

Of note is the existence of a nice feeding habitat of *E. imbricata*, immature and mature in the Howick Group north of the Great Barrier Reef (Bell & Pike, 2012). A recent genetic study (Bell & Jensen, 2018) of feeding habitat on the Howick Reefs north of the Great Barrier Reef showed that 70-92% of Hawksbill turtles at this site originated from rookeries in the Bismarck-Salomon region and about 15% from northern Queensland.

The 6.7 km of beach at Gnaraloo Bay is regionally important nesting habitat for *Caretta caretta* with approximately 370 nests per season (Hattingh *et al.*, 2020).

There are essentially two breeding stocks of *L. olivacea* in Australia: one in the Northern Territory (Tiwi Islands and McCluer Group Islands), and the other in Queensland, west of Cape York in the vicinity of Weipa (Flinders Beach) (Fitzsimmons & Limpus, 2014). The small Cape York population is genetically isolated from the population nesting in the Northern Territory. Concentration areas for the species appear to exist on the Australian continental shelf off Indonesia (Waayers *et al.*, 2015). These populations are threatened by entanglement of individuals in ghost nets (Jensen *et al.*, 2013).

Photo 86. Hatchling *Natator depressus* heading out to sea. Note the ochre-gray color of the back plates, typically edged with black
(© T. Read)

At the northern end of the Great Barrier Reef, Raine Island (11° 35′ 25 ″S, 144° 02′ 05 ″E) is a cay composed of sediment from the surrounding reef. Raine Island's reef has a perimeter of approximately 6.5 km and is bordered by coral reefs. This island is the most important nesting habitat of *C. mydas* in the world. Raine Island, Moulter Cay and McLennan Cay, included in Raine Island National Park, host more than 90% of the Australian nests of *Chelonia mydas*. Access is regulated in the 2003 Great Barrier Reef Marine Park Management Plan with a customary land use agreement. Reproductive performance is very negative on Raine Island due to poor incubation success due to tidal flooding and cliff scree (Limpus *et al.*, 2003; Pike *et al.*, 2015). Queensland

Government has initiated a program of actions (Raine Island Recovery Project 2015-2020) to address these issues. This breeding stock has an important feeding area in the Torres Strait and Gulf of Carpentaria where they are severely threatened by ghost nets (Wilcox *et al.*, 2012).

Limpus *et al.* (2003) counted 11,565, 11,467, and 14,519 breeding *C. mydas* on Raine Island in 1974, 1984, and 1996, respectively. More recently, the estimated number of breeding females was 8,144 ± 1,074 in early November 2016 and 12,508 ± 567 in early December of the same year during a drone count (Dunstan & Robertson, 2017). Up to 23,000 females were counted in one night on the beach, but there is considerable variability between seasons.

Recruitment of hatchling turtles has declined sharply since the 1990s on Raine Island in part due to nest destruction by females and flooding. Embryos were also found here to die at a premature stage, a phenomenon known as *early embryo death syndrome (*EEDS) (Booth & Dunstan, 2018).

Heron Reef surrounding Heron Island (23°26'S/151°55'E), in the Capricorn Group, at the southern end of the Great Barrier Reef, contains seagrass beds that are exceptional feeding habitat for two populations of *C. mydas*: adult males and females migrating from distant areas, and resident immature and adult turtles with nesting females on the island. 78.7% of this population is composed of immatures from 36 cm CCL (Limpus & Reed, 1985).

Cocos Islands Territory (ex Keelings islands), Ramsar site # 797, is located 975 km from Chrismas Island and about 1,000 km from Java. This outer territory of Australia is composed of two atolls of 27 islands. Whiting (2004) estimates several thousand juvenile and adult Hawksbills turtles feeding in the coral reefs of these atolls, but no nesting has been recorded on the islets. *C. mydas* lays eggs on North Keeling Island and may have existed in the past on the southern atoll islands (Gibson-Hill 1950; Director of National Parks 2015). This genetic stock of *C. mydas* is unique (Whiting *et al.*, 2014).

Both atolls are frequented by juveniles and adults ranging in size from 38.7 to 115.6 cm for *Chelonia mydas* and 24.8 to 84.5 cm for *Eretmochelys imbricata*. *Lepidochelys olivacea*, *Caretta caretta*, and *Dermochelys coriacea* are occasionally observed around the southern atoll (Murray *in*: Director of National Parks Annual Report 2015-16).

Preliminary estimates from Ashmore Reef (# 1220) indicate the presence of approximately 10,700 sub-adult Green turtles (Guinea 1995, Whiting & Guinea 2005). They feed on shallow water seagrass beds; Ashmore Reef has the most extensive seagrass beds on the Sahul Plateau, which may explain this concentration of turtles belonging to different metapopulations. Females nest on the beaches of West Island, Cartier Island, and the adjacent cay (Guinea, 1993; 1995; 2013). *E. imbricata* nest on Middle and East Islands and feed on the reef crest and in the lagoons. *C. caretta* occurs on the flat reef of Ashmore Reef where it feeds on Mollusks and Echinoderms. Only one nesting case has been reported (Whiting & Guinea, 2005).

No species nest in New Zealand, including on the subtropical island of Kermadec, 900 km northeast of the mainland. However, subadult *C. mydas* are present year-round in feeding habitats in neretic and northern oceanic waters (Godoy & Stockin, 2018). This aggregation is a mixed stock consisting of 14 identified management units with nesting habitat provenances from the southwest Pacific (sGBR, Coral Sea, New Caledonia), west-central Pacific (Marshall Islands, Micronesia, Palau, Guam/CNMI), south-central Pacific (American Samoa), and eastern Pacific (Revillagigedo, Michoacan, Costa Rica, Galapagos Islands) (Godoy, 2020).

Feeding habitats in Papua New Guinea host thousands of Green turtles from other Pacific islands, sometimes very far away (Spring, 1982; Hirth, 1993). The species nests primarily in northern and southern New Ireland Provine (Nago, Atmago, Nusalaman, Usen, Lemus Islands) and on Long Island, Madang Province (Trevors, 2010; Opnai, 2007). Pritchard (1978) and Spring (1980) report nesting of *E. imbricata* in East Sepik (Laboin, Musschu, Kairuru, Wuvulu, Kaniet Islands), Manus (Pak, Los Reyes, Harengan, Paluwak, Bipi, Ninigo Group Islands), New Ireland (Tabar, Anir, Boloma Group, Emirau, Mussau Islands), East New Britian (Nuguria), and Western Province.
Nesting and feeding Hawksbill turtles north of the Great Barrier Reef migrate mostly to West Papua and to Papua New Guinea (Miller *et al.*, 1998; Hamilton *et al.*, 2015). There appears to be development habitat for this species in Milne Bay Province (Rei, 2009) that should be protected. *D. coriacea* has good nesting habitat in Papua New Guinea along the north coast in Sepik Province (Kwala Village, Wom Point, Aitape, Vanimo and Ataliklikun Bay) (Pritchard, 1978), Madang Province, as well as the islands of New Guinea (Tulu, Ponam and Rambuso Islands), Manus Province (Harengan and Lou Islands) and New Ireland (Tanga, Lambon and Lihir Islands) (Pritchard, 1978; Read, 2002). Nesting of *N. depressus* is reported by Pritchard (1978) at Vanimo, East Sepik Province. Eggs of *L. olivacea are* reported by Spring (Spring, 1982) in the same area.

In the Federated State of Micronesia, Oroluk Atoll (Ponape District, Pohnpei State) is of interest as a nesting site for *C. mydas*, but also as a nursery and feeding area for this species in the lagoon (Pritchard, 1977; Naughton, 1991).
According to Pritchard (1977), nesting sites of *C. mydas in* addition to East Fayu (Chuuk State) include Fananu in Nomwin Atoll and Murilo Atoll. Green turtles and Hawksbill turtles are thought to have foraging habitats in the mangroves of the high islands of Yap State (Chuuk Lagoon, Pohnpei, Kosrae, etc.), as well as in Elato Atoll (McCoy, 2020).
Small nesting sites of *C. mydas* in the Republic of Palau (Palau) have been observed (2005 nest count) at Helen Reef (301 nests) and Merir Island, Sonsorol State (average of 440 nests per year) (Seminoff *et al.*, 2015 ; Maison *et al.*, 2010 ; Palau Bureau of Marine Resources, 2008). The other four nesting sites mentioned by Seminoff *et al*. (2015) have few clutches. More interesting in this region in terms of critical habitats is the extensive feeding area around Helen's Reef, Angaur and Peleliu Islands, off Southern Lagoon, Babeldaob Banks, south of Oreor and Sar Passage. There are exceptionally large seagrass beds off northern Babeldaob and northeast of Peliliu Island.
All islands in Palau have shallow-water coral reefs and lagoons that are attractive development and feeding habitats for *E. imbricata*, particularly the lagoons of Helen Atoll Reef and the Rock Islands, as well as the Blue Corner and German Channel areas (Geermans, 1992; Rice, 2020).

On the island of Guam, in the Philippine Sea, nesting of *E. imbricata* is apparently rare (Sumay Cove beach, Dikiki beach at Spanish Steps, etc.), but there is a lack of documentation on this subject (Grimm & Farley, 2008). Developmental and feeding habitats of the species exist around Guam (Kelly, 2020), but should be better known and protected.

The Republic of the Marshall Islands (RMI) consists of 29 atolls and five isolated islands. The Ramsar description sheet of Namdrik atoll (# 2072) located in the Ralik chain, in the west of the archipelago, indicates the presence of *C. mydas* and *E. imbricata*.

Three main sites, Bikar Atoll, Jemo Island, and Erikub Atoll are estimated to be important nesting habitats for *C. mydas* (McCoy, 2004; Rudrud *et al.*, 2007; Rudrud, 2008; Puleloa & Kilma, 1992). Bikar is considered as the most important site in the RMI, with estimates of 100-500 nesting turtles each year (McCoy, 2004; National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1998). Jemo Island and Erikub Atoll host 25 to 100 turtles each season.

McCoy (2004) indicates that Wotje, Taka and Bikini are also important nesting sites and points out that the atolls of Ailinginae, Rongelap and Rongerik have seen an increase in nesting due to the lack of inhabitants on these atolls after the Second World War as a result of nuclear testing. He estimates, from Hendrickson's (1972) surveys, that the breeding stock on Bikar can be estimated at 771 females. Feeding habitats of *C. mydas* is found around all the atolls with the apparent exception of Ujelang, Namdik and Bokak (McCoy, 2004; Rudrud, 2008).

E. imbricata nesting sites in the RMI are less well identified. However, seven locations have been reported as definite or potential nesting habitats with marked activity on the Wotje atolls (McCoy, 2004; Rudrud, 2008; Puleloa & Kilma, 1992). And throughout the RMI, 17 atolls are very rich in sponges and recognized as feeding habitats for the species.

Note that Puleloa & Kilma (1992) report *D. coriacea* as the third species in the north of the archipelago. Bikar Atoll (still called Pikaar) appears to have the highest concentration of *C. mydas* nests in the archipelago (followed by Adkup Atoll and Jemo Island), with a population of up to 500 females (McCoy, 2004). Mating occurs at sea near this atoll (Thomas *et al.*, 1989). Maragos (1994) reports nesting of *E. imbricata* there. A coral feeding area of this species is noted from Toke Island.

The Kiribati archipelago, south of Hawaii and not far from the American islands of Palmyra (site # 1971), is composed of 32 atolls and one coral island in three distinct chains (Gilbert Islands, Phoenix Islands, Line Islands). The waters of this archipelago are frequented by *Chelonia mydas* and *Eretmochelys. imbricata*. The presence of *Lepidochelys olivacea*, *Caretta caretta* and *Dermochelys coriacea* has been reported in this archipelago by Environment and Conservation Division - ECD 2010), but not confirmed by scientists.

Nesting of *Chelonia mydas* has been recorded on eight islets: Kanton, Nikumaroro, Enderbury-Rawaki, Phoenix, Birnie, Hull-Orona, Sydney-Manra, McKean. More than 200 females nest on Kanton Island (Balazs, 1975) and 165 nests have been recorded on Enderbury-Rawaki (Stone *et al.*, 2001). Between 100 and 300 turtles are reported to lay eggs each year in the Phoenix group.

During the period 2007-2008 a total of only 19 nests were recorded on Nooto-North Tarawa (site # 2143), in the whole of the Gilbert Islands, without specifying species. Little information is available about possible clutches in the Line group, in Christmas, Fanning, Vostok and Caroline Islands where Balazs (1995) had reported them.

The State of Solomon Islands, east-southeast of Papua New Guinea, stretches geographically both in the Solomon Sea and in the Coral Sea, and is made up of two archipelagos, the Solomons and the Santa Cruz, the whole counting a dozen large islands and nearly a thousand islets.

Three important nesting sites for *C. mydas* have been identified in the Arnavon Islands, Hakelake Islands, and Kerihikapa Islands (Maison *et al.*, 2010; Sulu *et al.*, 2012). The Arnavon Community Marine Conservation area (ACMCA) includes the only nesting habitat in the Solomon Islands where female emergences are monitored. Feeding habitats for *C. mydas* have been identified in Marovo Lagoon in New Georgia, Mbanika and Pavuvu in Russell Islands, Tetepare Islands, and Kolombangara (Green *et al.*, 2006; Esbach *et al.*, 2014; Argument *et al.*, 2009), developmental habitat for species has also been reported in the Arnavon Marine Conservation Area (AMCA) (Wilson *et al.*, 2004).

Three main nesting habitats of *D. coriacea* are recorded: Sasako in Santa Isabel Island, on Tetepare Island, on Zaira Beach in Vangunu Island with a seasonal number of nests for each site between 23 and 132 (Argument *et al.*, 2009; Wilson *et al.*, 2004; Trevor, 2010). Female Leatherbacks nesting in the Solomon Islands feed in the Tasman Sea, off Papua New Guinea, or in Fiji (Jino *et al.*, 2018; Benson *et al.*, 2011).

Nesting populations of *Dermochelys coriacea* throughout the Solomon Islands and Vanuatu, as well as Papua New Guinea, are believed to be larger than previously estimated (Dutton *et al.*, 2007). The most notable nest concentrations in the western Pacific, and perhaps now the entire Pacific Ocean, occur along the northern coast of Papua New Guinea (Hitipeuw & Maturbongs 2002; Dutton et *al.,* 2007), particularly in northwestern West Papua, Indonesia (Hitipeuw et *al.,* 2007), and along the Huon Coast (Benson *et al.,* 2007). The most important nesting habitat on the Huon Coast named Kamiali Wildlife Management Area (WMA) is near the village of Lababia (Pilcher & Chaloupka, 2013). Recorded nesting activity was between 1,865 to 3,601 nests each season from 2001 and 2004 at Jamursba-Medi and between 1,788 to 2,881 nests from 2002 and 2004 at Wermon.

Largest breeding colony of Hawksbill turtles in the South Pacific Ocean is located in the Arnavon Islands, (Maison *et al.*, 2010; Sulu *et al.*, 2012, Trevor, 2010), Big Maleivona Island, Kerihikapa Island, Sikopo Island and Little Maleivona (Mortimer, 2002; Hamilton *et al.*, 2015), located in the Solomon Islands in the heart of the Manning Strait between Santa Isabel and Choiseul Islands (Limpus, 1997).

In the 1970s, this population was in severe decline due to heavy exploitation. The national government intervened, declaring the Arnavon Islands as a sanctuary in 1976 and then, as exploitation resumed, a marine conservation area (AMCA) in 1995, and passed national legislation prohibiting the sale of all marine turtle products. The estimate in the AMCA is 600 nests per year, which represents a frequentation of the beaches by 125 to 150 females. The number of nests on Kerehikapo represents between 51 and 65% of the total number of nests on the four islands. This marine protected area is also a mating and feeding habitat for adults and immatures of both sexes of *E. imbricata* (Mortimer, 2002). It is also a nursery and nesting habitat (7.4% of all marine turtle nests in the Arnavon Islands for *C. mydas* (Vaughan, 1981).

Marovo Lagoon in New Georgia and Kolombangara are known feeding habitats for the Hawksbill turtle (Green *et al.*, 2006; Argument *et al.*, 2009) Adults and sometimes juveniles move between the Solomon Islands and Papua New Guinea, where they feed at Fisherman's Island and Tagula Island, and between the Solomon Islands and the Torres Strait and Great Barrier Reef in Australia (Mortimer, 2002; Hamilton *et al.*, 2015).

This breeding stock migrates for feeding habitats to Papua New Guinea (Tagula, Fisherman's Island) and onto the Great Barrier Reef of Australia (Hamilton *et al.*, 2015). Leary & Laumani (1989) estimate *C. mydas* nesting activity in Isabel Province, not including the Arnavon Islands, to be between 259 and 438 nests.

Vanuatu is an archipelago of 82 uninhabited islands. Green turtles nest on Epi, Espiritu Santo, Malekula (Bamboo Bay), Moso and Nguna, Pele, Motalava, Pentecost, Aniwa and Tegua, Torres islands. Bamboo Bay, west of Malekula, is currently the best monitored nesting area with 99 to 247 females landing the 11 km of beach each year (J. Aromalo *in:* Hickey, 2020). Uninhabited Vulai Island is currently the primary nesting site for the Maskelynes Islands (Avok, Awe, Wulei, Bagatelle, Kufivu, Koivu, Sakao). Mesina Bay, southeast of Vanua Lava in the Banks Group, north of Ravenga Island, as well as the vicinity of Santo, Uri, Aneityum Islands have important feeding habitats for Green turtles.
The number of nesting female Hawksbill turtles on some islands (Ambrym, Efate, Epi, Espiritu Santo, Malekula, Moso, Tegua, Torres, Kakula, Pele, Nguna, Uliveo Sakao, Vulai, Aneityum, Reef, etc.) is estimated to be as high as 300 (Mortimer & Donnelly, 2008). The beaches of Crab Bay, east of Malekula, and Wiawi are also considered as major Hawksbill nesting sites as well as areas just North of there on Uripiv Island and Port Stanley (Hickey, 2007). Feeding habitats are found in coral reefs southeast of Vanua-Lava in the Banks Group, north of Ravenga Island, around Reef (Rowa), Aneityum, Mystery (Inyueg), and Uri Islands, around Malekula and Lelepa, Kagula, Emao, Nguna, Pele, Emau, and Moso Islands (Johannes & Hickey, 2004).
D. coriacea nests on the islands of Epi (primarily Votlo Beach), Efate, Espiritu Santo, and Malekula (Siota, 2015; Trevor, 2009).

In New Caledonia, the areas occupied by dense seagrass beds represent 398.2 km^2, at a depth of less than 5 m, out of a total area including diffuse seagrass beds of 936.4 km^2. The largest seagrass beds are located in the Northern Province, around Balabio, Voh and Nehoué Bay. In the Southern Province, dense and shallow meadows are found in the region of Moindou-Poya and around Cape Goulevain. Based on the monitoring of ringed turtles, it is estimated that the vital feeding habitat of juvenile and adult Green turtles is 54.3 km^2.

Photo 87. Juvenile *C. mydas* in its developmental habitat at Tabou Reef near Amedee Lighthouse
(© J. R. Rêve)

Photo 88. Juvenile *C. mydas* grazing on seagrass at Tabou Reef
(© J. R. Rêve)

Grande-Terre beaches and the satellite islets in the northwest of New Caledonia are suitable for *Caretta caretta* nesting, while the Pleiades, in the Loyalty Islands to the north, host *Chelonia mydas* nests. The beach of Roche Percée - Baie des Tortues, in Bouraï, with an annual average of 305 female Loggerheads (min=180, max=382) and 182 nests (Nota: a small number of nests likely due to disturbance of females by tourists) (Fourniere *et al.*, 2015), has long been considered quantitatively the most important. Ongoing monitoring of the northwestern islets of Grande Terre and the Grand Lagon Sud teach us that the overall nesting population of *C. caretta* in New Caledonia has been underestimated (Oremus & Mattei, 2017). The Great South Lagoon, recognized by UNESCO as a World Heritage Site (3,145 km^2), includes 74 islets that are potentially nesting habitats for *Chelonia mydas* and *Caretta caretta*. Due to logistical difficulties, only 29 islets have been surveyed so far by the nature guards of the Southern Province and naturalists from WWF-France. For the 2016-2017 season, an average of 12 Loggerhead nests per islet was observed with three islets hosting 43% of the nestling activities. A minimum number of 345 nests (i.e. 80 to 172 females that came to nest on these islets) was estimated for this 2016-2017 season, which corresponds roughly to the 378 nests counted on the Roche Percée/Baie des Tortues site for the same period (Oremus & Mattei, 2017).

A recent genetic analysis confirms that the females nesting at this site belong to the same population as those at Mon Repos in Queensland and thus to the "Southwest Pacific stock" (Boyle *et al.*, 2009). Some coral islets with a coarse substrate, off Koumac, seem to be suitable for nesting *E. imbricata,* but this, as well as traces of landings, have never been observed by scientists and the Nature Brigade of the Northern Province.

Photo 89. One of the coarse substrate coral islands off Ohland Bay, favorable for nesting of *E. imbricata*
(© J. Fretey)

Photo 90. Hidden under the bushes of the Tiam'bouène islet, protected by the Nature Brigade of the North Province of New Caledonia, this Loggerhead can nest in peace (© J. Fretey)

The d'Entrecasteaux Reefs are atolls located about 230 km from the northern end of New Caledonia's Grande Terre. They should not be confused with the d'Entrecasteaux islands (Normanby, Fergusson, Goodenough, Sanaroa, Dobu) located east of Papua New Guinea.

Photo 91. Female C. mydas still ovipositing at daybreak at the southern tip of Huon Island, north of the d'Entrecasteaux reefs. Note the proximity of body cavities indicating either false nests typical of the species, or a concentration of nests
(© M. Oremus/WWF-France)

Photo 92. Green Turtle stuck in the beachrocks on Huon Island
(© H. Geraux/WWF-France)

In the 19th century, an American explorer, William Billings, reported many marine turtle nesting sites on the islets off New Caledonia. In 1979, George Balazs and Peter C. H. Pritchard made an aerial survey of the Entrecasteaux reefs. This overflight confirmed that there are Green turtles on these islets that lay eggs. Pritchard succeeded in December 1991 in setting up an expedition to go to the Entrecasteaux reefs. He counted 310 tracks on Surprise Island, 1,800 tracks on Huon, 572 tracks on Fabre and 130 tracks on a fourth unnamed islet. He estimated an average of 50 landings per night on Huon and an overall number of about 2,800 nests per year.

The Chesterfield Plateau, located between 19˚00' and 20˚30' S, and 158˚10' and 159°E, forms a structure 120 km long by 70 km wide and covers 4,765 km^2. The Bellona Reefs, located 60 km to the southeast and divided into four island groups, cover an area of 9,426 km^2 and a perimeter of 482 km. Currently, the Chesterfield-Bellona islets do not have reserve status like the d'Entrecasteaux reefs despite their inclusion in the Coral Sea Marine Park.

Photo 93. Female *C. mydas* in scanning phase, hidden under a False Tobacco (*Argusia argentea*), on Long Island, Chesterfields
(© M. Oremus/WWF-France)

Chelonia mydas nesting on the Entrecasteaux reefs have been identified as belonging to an independent genetic stock in the Australian region, while those linked to the Chesterfield-Bellona atolls would belong to a stock that could be called "Coral Sea" (Dethmers *et al*. 2006; Dutton *et al*. 2014; Read *et al*. 2015). However, these Green turtles nesting on the Entrecasteaux and Chesterfield-Bellona atolls are geographically close to those nesting in the Great Barrier Reef area in eastern Australia and frequent exchanges of individuals have been noted between these two locations.

Analysis of nesting data collected across these islets shows fairly high interannual variability typical of *C. mydas*, and that the number of annual ascents for recent years has averaged between 50,000 and 100,000 landings, making it a major breeding site for the entire South Pacific (Girondot & Fretey, 2017).

Photo 94. Green Turtle looking for a passage to the sea in the beachrocks on Long Island, southwest of Chesterfield
(© M. Oremus/WWF-France)

The Tuvalu archipelago consists of nine coral atolls. A few scattered nesting habitats of *C. mydas* are identified in the Funafuti Conservation Area, on the islets of Vasafua and Fuakea (Pita, 1980; Maison *et al*, 2010).

Fiji is composed of 322 islands and some 500 islets. Surveys throughout the archipelago have not revealed any signs of significant nesting activity, but this remains to be confirmed. *C. mydas* nests are reported on Wailagilata Atoll and Yadua, Central Lau Seamount Islands. *E. imbricata* nests are recorded on Mamanuca, Yasawa, Nananu, Leleuvia, Caqalai, Makogai, Batiki, Kia, Hatana, Hofliua, Uea, Central Lau Seamount islands, and Wailagilata Atoll (Laveti *et al.*, 2011; Sykes, 2007). *C. mydas* and *E. imbricata* also nest in small numbers on the islands of Ringgold and Heemskercq reefs. Hawksbill nests are also observed on Nakusernanu, Nanuku Lailai, Namena, Yadua, Astrolabe Lagoon islands, Vanua Kula, Nananu-i-ra and Leleuvia (Derrick, 1957; Guinea, 1993). A total estimate of a Fijian breeding stock of 150 to 200 females has been made.

Qoliqoli Cokovata site #2331 is part of a huge 260 km long barrier reef called the Great Fiji Reef or Cakaulevu. This site has marine habitats suitable for Hawksbill and Green turtles, but we do not know how important they are.

Recent data (Batibasaga *et al.*, 2006; Petit, 2013; Jit, 2007) indicate that Fiji has foraging habitat for adult Green turtles breeding in the Cook Islands, French Polynesia, and Australia. In addition, the shallow coastal waters of Yadua and Makogai Islands are identified as developmental habitats for juvenile Green turtles from American Samoa, New Caledonia, and French Polynesia (Piovano, 2020).

Several coral reefs in Fiji (Grande Mer, etc.) are feeding habitats for individuals of *E. imbricata* nesting locally or from American Samoa (Jayne & Solomona, 2007). Foraging habitat for *C. caretta* also appears to exist in the shallow waters of the Great Sea, Hemskercq, Ringgold, Central and Southern Lau Group reefs, and along the Suva and Kaba peninsulas (Batibasaga *et al.*, 2006).

Developmental and feeding habitats are on the other hand remarkable around certain islets like Yadua and Makogai distant one from the other of approximately 100 km. Immature Green turtles, males and adult females, live together there. Traditional tagging and satellite telemetry have shown that adult females feeding in Fiji originated from nesting habitats in Samoa, Australia, French Polynesia, Cook Islands, Tonga, etc., (Piovano *et al.*, 2019).

The Kingdom of Tonga comprises three archipelagos of approximately 170 islands and islets. Green turtles nest on various islands in the Ha`apai and Vava`u Groups (Bell *et al.*, 2009). Visitation is low and does not exceed about 20 nests (Havea & MacKay, 2009). Significant foraging habitat for this species is reported in the Vava`u Group, at Hunga Lagoon, Foelifuka, and Neiafu Harbor (Walker *et al.*, 2015).

E. imbricata appears to have breeding sites in the Ha`apai and Vava`u Groups, with good nesting densities on Maninita, Fonua'one, and Taula Islands. Hawksbill feeding habitats are recorded around Longomapu and Split Rock (Walker *et al.*, 2015).

Tokelau, under New Zealand sovereignty, is composed of three atolls: Fakaofo, Nukunonu and Atafu. *C. mydas* nests essentially along the east and south coasts of Nukunonu. In the 1970s, 210 females per year came ashore on Nukunonu Island and 90 on Fakaofo Island. Habitats for the development of the species are known along the reefs and in the lagoons (Balazs, 1983; Pierce *et al.*, 2012).

The Independent State of Samoa consists of two main islands (Savaii and Upolu) and seven smaller islands. The islands of Namu'a, Nu'utele (Nu'utele and Vini beaches) and Nu'ulua have been identified as the primary nesting sites for *E. imbricata*. Witzell & Banner (1980) and Zann (1989) suggest that the nesting population of this species is small, with no more than 45 females coming to lay eggs annually on the Aleipata Islands. Feeding habitats of *C. mydas* are distributed along the southern shore of Upolu Island near the communities of Tafitoala and Malaela (Bell *et al.*, 2011). It is hypothesized that these adult turtles breed in Rose Atoll, American Samoa (Witzell, 1982).

In the Central Pacific Ocean, between Hawaii and American Samoa, the American atoll of Palmyra is part of the Pacific Remote Island Areas (PRIAs). Developmental and feeding habitats of regional interest for *C. mydas* and *E. imbricata* are noted by Maison *et al*. (2010) in the waters surrounding the islands of this atoll. A spatial distribution was observed by size (Sterling *et al.*, 2013).

Photo 95. Nesting track of a Green turtle on the beach of Tetiaroa
(© Te mana o te moana)

Proposed actions by experts J. Fretey and P. Triplet

We should note here the exemplary initiatives of the Australian State with regard to marine turtle habitats. These habitats are protected through a variety of legal mechanisms, whether at the state, territory or Commonwealth legislative level. For example, the boundary plan for the Great Barrier Reef Marine Park incorporates all of the region's high priority nesting sites and approximately 20% of the foraging habitat. The Commonwealth's regional planning process for biological diversity with the creation of new marine reserves, as well as the various marine parks in the Northern Territory and the West, consider diverse marine turtle habitats (Dobbs *et al.*, 2007; DSEWPaC, 2012).

Australia has many terrestrial and coastal marine turtle habitats that deserve appropriate management for conservation. We cannot list here all the sites that would merit Ramsar designation. The excellent Australian Sea Turtle Recovery Plan (Boyle *et al.*, 2017) provides guidance for selection.

However, special attention should be given to important nesting beaches of *Natator depressus* since this species is native to this area. Crab Island, in the Gulf of Carpentaria, is one such site with approximately 3,000 flatback turtles laying eggs there each year (Sutherland & Sutherland, 2003). Major sites are also located at Barrow Is. (approximately 1,700 nests per season), Mundabullangana Station and Delambre Is. (Limpus, 2009).

Juveniles of *N. depressus* do not disperse like those of other species in oceanic waters, but grow in shallow, turbid waters of the Australian continental shelf (Walker & Parmenter, 1990). Some growing areas less than 6 m deep would likely require Ramsar classification. A recent study (Bella *et al.*, 2020) reports a sharp 57% decline in *Eretmochelys imbricata* clutches in 20 years on Milman Island, from 452 nests in the 1996-1997 season to 147 for 2016-2017. A management plan in the context of Resolution XIII-24 appears necessary.

We believe that a Ramsar classification of the Arnavon Islands (Solomon Is.) and neighboring islands (Wagina, Ausilala, Maifu, Balaka, Three Sisters) would be beneficial.

Classification of some of developmental and feeding habitats of Hawkbill turtle in New Georgia and Kolombangara would be wise.

Helen Reef (Republic of Palau) should be classified as a Ramsar site.

France and the New Caledonian government are responsible for a prodigious wealth of island habitats concerning *Chelonia mydas* and *Caretta caretta*. The d'Entrecasteaux atolls have been inscribed on the UNESCO World Heritage List since July 2008 and the whole area is classified as the d'Entrecasteaux Atolls Nature Park (decree n° 2013-1003/GNC of April 23, 2013), with a nature reserve classification except for the islet Le Leizour and the vegetated part of the islet Surprise, which are in reserves. It seems essential to us that the whole of the Entrecasteaux reefs and the Chesterfield-Bellona Plateau, a world hotspot for the Green turtle, be listed as Ramsar sites.

In the vast island complex of the Grand Lagon Sud, only the islets Kié and Améré have the status of Yves Merlet integral nature reserve. The Ramsar classification with a seasonal integral reserve of the islets most frequented by *C. caretta* during the nesting and emergence period, as proposed by WWF-France, seem to us appropriate measures. But it would also be necessary to classify the beach of the Roche Percée - Baie des Tortues, in Bouraï, and all the islets of the Ohland bay.

The Southern Pleiades, suitable for the nesting of *C. mydas* but physically difficult to monitor, would require more means in order to better know nesting frequency, and certainly also a designation.

Despite the theoretical application of the Environment Act of 2003 to some of the atolls in the Northern Group of the Cook Islands, and the local regulations based on that Act, we believe that Tongareva Atoll, at a minimum, should be submitted for Ramsar designation.

We can only encourage the Republic of the Fiji Islands to identify and propose sites for Ramsar listing, based on the report by Laveti *et al.* (2011), that would combine foraging and nesting habitats.

A cluster of several atolls in the northern Marshall Islands would merit Ramsar designation for their vital marine turtle habitats.

The Polynesian atoll of Tetiaroa and the Arnavon Islands (Sikopo, Kerehikapo, Big Maleivona, Small Maleivona), in the Solomon Islands, would merit a Ramsar designation. We lack quantitative information concerning many archipelagos of the South Pacific. We have indicated them here to evoke the need for possible Ramsar classifications.

It would be symbolically interesting to classify the Hawaiian islets of French Frigate Shoals as outstanding *basking* habitats and for their seagrass beds (Kawela Bay, Palaau, Kahului Bay) which are significant nursery and feeding habitats.

If the Republic of Kiribati is considering Ramsar designation of more of its islets, we recommend Kanton Island and Enderbury-Rawaki. Invasion of the Kiribati islands by accidentally introduced rodents and degradation of the reefs are emerging as threats to marine turtles.

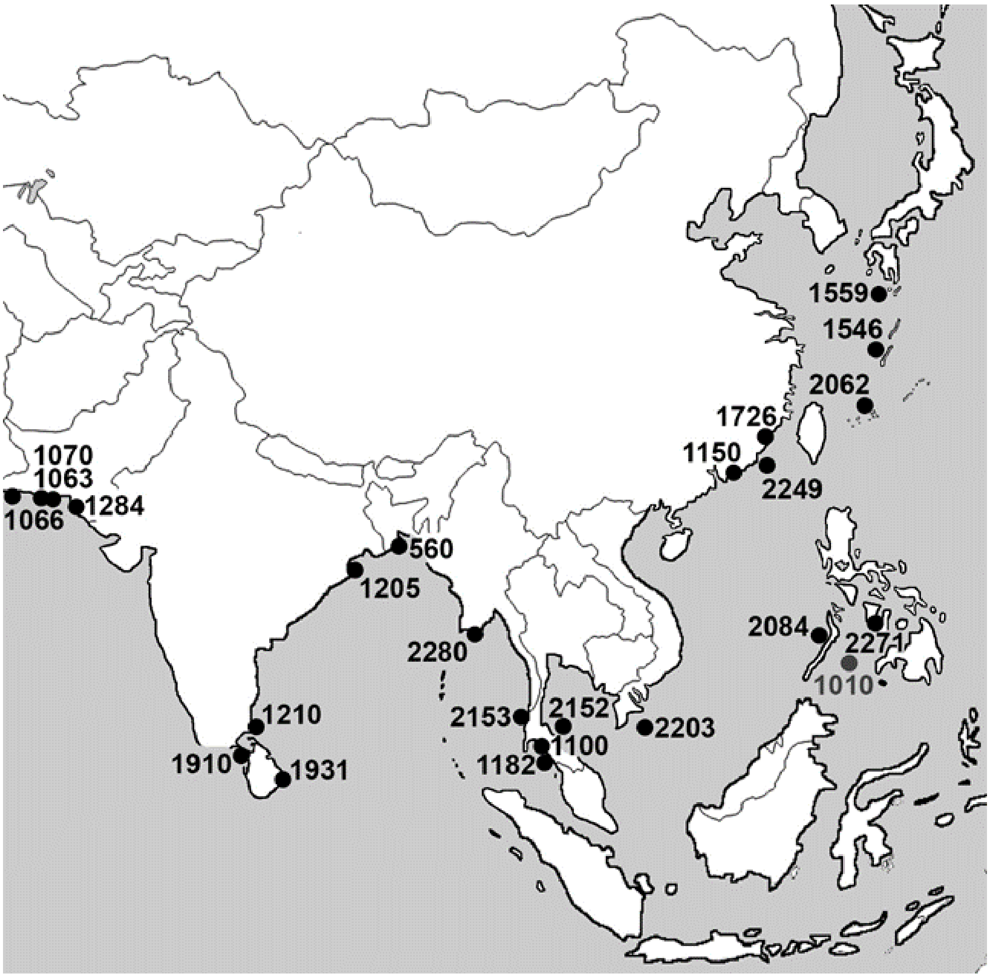
Maskelynes and Malekula Islands, with their large seagrass beds, extensive coral reefs and nesting beaches would merit a Ramsar designation.

The Australian management plan for Ramsar site 631 (Moreton Bay, Australia), with the quality of its recommendations, could serve as a model for the governance of the terrestrial and marine habitats of all the existing or future Ramsar sites inventoried here.

Photo 96. Female Leatherback nesting on the Huon coast, New Guinea
(© N. Pilcher)

REGION 8

Asia.



Map 11. Location of Ramsar sites in Asia.

Table X. Inventory of Asian sites

Site number	Contracting Parties	Administrative region	Site name	Species present
2203	Vietnam (Socialist Republic of Vietnam) Accession: 20/09/1988	Ba Ria Vung Tau	Con Dao National Park	Dc, Ei, Cm, Lo
1182	Thailand (Kingdom of Thailand) Signature: 13/05/1998	Trang Province	Had Chao Mai Marine National Park - Ta Libong Island Non-Hunting Area - Trang River Estuaries	Ei, Cm
2152	Thailand	Nakhon Sri Thammarat Province	Ko Kra Archipelago	Ei, Cm
1100	Thailand	Krabi Province	Krabi Estuary	Ei
2153	Thailand	Phang Nga Province	Ko Ra-Ko Phra Thong Archipelago	Lo, Cm, Ei, Dc
2192	Indonesia (Republic of Indonesia) Ratification : 08/04/1992	Central Kalimantan	Tanjung Puting National Park	Ei
1910	Sri Lanka (Democratic Socialist Republic of Sri Lanka) Accession: 15/06/1990	Mannar District	Vankalai Sanctuary	Cm, Lo, Cc
1931	Sri Lanka (Democratic Socialist Republic of Sri Lanka)	Ampara District	Kumana Wetland Cluster	Cm, Lo, Cc
2280	Myanmar (Burma) (Parliamentary Republic of Myanmar) Accession: 17/11/2004	Bogalay Township, Ayeyarwady Region	Meinmalha Kyun Wildlife Santuary	Ei, Cm, Lo
2421	Myanmar (Parliamentary Republic of Myanmar)	Rakhine State	Nanthar Island and Mayyu Estuary	Cm, Dc, Lo
1546	Japan (State of Japan) Accession: 17/06/1980	Kyushu/Okinawa Region	Kerama-shoto Coral Reef	Ei, Cm, Cc
1559	Japan (State of Japan)	Yakushima Island	Yakushima Nagata-hama	Cc, Cm
2062	Japan (State of Japan)	Miyako Island	Yonaha-wan	Ei, Cc, Cm
2249	China (People's Republic of China) Accession: 31/03/1992	Guangdong Province	Guangdong Nanpeng Archipelago Wetlands	Cc, Cm, Lo, Ei, Dc
1150	China (People's Republic of China)	Guangdong Province	Huidong Harbor Sea Turtle National Nature Reserve	Cm

1726	China (People's Republic of China)	Yunxiao County	Fujian Zhangjiangkou National Mangrove Nature Reserve	Ei, Dc, Lo, Cc
1010	Philippines (Republic of the Philippines) Accession: 08/07/1994	Sulu Sea	Tubbataha Reefs Natural Park	Ei, Cm
2271	Philippines (Republic of the Philippines)	Negros Occidental, Negros Island Region	Negros Occidental Coastal Wetlands Conservation Area (NOCWCA)	Ei, Cm, Lo
2084	Philippines (Republic of the Philippines)	Island of Palawan	Puerto Princesa Subterranean River National Park	Ei, Cm
1205	India (Republic of India) Accession: 01/10/1981	Odisha	Bhitarkanika Mangroves	Lo
1210	India (Republic of India)	Tamil Nadu	Point Calimere Wildlife and Bird Sanctuary	Ei, Lo, Cm
560	Bangladesh (People's Republic of Bangladesh) Acceptance: 21/05/1992	Khulna Civil Division	Sundarbans Reserved Forest	Lo
1063	Pakistan (Islamic Republic of Pakistan) Ratification: 23/07/1976	Balochistan Province	Astola (Haft Talar) Island	Cm, Ei ?, Lo ?
1066	Pakistan (Islamic Republic of Pakistan)	Balochistan Province	Jiwani Coastal Wetland	Lo, Cm
1070	Pakistan (Islamic Republic of Pakistan)	Balochistan Province	Ormara Turtle Beaches	Cm, Lo, Ei ?
1284	Pakistan (Islamic Republic of Pakistan)	Sindh Province	Indus Delta	Lo, Cm

Notes:

In Pakistan, a nursery habitat of *C. mydas* and *E. imbricata* off the *L. olivacea* nesting beach of Kancheepuram deserves appropriate conservation measures to avoid incidental capture in fishing nets (Dharini, 2010). The two beaches of Hawkesbay and Sandspit are also considered to be the most important in the Indian subcontinent with the annual arrival of about 6,000 females *C. mydas* for nesting (Kabraji & Firdous, 1984; Seminoff, 2002).

Photo 97. Adult male Hawksbill turtle in a coral habitat in Sabah state territorial waters
(© N. Pilcher)

Photo 98. Green turtle in a resting and cleaning habitat in the Maldives
(© N. Pelletier)

The Maldives is composed of 1,200 coral islands and atolls that represent a fine set of foraging habitats for *E. imbricata*. An underwater count conducted at eight reefs there counted the presence of Hawksbill turtles with a frequency of up to 2.5 sightings per hour (Ali *et al.*, 2016).

The Gahirmatha, Devi muhan and Rushikulya muhan *arribadas* on the coast of Orissa, (now Odisha) India, are estimated to be the largest in the world with simultaneous rises of 100,000-800,000 females *L. olivacea* (Bustard, 1976; Patnaik *et al.*, 2001; Mohanty *et al.*, 2004), although these exceptional numbers are sometimes disputed (Tripathy, 2002).

The Indian mangrove site of Bhitarkanika (20°39′N 086°54′E) (# 1205), with an area of 65,000 ha, is an exceptional wildlife sanctuary. Gahirmatha which is classified as a marine sanctuary within the Bhitarkanika National Park is located at the mouth of the Maipura River. Within this rookery, the part exploitable by the turtles on the site of the Nasi islands has fragmented because of the littoral erosion, the development of the human activities, the plantations of *Casuarina*.

Photo 99. Female Loggerhead returning to the sea after nesting at a Japanese site
(© Sea Turtle Association of Japan)

Photo 100. Arrival and departure phenomenon of female *L. olivacea* during an arribada in Odisha, India
(© K. Shanker)

Massive aggregations of turtles, especially of gravid females, are observed in front of the mouth of the Maipura River, which is assumed to be due to a wealth of prey. During the last decades, a number of development projects, as well as the establishment of coastal chemical industries and refineries, have endangered this breeding stock of *L. olivacea* through their effluents and discharges. Between 1994 and 2002, the anthropogenic mortality in this breeding stock was estimated by Tripathy at 90,000 turtles. The scientific community has widely once expressed its disagreement with the proposed construction of a port at Dhamra with a crude oil terminal at Rushikulya, as well as the planning of four to six other ports in this region, all of which bring new threats to all egg-laying sites in the region (Anon., 2000; Rodriguez & Sridhar, 2008; Shanker, 2008).

Nagapattinam (one of the 13 maritime districts of Tamil Nadu) is also a significant nesting area for *L. olivacea* with about 1,000 nests per season. But 95.6% of these nests are predated by Golden Jackal (*Canis aureus*) and many female turtles die accidentally in nets (Bhupathy, 2003; Sachithanandam *et al.*, 2015). Coconut plantations and erosion wall construction have also heavily impacted nesting habitats on the west coast.

Photo 101. Researcher Kartik Shanker in 2013 during an exceptional Indian arribada on the 6 km long Rushikulya beach in Ganjam district, Odisha. About 250,000 turtles can land on this beach in a few days, in groups of 10,000 females at a time
(© M. Khosla)

Photo 102. Close-up of an Olive Ridley laying eggs at the Rushikulya nesting hotspot. In order to avoid the digging up of eggs by the turtles themselves, many nests will be transplanted to hatcheries by the Rushikulya Sea Turtle Protection Committee
(© A. Swaminathan)

In Sri Lanka, four nesting *hotspots* are known and monitored: Rekawa (Kapurusinghe, 1996; Richardson, 1998), Kosgoda (Ekanayake *et al.*, 2010), Godawaya and Bundala National Park. In order of nest abundance, the Rekawa site 200 km from Colombo is 3.5 km of nesting habitat for *Chelonia mydas*, *Lepidochelys olivacea*, *Dermochelys coriacea* and *Caretta caretta*. Kosgoda Beach, which is 4 km long and located on the southwest coast, supports an average of 298 *Chelonia mydas* nests per year (Ekanayake *et al.*, 2010). Medilla Beach is not important as a nesting beach, but its reef area appears to be foraging habitat for the many females nesting on nearby Rekawa Beach. Similarly, the reef lagoon west of this Rekawa beach is an ideal busy resting habitat during the nesting season (Perera *et al.*, 2005).

We do not have relevant information regarding marine turtle habitats at sites # 1910 and # 1931.

In Myanmar (formerly Burma), based on the commercial exploitation of hundreds of thousands of eggs, Maxwell (1911) estimated that 5,000 *C. mydas* and 3,750 *L. olivacea* were nesting on Diamond Island (now Thamihla Kyun) at the mouth of the Pathein River, on Kaingthaung Kyun and Thaugkadun in the Ayeyarwady River estuary. More recent data (Thorbjarnarson *et al.*, 2000) indicate a drastic decline in the populations that used to lay eggs on these small islands.

Site 2280 is a coastal wetland located in the southern part of the vast delta of the Irrawaddy River (also called Ayeyarwady) which flows into the Andaman Sea. Only about 300 nests are counted in this region each year; 70% of them are *L. olivacea* nests, 20% are *Caretta caretta* nests and 10% are *Chelonia mydas* nests. The only remaining concentration in the area is on the beach of Thamihla Kyun with 20-30,000 eggs of Green turtles and 7-15,000 eggs of Loggerhead and Olive Ridley sea turtles each season.

In Bangladesh, nests of *L. olivacea* have been observed on beaches all along the mainland coast of Cox’s Bazar District, on adjacent islands on the south-central coast, as well as at Inani, Kochopia, Monkhali, and Teknaf along the southeastern mainland coast of the Teknaf Peninsula and Sonadia Island, on the southeastern coast of Kutubdia, Moheskhali, and St. Martin islands. Nests of *C. mydas*, in smaller quantities, are noted from these mainland coasts and some islands (Rashid & Islam, 1999; Hossain et *al.,* 2013). Nests of *C. mydas* and *E. imbricata* are less common in this region.

There are very few data on egg-laying in Sonadia and Kutubdia islands off the southeast coast and in the Sundarbans. Sonadia Island is located about 3.5 km northwest of Najirartek, Cox Bazar District. It is the main nesting site of *L. olivacea* and *C. mydas*.

Nest poaching, fisheries bycatch, beach and coastal dune degradation have significantly reduced breeding populations in Bangladesh. In addition, the expansion of *Casuarina* plantations on Sonadia Island by the Forest Department poses a serious potential threat to marine turtle nesting habitat between Paschimpara and Belekerdia. In India, *Casuarina* has been reported to cause a decline in nesting of *L. olivacea* (Mohanty 2002). Another threat is the development of a port at the northern end of Sonadia, with 58 jetties over a total length of 11 km.

Located in the Bengal Bay, the Indian islands of Andaman and Nicobar (6°45’- 13°41’N / 92°12’-93°57E) consist of 345 islands, islets and rocky outcrops. Extensive coral reefs and seagrass beds are exceptional feeding habitats for marine turtles (Das, 1996). Along the coast of Nicobar Island, seagrass beds cover shallow areas in South Bay, providing good feeding habitat for nesting Green turtles in the archipelago at several sites (Bhaskar, 1979). Concerning the nesting of *D. coriacea* in these archipelagos, two beaches are known in the Andaman and three on the east coast of Great Nicobar Island

(Tiwari, 1991; 1994). For the 2000-2001 season, the breeding stock that laid eggs was estimated at 483 females on Great Nicobar and 100 for Little Andaman (Andrews *et al.*, 2001). Andrews and Shanker (2002) more optically estimated that about 1,000 *D. coriacea* were nesting on Great and Little Nicobar, making it one of the largest nesting concentrations for the entire Indian Ocean. One of the most significant sites was on the west coast of Galathea Bay on Great Nicobar Island, but the habitat has been severely disturbed by very high anthropogenic pressure (sand mining, port construction, nest poaching, meat consumption, etc.) and the 2004 tsunami (Bhaskar, 1994; Namboothri *et al.*, 2012; Tiwari, 2012).

E. imbricata is known to nest on The Twin Islands, Rutland Island and Little Andaman Island.

The small uninhabited Thai island of Kra Yai, in the Ko Kra archipelago (# 2152), seems to be a good nesting site for *E. imbricata* and *C. mydas* in the Gulf of Thailand. The best rookery for these two species, however, seems to be on Khram Island (Chonburi Province) and possibly in Mu Ko Chang National Park. Off the coast of Songkla, Losin Island, would host in addition to the two species mentioned above, nesting of *D. coriacea* (Settle, 1995). Unfortunately, we have too few data for these islands which are mostly controlled sporadically by the Thai Navy.

Khram Island, Chonburi Province, is reported to be the most important egg-laying site for *C. mydas* and *E. imbricata* with 51 and 13 nesting females respectively in 1993, which is actually very few.

The Thai site # 2153 would provide both nesting and feeding habitats for four species: *C. mydas*, *L. olivacea*, *E. imbricata* and *D. coriacea*.

In Southeast Asia, Hawksbills turtles are less common than Green turtles, and their main egg-laying habitats are located in a limited number of areas, such as Melaka and Sabah (Chan, 2006; Chan *et al.*, 1999) in Malaysia and Vietnam (Stiles, 2009).

The Federation of Malaysia has six Ramsar sites on its west coast. These were classified because of their mangroves. We did not find any bibliographical references on the presence of marine turtles for these sites. Along the same western coast, the island of Penang (Pulau Pinang) hosts *C. mydas* and *L. olivacea* nesting sites, particularly the two beaches of Panta Kerachut and Telok Kampi (Salleh *et al.*, 2012).

Breeding populations of *D. coriacea* have collapsed in recent decades (Sarti Martínez *et al.*, 1996; Spotila *et al.*, 1996; 2000) to the point where the large Malaysian population appears to be on the brink of extinction (Chan & Liew, 1996). Between 1967 and 1976, 37,654 female landings were recorded on the 19 km long Rantau Abang beach in Terengganu State. The breeding stock was estimated (overestimated?) at 15,525 females, before the number declined (Chan & Liew, 1996). Over the past 30 years, the famous Leatherback population declined sharply from an estimated 2,800 to 6,500 nesting females each season in the late 1950s - mid-1970s (Chua, 1988), to only 30-50 females coming to nesting in the 1989 season (Mortimer, 1990), and to only 10 nests in the 2000s (Hamann *et al.*, 2006). It is functionally extinct. There has not been a nest in 13 years (N. Pilcher, pers. comm.)

In Malacca State (Melaka), the annual number of *E. imbricata* nests distributed on 20 beaches (20% in Padang Kemunting, 12% in Kem Terendak, 10% in Balik Batu, Palau Upeh, Meriam Patah) was estimated to be 481 and 463 for 2013 and 2014 (Salleh *et al.*, 2017), and then averaged 419 for the following years (Mortimer *et al.*, 1993; Salleh *et al.*, 2017).

In 1977, the State of Sabah established a marine protected area named Turtle Islands Park (TIP). This park includes three islands (Selingaan, Bakkungan Kecil, Guilisaan) and has a coverage of about 1,740ha of coral reefs and seagrass beds. In 1996, the TIP was combined with the Turtle Islands Wildlife Sanctuary of the Philippines (TIWS) to form a single, huge 318,000 ha transboundary marine park named Turtle Islands Heritage Protected Area (TIHPA). Three species nest in the TIP. The majority of nests (94%) are Green turtles, followed by Hawksbill nests (6%). Only five cases of *L. olivacea* nesting were recorded. The TIP has recorded over 260,000 Green turtle nests from 1979 to 2016. On Mantanani Island, off the northern coast of Sabah, juvenile and pubescent Green turtles have nursery habitats, and adults have foraging habitat (Pilcher *et al.*, 2019).

Photo 103. Spectacular departure to the sea of hundreds of Olive Ridley hatchlings from the nests on Rushikulya beach
(© S. Chakraborty)

Photo 104. Large male *C. mydas* in a feeding habitat in Turtle Islands Park, Sabah State
(© N. Pilcher)

Hawksbill turtles in the Sulu Sea gene pool nest primarily on nine beaches in the TIP, including Palau Gulisaan (about 90% of nests), Palau Selingan (about 8%), and Palau Bakkungan (about 5%). Regular or periodic nesting of the species also occurs on many islands in the Sesmporna region of Sabah, as well as on the Sulu and Celebes Sea (Chan *et al.*, 1999). For Malaysia as a whole, the Sabah islands hold the most Hawksbill nests with a total of 400-600 per year.

In Indonesia, scattered nests of *E. imbricata* are observed on more than 205 islands. From one to 10 nests were found on 196 islands, from 11 to 50 nests on 56 islands, between 51 and 100 nests on nine islands, and more than 101 nests were recorded on eight islands (Suganuma, 2005). Five of the islands in Kepulauan Seribu (Peteloran Timur, Penjaliran Timur, Gosong Pengat, Penjaliran Barat, Peteloran Barat), in Jakarta Bay, host the egg-laying of about 500 *E. imbricata,* but this number seems to be decreasing significantly. The islands of Bangka Belitung Province used to have 1,100 nests annually, and the islands of South Sulawesi between 3,000 and 4,000 nests (Groombridge & Luxmoore, 1989), but few recent data exist. A survey by Tanaka *et al*. (2013) notes 672 nests for 2006 and 838 in 2010 on Pulau Sambergelap. Putrawidjaja (2000) reports *E. imbricata* nests on five islands in Cendrawasih Bay: Nusambier, Iwari, Kuwom, Matas, Wairundi. This bay of Cendrawasih which has tens of thousands of hectares of coral reefs is certainly an important feeding habitat for the species. The Indonesian archipelago of Raja Ampat has some 1,500 islands off the coast of West Papua. Very little information is available about the presence of marine turtles in this archipelago, only that it is very rich in nesting and feeding habitats for several species, mainly *E. imbricata* and *C. mydas*.

The provinces of East Java, South Kalimantan and South Sulawesi were known in the 1980s to represent important rookeries for the Hawksbill turtle. From 5,050-5,450 nests, Sumatra Selatan has dropped to 1,300 nests; from 3,000-4,000 nests, Sulawesi Selatan now hosts only 100 nests.

In the Philippines, the Tubbataha site (#1010), isolated in the middle of the Sulu Sea, is an important marine developmental habitat for juvenile and sub-adult Green and Hawksbill Turtles. This site is safe from anthropogenic threats. It is unknown whether adult female turtles belong to the same genetic stock as juveniles and grow up and nest at Tubbataha, or whether they are a genetically distinct set that migrate to Tubbataha for egg-laying and depart elsewhere to another feeding area (Thomas *et al.*, 2017).
E. imbricata nests in a scattered and diffuse manner on the Panikian and Calamian Islands. In the Calamian Archipelago, nesting, nursery, and feeding habitats such as coral reefs and seagrass beds are numerous and are frequented by other species as well (Poonian *et al.*, 2016). The Gulf of Lagunoy, in the Bicol area, includes significant developmental habitat for the Hawksbill turtle (Cruz, 2002). Concentrations of this species are also noted at Romblon Island and in the Gulf of Davao (Marine Wildlife Watch of the Philippines, 2014).

West of Taiwan, in the Peng-Hu Archipelago, Wan-an Island has nine beaches where *C. mydas* lays (Cheng & Cheng, 1995). A second, perhaps more significant area worthy of ranking for nesting of the species is on Lanyu Island (Orchid Is.) 75 km southeast of Taiwan, mainly on Badai, Big Badai and Donchin beaches (Cheng *et al.*, 2009).

In the North Pacific, the majority of *C. caretta* nest between 24 degrees and 37 degrees north latitude. Uchida & Nishiwaki (1981) report the nesting of three species in the East Asian island region: *Caretta caretta, Chelonia mydas and Eretmochelys imbricata*. Loggerhead is found throughout the main Japanese islands (excluding the Hokkaido distict) and especially in the extreme northeast of the Ryukyu Archipelago (Kamezaki, 1989).
Yakushima (# 1559) is a small Japanese island located 60 km south of Kyushu Island at the northern end of the Ryukyu Archipelago. The Loggerhead nests northwest of Yakushima on the three beaches of Maehama, Inaka-hama, and Yotsuse-hama (Okano & Matsuda, 2013). These sites with a total length of 1.2 km are collectively named Yakushima Nagata-hama (or Nagatahama). These beaches are the most important nesting habitats for the species in the North Pacific. It is estimated that 2,000 to 3,000 females come to lay eggs there each year (report in Japanese Yakushima Umigame-kan, 2013). Nagatahama was designated as a National Park in 2002.

Photo 105. *C. mydas* juvenile male in the Papua Passage, Rarotonga, Cook Islands
(© M. White)

In Japan, several sets of *C. mydas* nesting habitats are located in Yakushima Island, the Yaeyama Group, the Ogasawara Group and the Ryukyu Archipelago. The coastal waters of the islands, along the strong Kuroshio Current, provide numerous feeding habitats for juvenile, subadult and adult Green turtles (Suganuma, 1987). These feeding areas accommodate locally breeding adults but also individuals from several distant rookeries in the western Pacific, Indian Ocean and Southeast Asia (Nishizawa *et al.*, 2013). Turtles nesting in the Ogasawara rookeries are primarily found in the Nomaike, Muroto, and Kanto feeding habitats (Nishizawa, 2013).

Northern end of the Ryukyu archipelago, Yakushima Island, which has been designated as a biosphere reserve and world heritage site, has a rich biodiversity and a culture that depends on the local ecosystem. The biodiversity of this island is characterized by a unique biota because the island is located at a biogeographic boundary. Yakushima Island is located at the biogeographic boundary of the northern limit of the subtropical zone and the southern limit of the Palearctic zone; every year, Loggerheads (*C. caretta*) come to nest on the beautiful white sandy beaches made of shaved granite sand on the northwest coast of Yakushima, in Nagata: Maeha-ma, Inaka-hama and Yotsuse-hama. As these beaches have the largest number of turtle nests in the North Pacific, they are crucial to the life cycle of the turtle. The three beaches, collectively called "Nagatahama" have been designated as protected wetlands.

The South China Sea includes hundreds of islands, atolls, coral reefs and cays that provide significant nesting and feeding habitats for marine turtles, but knowledge of turtles at these sites is still very limited. For example, the Nan-sha archipelago alone is composed of 102 coral islands and atolls. The Chinese Navy occupying the island of Taping Tao estimates that each year this island can host up to a hundred nests of

C. mydas and *E. imbricata*. If the use of the 101 other islands and atolls is of the same order, the Nan-sha archipelago as a whole may prove to be an important nesting area in the South China Sea (Cheng, 1996).

The Chinese site of Huidong Harbor Sea Turtle National Nature Reserve (# 1150) has been a nature reserve since 1992. The beach, only 1 km long, hosts 400 to 500 female *C. mydas* each season.

Proposed actions by experts J. Fretey and P. Triplet

In order to diversify and enrich its catalog of listed wetlands, the State of Malacca could nominate the Turtle Island sites, such as Padang Kemunting and Kem Terendak, as outstanding marine turtle nesting habitat.

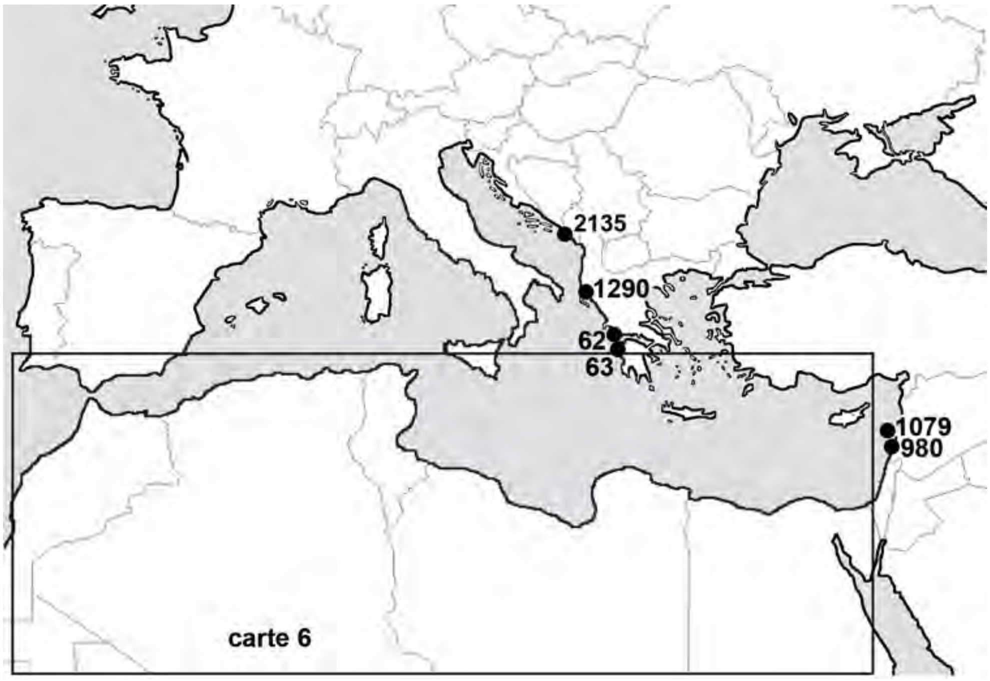
Several sites in Sabah, in the Turtle Islands Heritage Protected Area for *C. mydas* and islands in the Sesmporna area for *E. imbricata*, could be proposed for Ramsar designation.

In Sri Lanka, the coastal wetlands comprising the Rekawa lagoon (250 ha) and the system of canals that bring irrigated fresh water into this brackish water lagoon are rich in mangroves. Several beaches and subtidal areas in the same region, between Tangalie and Pilinnawa, including the Rekawa and Godawaya hotspots, would be classified with these mangroves and lagoon as outstanding habitats.

On the Japanese island of Ishigaki, in the Ryukyu archipelago, the significant beach of Ibaruma would deserve the Ramsar classification. This beach, 3 km long, hosts each year about 600 nests (about 76% *Chelonia mydas*, 17% *Caretta caretta* and 2% *Eretmochelys imbricata*) (Abe *et al.*, 2003).

REGION 9

Mediterranean.



Map 12. Location of Ramsar sites in the Mediterranean.

Photo 106. Loggerhead in its pelagic habitat in the Mediterranean (© L. Laurent)

Table XI. Inventory of Mediterranean sites

Site number	Contracting Parties	Administrative region	Site name	Species present
2135	Montenegro (Parliamentary Republic of Montenegro) Notification of succession: 26/04/2007	Tivat Municipality	Tivat Saline (Tivatska solila)	Cc
1898	Algeria (People's Democratic Republic of Algeria) Accession: 04/11/1983	Béjaïa, Région de la Kabylie	Vallée de l'oued Soummam	Cc
1961	Algeria (People's Democratic Republic of Algeria)	District d'Ain Témouchent	Ile de Rachgoun (Wilaya de Aïn Temouchent)	Cc; Dc?
980	Lebanon (Republic of Lebanon) Accession: 16/04/1999	District de Tyr	Tyre Coast Nature Reserve	Cc, Cm
1079	Lebanon (Republic of Lebanon)	District de Tripoli	Réserve Naturelle des Iles des Palmiers	Cc, Cm, Dc
1290	Albania (Republic of Albania) Accession: 31/10/1995	District de Vlora	Butrint	Cc, Dc
1473	Morocco (Kingdom of Morocco) Signature: 20/06/1980	Province de Nador	Cap des Trois Fourches	Cc
1704	Tunisia (Tunisian Republic) Accession: 24/11/1980	Gouvernorat de Sfax	Iles Kneiss avec leurs zones intertidales	Cc
2012	Tunisia (Tunisian Republic)	Gouvernorat de Sfax	Iles Kerkennah	Cc, Cm, Dc
1026	Libya (State of Libya) Accession: 05/04/2000	Jabal al Akhdar District	Ain Elshakika	Cc
1027	Libya (State of Libya)	Jabal al Akhdar District	Ain Elzarga	Cc
62	Greece (Hellenic Republic) Accession: 21/08/1975	Région d'Aitoloakarnania	Messolongi Lagoons	Cc, Cm
63	Greece (Hellenic Republic)	Dytiki Ellas	Kotychi lagoons	Cc

407	Egypt (Arab Republic of Egypt) Ratification: 09/09/1988	Gouvernorat du Sinai Nord	Lake Bardawil	Cc, Cm
408	Egypt (Arab Republic of Egypt)	Gouvernorat de Kafr el-Cheik	Lake Burullus	Cc, Cm
2311	Italy (Italian Republic) Ratification: 14/12/1976	Tuscany Region	Massaciuccoli lake and marsh	Cc
657	Turkey (Republic of Turkey) Accession: 13/07/1994	Province de Mersine	Göksu Delta	Cc
943	Turkey (Republic of Turkey)	Province d'Adana	Akyatan Lagoon	Cc, Cm
1619	Turkey (Republic of Turkey)	Province d'Adana	Yumurtalik Lagoons	Cc, Cm

Notes:

Casale *et al*. (2018) consider that there are 52 major nesting habitats for *Caretta caretta* and 13 for *Chelonia mydas* in the Mediterranean. These are located in Turkey, Cyprus and Syria. Sites of lesser importance are inventoried in Egypt, Lebanon and Israel.

In the Mediterranean Sea, 96% of the regular and notable *C. caretta* nesting activities are observed in Cyprus, Greece, Libya and Turkey. The hotspots are the island of Zakynthos and the bay of Kiparissia (Greece), Belek and Anamur (Turkey) and Chrysochou Bay (Cyprus). Concerning the Green turtle, 13 major rookeries are located in Turkey, Cyprus, Crete and Syria with smaller occurrences in Egypt, Lebanon and Israel. Akyatan beach in Turkey hosts 20% of the total nests in the Mediterranean (Casale *et al*., 2018).

Photo 107. First historical photo of a Loggerhead nesting in Kiparissia Bay in 1977
(© Y. Lanceau)

In the 2000s, the seasonal average number of *Caretta caretta* nests at the major sites is 1,084 on the island of Zakynthos and 987 South of Kyparissia in Greece, 269 at Dalyan in Turkey, 239 in Chrysochou Bay in Cyprus. The Turkish beach of Akyatan (site # 943) hosts an average of 319 *Chelonia mydas* nests annually for 255 on Kazanh beach and 212 on Samandağ beach (Casale *et al.*, 2018).

Margaritoulis (2000) described the importance of the island of Zakynthos as the most important Mediterranean nesting habitat with the excavation of 857 to 2,018 nests per season. The island has, in the bay of Laganas, six distinct beaches with a total length of about 5 km: Gerakas, Daphni, Sekania, Kalamaki, E. Laganas and islet Marathonissi. Sekania is classified as one of the highest nesting concentrations of Loggerheads in the world.

Tourism exerts significant pressure on these nesting habitats (Arianoutsou 1988; Katselidis & Dimopoulos 2000). Since 1983, the number of tourists has increased twenty-fold, reaching over 380,000 in 1999, while the resident Greek population of the island is only 30,000. Approximately 50% of the tourist facilities on the island are located in the bay of Laganas (Dimopoulos, 2001). Despite various attempts by NGOs and the European Union since 1984 to protect the bay from coastal development for mass tourism, construction has increasingly encroached on the once wild Daphni beach. European complaints against Greece and the creation of the Zakynthos Marine National Park have partially resolved the situation, properly monitoring the beaches and controlling garbage, with much needed educational signage. But the construction of new roads and infrastructure on Zakynthos show that this site remains in peril (Venizelos & Robinson, 2006-2007).

Kyparissia Bay in the western Peloponnese, comprises a 44 km beach from the Alfios River in the north to the Arcadikos River in the south; 84% of nests are concentrated in the southernmost 9.5 km (Margaritoulis *et al*., 2015).

The Turkish coast on the Aegean and Mediterranean Sea is 8,333 km long; out of 606 km of beaches, only 20% are good nesting habitats (Baran, 1989). Türkozan *et al*. (2003) and Aymak *et al*. (2005) inventoried 20 Loggerhead nesting beaches in Turkey: Ekincik, Dalyan, Dalaman, Fethiye, Patara, Kumluca, Kale, Tekirova, Belek, Kizilot, Demirtaş, Gazipaşa, Anamur, Göksu Delta, Kazanlĭ, Akyatan, Samandağ, Later, Alata, Yumurtalik. Türkozan *et al*. (2003) estimate that on an annual average the entire Mediterranean coast of Turkey hosts 1,267 Loggerhead nests, which is about 25% of the clutches for the entire Mediterranean. Dalyan beach alone contributes 11.9% of Turkish nests (Canbolat, 2004).

The seasonal number of *Chelonia mydas* nests on Turkish beaches varies between 452 and 2,051 with Sugözü, Alata, Kazanlĭ and Samandağ as the main beaches (Türkozan & Kaska, 2010).

Photo 108. Nesting habitat of *C. caretta* in Turkey, at Patara beach
(© O. Turkozan)

Photo 109. Turkish beach of Dalyan
(© O. Turkozan)

Photo 110. Landing of Dalyan beach by a female Loggerhead
(© O. Turkozan)

On Cyprus, 88 beaches are nesting habitats for marine turtles. In the area under Turkish governance, the entire coastline from Magosa Bay (Famagusta) to the east of Guzelyurt Bay (Morphon) is used by *Caretta caretta* for nesting. The most frequented beaches are Alagadi (Alakati) for 17.3%, Akdeniz (Ayia Irini) for 10.3%, and Talisu (Akanthou) for 10.3%. Main nesting beaches for *Chelonia mydas* are north and south of Karpaz, and in Alagadi (Fuller *et al.*, 2010). According to Broderick *et al.* (2002), this area hosts about

30% of total Green turtle and 10% of Mediterranean Loggerhead nesting. For the western part of the island, there are five beaches where Green turtles and Loggerheads nest together. But the nests of *C. caretta* are mainly concentrated on the 12 km of eight beaches in the bay of Chrysochou. During the 2004 season, the number of females nesting in this bay was estimated at 300. The population of Green turtles nesting in Chrysochou Bay and nearby beaches (Lara-Toxeftra, Potima, Paphos airport) is estimated at 100 females (Demetropoulos & Hadjichristophorou, 2010).

Photo 111. Aspect of Ronnas Bay, Cyprus, during the 90s
(© Marine Turtle Research Group, University of Exeter)

Photo 112. On a Cypriot beach, a Green turtle has dug its body bowl between the numerous garbage of the beach
(© Marine Turtle Research Group, University of Exeter)

Caretta caretta nesting in southern Lebanon, with 21 to 100 nests per season, is considered to be of medium importance (Margaritoulis, 2000). The same is true for *Chelonia mydas* nesting (Kasparek *et al.* 200). Only Tyre beach is classified as a Ramsar site (# 980). It has been protected since 1998 as Tyre Coast Nature Reserve but is divided in two due to the presence of about 7,000 displaced Palestinians (Rashidieh Palestinian Settlement). The other part is polluted at night by the lights of many restaurants for tourists. The actions of MEDASSET[13] and the MedWetCoast[14] project ensure however a good conservation of the females coming up to lay eggs.

Further south, El Mansouri beach on the border with Israel, 1.4 km long, is identified as the main nesting site for marine turtles in this area. In 2005, 51 nests of *C. caretta* were counted there for a single nest of Green turtle on Tyre beach (Cross & Bell, 2005).

The Palm Islands (# 1079) were classified as a marine reserve in 1992. The surrounding waters are said to host the overwintering of Green turtles, but we did not find any documentation on this subject.

Photo 113. Nesting habitat at Sekania, on the island of Zakynthos
(© J. Fretey)

Libya, with its 1,450 km of poorly surveyed coastline, likely has a high level of Loggerhead nesting activity (Hamza, 2010). Casale (2020) cites an average number of 681 nests for the 2006-2007 season with five major sites and 23 minor sites.

The Kuriat islands, in the Gulf of Hammamet in Tunisia, are 2 km apart from each other, 18 km east of Monastir. The smallest, named Qûrya Essaghira (Kuria Sgihra or Conigliera), has an area of about 0.7 km^2 and the largest, Qûrya el Kebira (Kuria Kbira),

[13] Mediterranean association to save the sea turtles.
[14] Project for the Conservation of Wetlands and Coastal Ecosystems in the Mediterranean region.

2.7 km^2. The annual number of nests on Kuria Kbira can be around 30 for *C. caretta*. The average number of nests on the small island is 3.7. The expansion of tourist camps has led to the proliferation of black rats, which are a threat to newborn Loggerheads (Jribi & Bradai, 2014).

Photo 114. Loggerhead hatchling stuck in the beach rocks of Sekania beach, Zakynthos Island
(© J. Fretey)

Dispersal of juvenile *C. mydas* smaller than 30 cm is thought to occur in the Levantine Basin and has been reported in Fethiye Bay in western Turkey (Türkozan & Durmus, 2000), Northern Cyprus (Snape et *al.,* 2013), Lakonikos Bay (Margaritoulis & Panagopoulou, 2010) and Patok Bay in Albania (Haxhiu, 2010).

Winter aggregations of lethargic *C. caretta* have been observed on soft bottoms with *Posidonia oceanica* at a depth of 25 to 50 m in the Mediterranean Sea in the Bay of Lakonikos in the Peloponnese (Greece), in the northern Adriatic, in the Aeolian archipelago north of Sicily, in eastern Turkey, off the Kuriates Islands (Tunisia) and elsewhere in the Gulf of Gabes between Sousse and Libya (Margaritoulis *et al.,* 1992; Argano and Cocco *in:* Groombridge, 1990; Laurent & Lescure, 1994 ; Argano and Cocco *in:* Groombridge, 1990 ; Gruvel, 1931 ; Laurent & Lescure, 1994).

The northern Adriatic Sea is one of the most important feeding habitats for Loggerheads in the Mediterranean basin, inhabited by juveniles and adults belonging primarily to the Ionian-Adriatic population. Recruitment occurs in the northern Adriatic at small sizes, but the habitat use and movements of juveniles, which make up the bulk of this population, are unknown (Lazar *et al.*, 2019).

Proposed actions by des experts J. Fretey and P. Triplet

The recent discovery of the importance of the Turkish beach of Davulepe (Ergene *et al.,* 2016), in the southwestern province of Mersin leads us to propose its designation. This 2.8 km long beach has hosted 632 *Chelonia mydas* nests and an annual average of 4.8 *Caretta caretta* nests since monitoring began.

On Cyprus, coastal development brings a lot of pollution on the beaches and also photopollution, and sand extraction causes strong erosion. We recommend the Karpaz peninsula for Ramsar designation. To the west, the areas of Polis-Limni and Yialia, in Chrysochou Bay, have been declared a Natura 2000 site; we think it would be wise to complete this label with a Ramsar classification of the entire bay.

Kuriat islands in Tunisia, with their internationally important birdlife and rich marine biodiversity, are all the more deserving of a Ramsar classification as they are the most important nesting site for Loggerheads in Tunisia and one of the most important in the southern Mediterranean.

We see here with the example of the Mediterranean overwintering in the bay of Lakonikos in the Peloponese, at a depth of more than 25 m, that the Ramsar resolution on the habitats of marine turtles has limits of application for their management, and that the Bonn Convention is not suitable either to ensure a good conservation of habitats of a migratory species like the Loggerhead.

Loggerhead cleaning stations, on sandbanks off Zakynthos Island in Laganas Bay (37°43’ N, 20°52’ E), at a depth of about 2.5 m and about 100 m from the coast (Schofield *et al.*, 2006; Papafitsoros and Schofield, 2019; Schofield *et al.*, 2017) would merit Natura 2000 classification and marine national park status over a wide marine strip with a Ramsar classification, with strict prohibition of motorized craft from entering.

RAMSAR SITES AND CONSERVATION OF MARINE TURTLES

« The first site designated to the Ramsar Convention in 1974, Cobourg Peninsula, hosted marine turtles »

5-2 Analysis

This analysis includes 261 sites in 77 countries (Figure 6). Thirty-one countries have only one Ramsar site hosting marine turtles and only one, Mexico, has designated 63 sites hosting at least one species. Australia is far behind with 13 sites and Brazil has 11. France, despite its maritime surface of 11,614,000 km^2 and a large number of breeding sites in all oceans, ranks fourth, together with the Netherlands, in number of sites, with eight, all in the Overseas Territories: Grand Cul-De-Sac Marin (Guadeloupe); Wetlands and marine areas of Saint-Martin, Basse-Mana (Amana Reserve) and Sinnamary River estuary (French Guiana), Etang des Salines (Martinique), Moorea Lagoon (French Polynesia), Vasière des Badamiers (Mayotte), Europa Island (Eparses Islands, French Southern and Antarctic Territories).

77

countries have a responsibility for marine turtle future

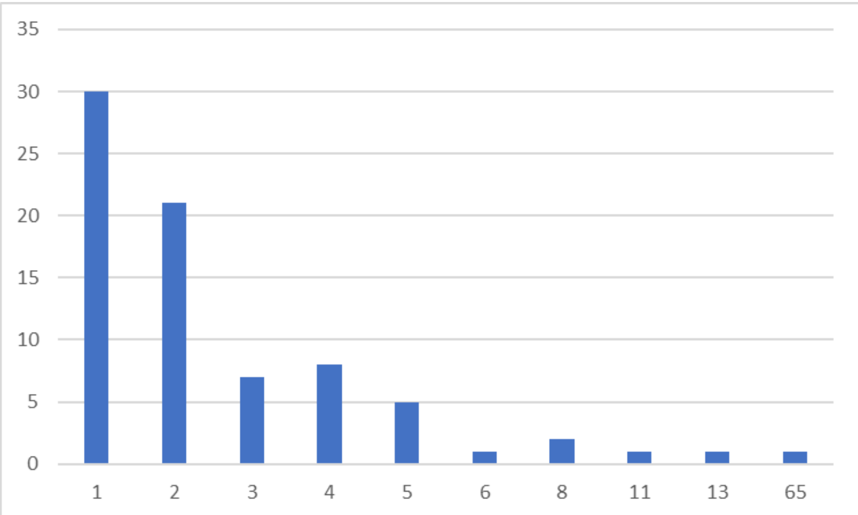


Figure 6. Distribution of countries by number of designated Ramsar sites with marine turtle habitats.

In terms of surface area, there is great disparity between sites (Figure 7). The surface areas of Ramsar sites hosting marine turtles range from 5.3 ha (Hawar Islands, Bahrain) to the Amazon Estuary and its Mangroves site (Brazil), which covers 3,850,253 ha.

The class of surfaces between 2,000 and 5,000 ha is the one with the most sites (24). However, there is no bell-shaped distribution of the different surfaces, all cases being possible between the two extremes above.

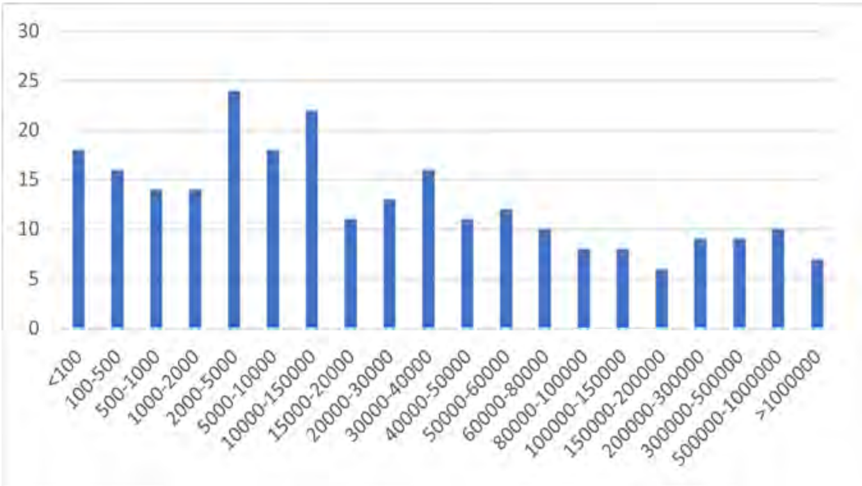


Figure 7. Distribution of Ramsar sites hosting marine turtles according to their surface.

The creation of Ramsar sites hosting marine turtles is not recent, as the first site designated to the Ramsar Convention in 1974, Cobourg Peninsula, hosted marine turtles (Figure 8). But it was only ten years later that the second site was created. However, it was with the Amana site (French Guiana), designated on 8 December 1993 from the data sheet written by one of us (JF), with 59,000 ha, that a designation was made with the main purpose of preserving a world nesting site for a species of marine turtle, in this case *D. coriacea*.

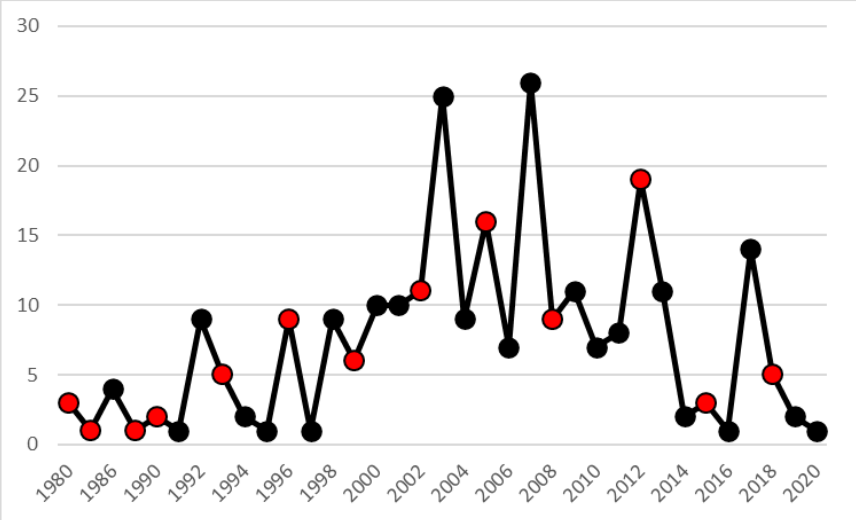


Figure 8. Graphical representation of the years of Ramsar sites labelling hosting marine turtles. The date of the first site labelling, in 1974, is not indicated in order to maintain the coherence of the figure.
Red dots symbolize the years of the Conferences of the Parties. It can be seen that these do not lead to more designations. Similarly, after the 2018 Conference of the Parties and the adoption of the marine turtle resolution, there has not yet been any momentum for new site designations.

Since then, the creation of sites has shown significant fluctuations and saw its maxima of designations in 2003 and 2007 with 25 and 26 sites hosting marine turtles labeled in each of those years. The goal of the resolution passed in October 2018 is to spur the labeling of more sites, which, from Figure 8, is not yet the case.

The number of species per site is two at 71 sites. Fourteen sites host five species and only one, Cobourg Peninsula in Australia hosts six species (figure 9).

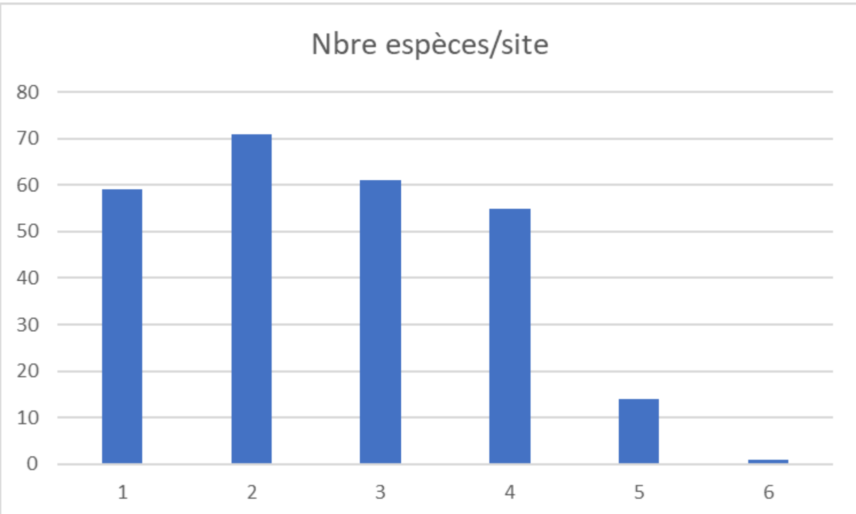


Figure 9. Number of sites hosting marine turtles by number of species at sites.

Ranking the species according to the number of Ramsar sites where they are present indicates that *Chelonia mydas* is present at 165 of the 261 sites. Conversely, *Natator depressus* is only found at six sites, all of which are in Australia (Figure 10).

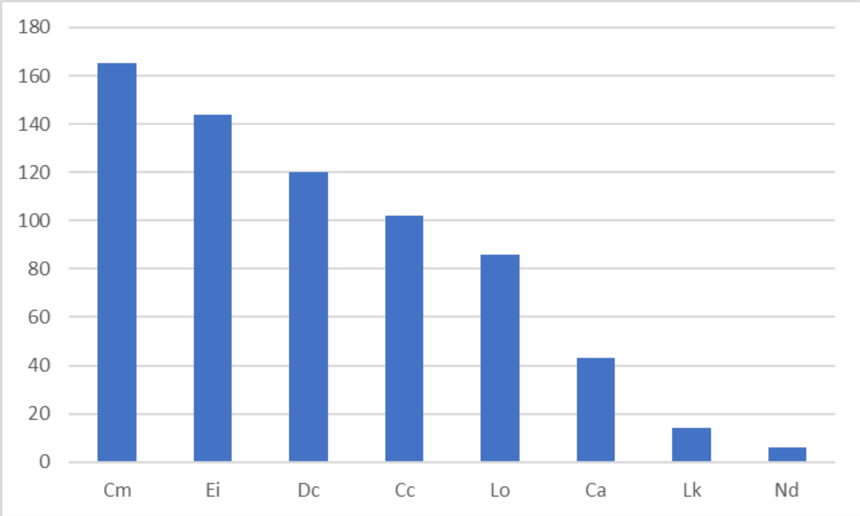


Figure 10. Number of sites hosting each of the marine turtle species.

Curiously enough, six sites did not use any criteria for their designation. These are sites whose data sheets have not yet been updated since the sites were designated. Figure 11 shows that sites are designated with four to six criteria. Sixteen sites are based on only one criterion, which is generally to be avoided because of the risk that one day the site will no longer meet it, while two sites are considered to meet them.

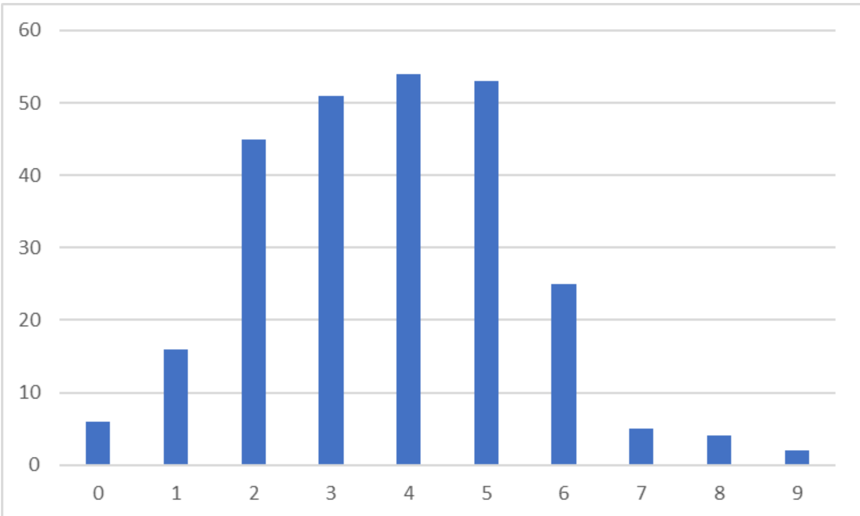


Figure 11. Distribution of sites hosting marine turtles based on the number of designation criteria used for each site.

Designation of sites to the Ramsar Convention is only possible if the site meets at least one of the nine criteria listed in Table XII. Criterion 2 is the most appropriate one to consider marine turtles because it allows for listing based on the vulnerability status of species other than birds.

Table XII. Characterization of the criteria for identifying Ramsar sites

Group	**Ramsar criterion**	**Criterion title** "A wetland should be considered internationally important if..."
Wetland type	1	It contains a representative, rare or unique example of a natural or near-natural wetland type from the biogeographic region concerned
Species or ecological communities	2	It is home to vulnerable, endangered or critically endangered species or threatened ecological communities
	3	It is home to populations of animal and/or plant species that are important for maintaining the biological diversity of a particular biogeographic region
	4	It is home to plant and/or animal species at a critical stage of their life cycle or if it serves as a refuge under difficult conditions
Water birds	5	It is usually home to 20,000 or more waterbirds
	6	It usually supports 1% of the individuals in a population of a waterbird species or subspecies
Fish	7	It supports a significant proportion of native fish subspecies, species or families, individuals at different life stages, interspecific interactions and/or populations representative of wetland benefits and/or values and thus contributes to global biological diversity
	8	It serves as an important fish food source, nesting area, nursery area, and/or migration route on which fish stocks within the wetland or elsewhere depend
Other species	9	It regularly supports 1% of the individuals in a population of a non-avian wetland-dependent animal species or subspecies

The resolution adopted in October 2018 in Dubai calls for the use of Criterion 2 to both update existing sheets and to argue for the designation of new sites. It should be noted that 250 of the current sites hosting marine turtles are based in part on this Criterion 2, which is the criterion most used when drafting Ramsar fact sheets (Figure 12). Criterion 4, which can also be used since it concerns sites hosting species at a critical stage of their life cycle, is the second criterion cited in the description sheets, with 195 mentions; this indicates that the vast majority of those who drafted the site sheets took into account the presence of marine turtles in their approach. In the framework of the updating of the Ramsar files, it would be important that each of the sites hosting marine turtles mentions criterion 2.

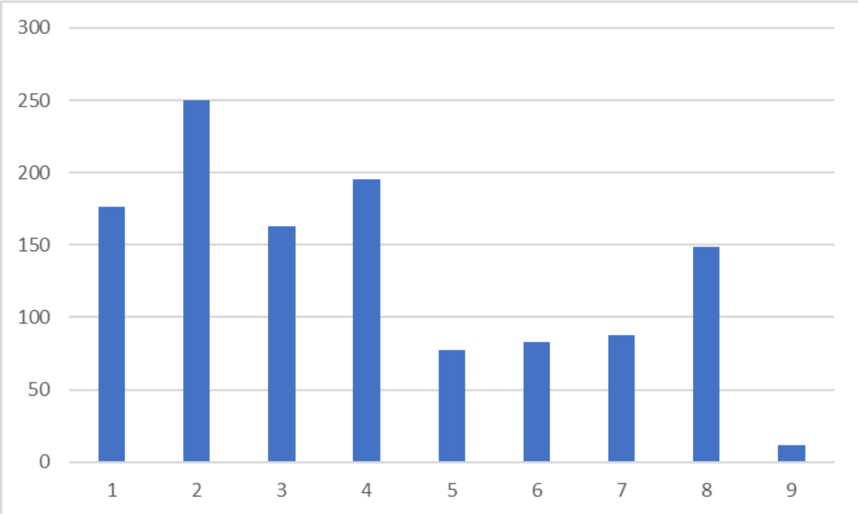


Figure 12. Distribution of sites according to the use of each of the criteria for defining a Ramsar site.

The habitat most regularly mentioned in the data sheets (XIII) is the type "fine, coarse or pebble sand shores", which is mainly used for nesting species. The second category corresponds to mangroves associated with tropical areas. Overall, the environments designated to the Ramsar Convention are therefore sandy beaches, often near mangroves, with shallow and permanent water.

Table XIII. The different habitat types reported in the Ramsar descriptive sheets

Code	Type of habitat	Number of mentions
E	Fine, coarse or pebble sand shores	170
I	Intertidal forested wetlands	153
A	Shallow and permanent marine waters	145
J	Coastal brackish/salt lagoons	121
F	Estuarine waters	110
B	Subtidal aquatic marine beds	107
H	Intertidal marshes	105
G	Intertidal mudflats, sandbanks or salt flats	101
C	Coral reefs	84
D	Rocky marine shores	74

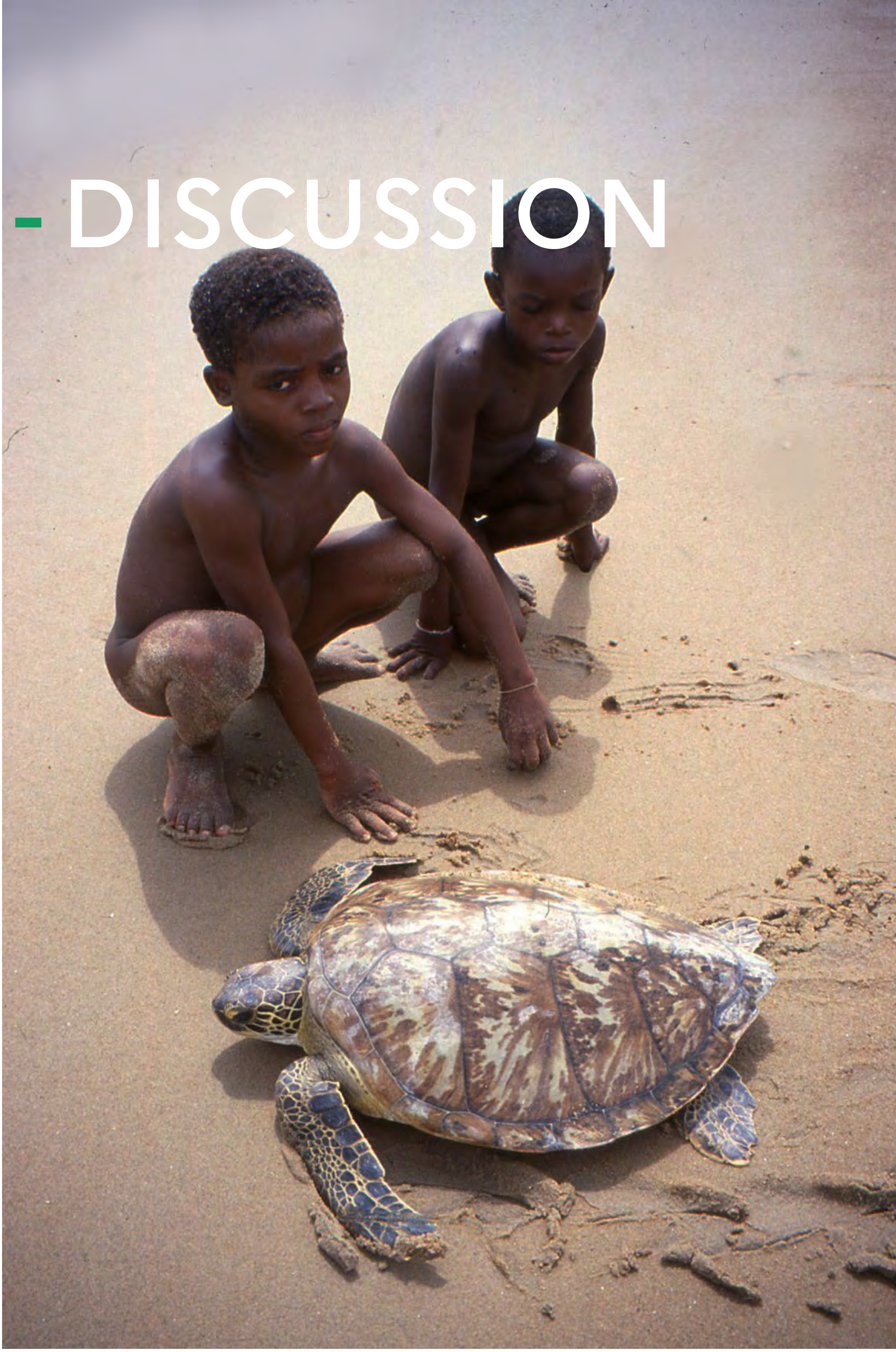
The last descriptive element of the Ramsar sites is the different threats they face (Table XIV). For this purpose, we have used the nomenclature of the information service on Ramsar sites, reclassifying the elements provided on each sheet. For those that had been written a long time ago and had not been updated, the description of threats was not standardized, which offered the advantage of great precision when one was interested in one or a few sites, but had the disadvantage of not being able to be compared. Thus, the term "use of biological resources" includes fishing, hunting and their corollaries, overfishing and intensive hunting, poaching, but also the capture and destruction of turtles and their eggs, while the term "pollution" includes several elements: water, liquid and solid pollution, etc. The old nature of a certain number of sheets does not allow us to determine whether the threats described still exist, have worsened or whether solutions have been implemented to reduce them. This table can therefore only be provided as an indication and confirms the need to update the Ramsar descriptive sheets in order to truly characterize the various current threats.

Table XIV. Classification of the different categories of threats recorded on the descriptive sheets

Threats	Number of cases
Use of biological resources	145
Pollution	140
Anthropogenic intrusions and disturbances	107
Human settlements (non-agricultural)	85
Modification of natural systems	67
Climate change and severe weather	40
Energy production and mining	19
Invasive or problematic species and genes	9
Agriculture and aquaculture	6

Finally, 201 sites had, at the time of writing the Ramsar descriptive sheet, a protection status provided by the legislation in force in the country concerned. It should be noted that 108 of these sites had a management plan at the time of writing the descriptive sheet. The low percentage in relation to the total number of sites concerned by the presence of turtles encourages the authorities and site managers to implement management plans in order to improve the management of the sites and to strengthen the measures for the conservation of the species, and in particular the marine turtles.

6 - DISCUSSION



Young Cameroonians from Ebodjé village watching an immature Green Turtle that was captured incidentally in a fishing net
(© J. Fretey)

DISCUSSION

« Construction of mineral and commercial ports in tropical and equatorial regions is a serious threat that must be countered. »

The life cycle of marine turtles has no equivalent in the animal world. After having freed itself from the membrane of its egg in the depth of a sandy substratum saturated in CO_2, succeeded in reaching the surface of a beach and oxygen after several days of gregarious landing, ran on tens of meters to reach the sea, swam frantically against the current, sometimes letting itself be carried away by sargassas, a newborn turtle is linked in its first days of life to several types of habitats already very different, both terrestrial and marine. The months and the years passing, it will gain a coastal or neritic area of growth and a feeding area where it will mix with its congeners. After one or several tens of years according to the species, following magnetic fields, it will swim sometimes on thousands of kilometres, will return in the majority of the cases to the surroundings of its beach of birth, will mate there and, female, will climbs onto land to lay. Numerous and varied habitats will thus have been frequented.

The Bonn Convention,

another tool for marine turtle protection

When Hornell (1927) and Moorhouse (1929) in the Seychelles, Duncan (1943) and Carr (1952) in Florida, Hendrickson (1958) in Malaysia, and then Prichard (1969) in Guyana and Suriname, began monitoring marine turtle nesting, it was clear that the killing of females and poaching of all nests would lead to vulnerability and population decline. Following these pioneering years, field projects on almost all nesting beaches in all oceans have focused on protecting adult females and nests. These beaches were and still are guarded by volunteer associations, sworn guards, the military, local employees of ecotourism projects, etc. The enemy, the poacher, was a villager. It is only quite recently that there has been an awareness that this poacher was a father and that if he killed a marine turtle, often in defiance of the law, it was either directly for the consumption of the meat or for the sale of it, to feed his family. The marine turtle conservation projects have therefore included a community assistance component to improve the quality of life of villagers living near a nesting site. Raising awareness among fishermen and school children has also become a routine activity.

Construction of mineral and commercial ports in the tropics and equatorial regions led to serious coastal erosion problems. Removal of marine sand for construction of buildings sometimes led, as in Sao Tome in the Gulf of Guinea, to the disappearance of nesting beaches.

All this to explain that all the energy of researchers and nature protection associations was essentially focused on the terrestrial habitat of marine turtles with sometimes limited or questionable results. And in parallel to these terrestrial actions, human activities were developing that were very destructive of marine habitats.

While we were spending a lot of energy on one habitat, the terrestrial one, more serious threats were accumulating at sea: numerous and frequent bycatch by industrial trawlers (Lewison *et al.*, 2004; Wallace *et al.*, 2008), physical and chemical pollution, collisions with propellers of freighters and jet-skis (Lutcavage *et al*, 1997; Hazel & Gyuris, 2006; Hazel et *al.,* 2007), blasting and coral bleaching (Wilkinson 1998), seismic oil exploration (McCauley et *al.,* 2000), etc. These threats endanger juvenile, sub-adult and adult turtle populations on their nursery, feeding, mating and hibernacula areas, or on their migration corridors.

While biological rest periods lead to a seasonal ban on industrial fishing in certain regions, the use of the American "*Turtle Excluder Device*" (TED), and the awareness of fishermen, make it possible to reduce bycatch. Other threats require a better management of wastewater, industrial and agricultural discharges at sea, plastic waste, a better respect of the non construction on the terrestrial part of the public maritime domain, a more adapted regulation of the traffic of ships and marine leisure gear.

It seems almost impossible to ensure protection of all marine turtle habitats, especially offshore. In the western Atlantic, for example, the juvenile turtles of 4 species (*Caretta caretta*, *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys kempii*) have a pelagic stage commonly called "lost year". They occupy a habitat dominated by floating mats of pelagic Sargassum (*Sargassum natans, S. fluitans*) (Witherington *et al.*, 2012). Yet, Burns & Teal (1973) found that the convergence lines containing these pelagic Sargassum were commonly contaminated with tar balls and other hydrocarbons, pieces of plastic, oils, etc.

The Ramsar classification of a coastal site may include an offshore area up to 6 meters deep. This will not allow to try to prevent pollution of a floating pelagic habitat of Sargassum. But this or that site will be interesting to classify because it has, for example, rocky areas covered with Phanerogams, coral reefs or flooded mangroves that will be developmental areas for *C. mydas* and *E. imbricata*.

Ramsar Resolution XIII.24 is unfortunately completely inadequate to manage the conservation of migration corridors between nesting and feeding habitats when these are oceanic and sometimes span thousands of kilometres. For these corridors, it would be desirable to have more oceanic memoranda between Parties to the Bonn Convention.

In general, for these migratory species, which are sometimes unfaithful to a single site for their reproduction, we recommend a very dense network of Ramsar sites, each of which would be endowed with an adequate and individualized management plan, but also regional plans taking into account the dispersion of habitats according to the life cycles of each species and each population.

Hawksbill turtle foreleg blistering
(© J. Fretey)

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C. mydas **hatchling moving away from its birth habitat on the Tetiaroa beach**
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Adult female Green Turtle swimming in French Polynesia clear waters
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Adult *E. imbricata* swimming over coral formations
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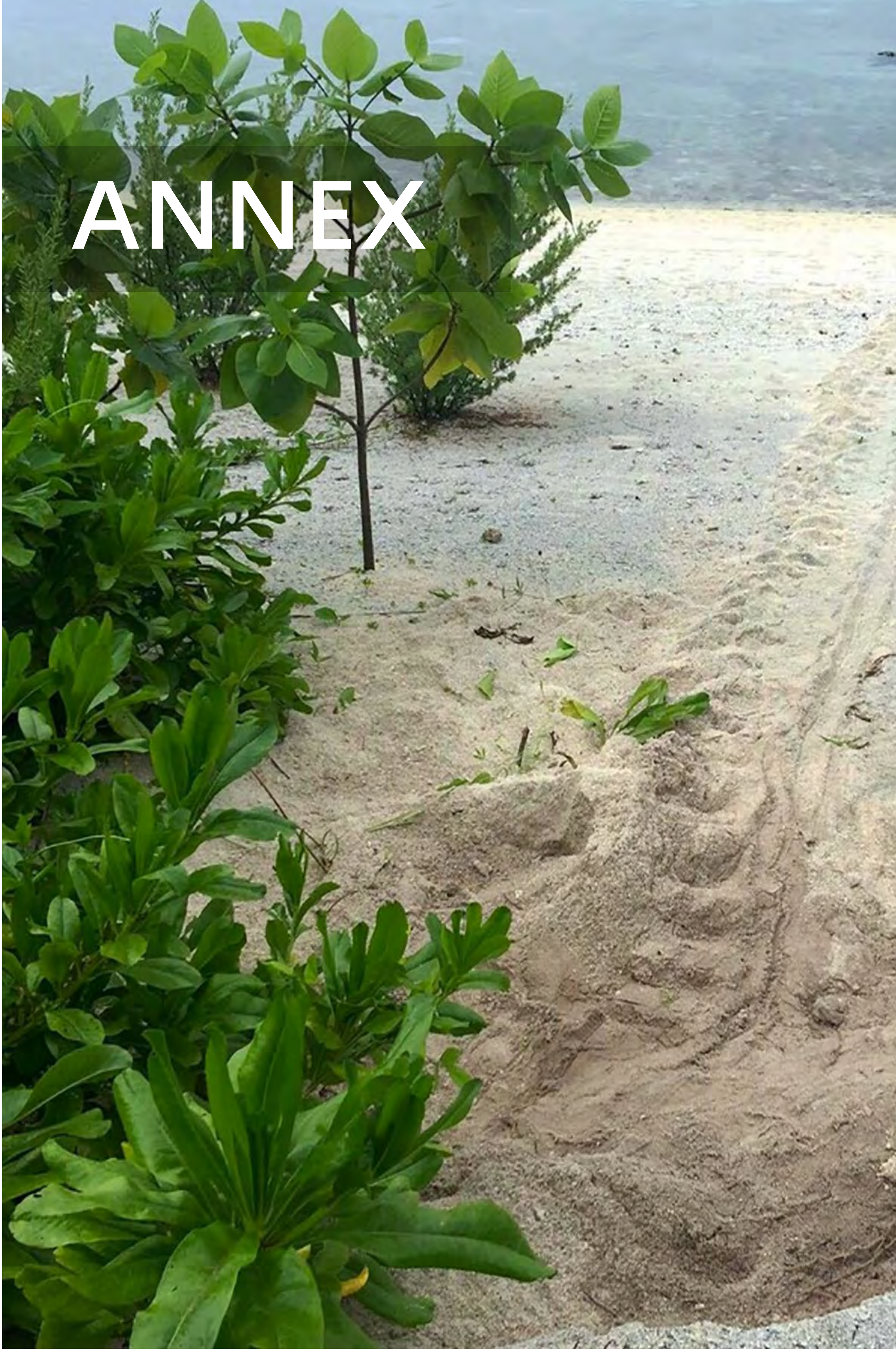
ANNEX



Locomotion trace and body bowl of a female Green Turtle around shrubby vegetation, on a Polynesian beach
(© Te mana o te moana)

ANNEX

13th Session of the Conference of the Contracting Parties to the Ramsar Convention on Wetlands (COP13)

"Wetlands for a Sustainable Urban Future" Dubai, United Arab Emirates, 21-29 October 2018

Resolution XIII.24

The enhanced conservation of coastal marine turtle habitats and the designation of key areas as Ramsar Sites

1. NOTING that six out of seven species of marine turtle (Dermochelyidae: D*ermochelys coriacea; Cheloniidae: Chelonia mydas, Caretta caretta, Eretmochelys imbricata, Lepidochelys olivacea, Lepidochelys kempii, Natator depressus*) have a conservation status ranging from vulnerable to critically endangered according to criteria of the IUCN Red List of threatened species; and ALSO NOTING that in order to live and survive these species depend on a variety of coastal habitats throughout their life cycle;

2. RECALLING that the Conference of the Contracting Parties to the Convention has adopted several Resolutions that are relevant and can benefit the conservation of habitats important for marine turtles: Resolution VII.21 on *Enhancing the conservation and wise use of intertidal wetlands; Resolution VIII.4 on Wetland issues in Integrated Coastal Zone Management (ICZM); and Resolution VIII.32 on Conservation, integrated management, and sustainable use of mangrove ecosystems and their resources;*

3. CONSIDERING that habitats that are home to endangered marine turtle species meet Criterion 2 of the Convention's Criteria for Identifying Wetlands of International Importance and that, consequently, the Convention can play a role by encouraging Contracting Parties to strengthen their management and conservation actions related to the wetland habitats that are essential to these species;

4. ALSO CONSIDERING that marine turtles are included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora and Appendices I and II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), and are addressed by regional instruments and international organizations such as the Berne Convention on the Conservation of European Wildlife and Natural Habitats, the Abidjan Convention on Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa Region, the Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC), the Cartagena Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region, the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution, the CMS Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA Marine Turtles MoU), and the CMS MoU concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa

(African Atlantic Turtles MOU), the Secretariat of the Pacific Regional Environment Programme, and the Permanent Commission for the South Pacific, under which their members have committed to enhance protection for marine turtles;

5. NOTING the existence of additional action plans such as, for example, the Pacific Islands Regional Marine Species Programme's Marine Turtle Action Plan and the Single Species Action Plan for the loggerhead turtle Caretta caretta in the South Pacific Ocean, adopted by the Conference of the Parties to the CMS in Quito in November 2014, and the development of the Single Species Action Plan for the conservation of the hawksbill turtle (in accordance with CMS COP12 Decision 12.17);

6. NOTING that some marine turtle subpopulations, such as northwest Atlantic loggerhead turtles, have increased as a result of significant conservation efforts, which include prohibiting or modifying fishing practices, designating protected areas and addressing light pollution;

7. CONCERNED that several regional populations of marine turtle are facing a high risk of extinction; NOTING the degradation of their coastal habitats, the significant impact of fisheries bycatch; and ALSO NOTING the excessively high mortality rates owing to egg collection, killing or poaching of adult females on the nesting beaches and the impact of native or introduced predators, as well as natural mortality of eggs and hatchlings;

8. CONSIDERING that marine and coastal feeding and nursery areas that are used by marine turtles during their life cycle such as, inter alia, estuaries, seagrass beds, coral reefs and mangroves, are often threatened physically and chemically by human activities such as urban, industrial, port and tourism development and infrastructure as well as discharges of wastewater and industrial effluents, and agricultural runoff;

9. RECOGNIZING the potential and demonstrated role of indigenous peoples[11] and local communities including women and other vulnerable groups in marine turtle conservation and management;

10. CONSIDERING that the protection of nesting beaches, marine and coastal feeding areas, nurseries and growth areas will improve the survival rate of adult females, hatchlings and immature turtles and that their designation as Wetlands of International Importance (Ramsar Sites) is a first step towards an enhanced protection

11. NOTING that Resolution 12.25 on *Promoting Conservation of Critical Intertidal and Other Coastal Habitats for Migratory Species* adopted by the twelfth session of the Conference of the Parties to CMS (Manila, October 2017) urges those Parties to conserve intertidal and coastal habitats for migratory species;;

12. FURTHER NOTING that CMS Resolution 12.23 on Sustainable Tourism and Migratory Species outlines general principles for ensuring that tourism activities benefit from and do not harm migratory species, including involvement of and benefits to local communities;

13. NOTING that 248 Ramsar Sites and 76 Contracting Parties (listed at Annex 1 of the present Resolution) already provide habitat for at least one species of marine turtle;

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1 In compliance with national laws and rules.

14. RECOGNIZING that the African Atlantic Turtles MoU and the IOSEA Marine Turtles MoU of CMS have adopted resolutions the application of which can help improve the conservation of marine turtles;

15. RECALLING that an MoU has been signed between the IAC Secretariat and the Secretariat of the Ramsar Convention and that its goal is to join the efforts made in the frameworks of the two Conventions, with the aim of building capacities of the Parties of both Conventions to identify and strengthen the conservation and wise use of Ramsar Sites;

THE CONFERENCE OF THE CONTRACTING PARTIES

16. ENCOURAGES the Contracting Parties whose coastlines contain marine turtle breeding areas, nesting beaches, coastal migration corridors and feeding and nursery areas to identify index nesting and foraging sites and ensure the populations are monitored as precisely as possible, in order to improve our knowledge of the distribution, numbers and state of health of each of the species involved;

17. ENCOURAGES the Contracting Parties to strengthen the conservation and management of the identified index nesting and foraging sites, and notably, if possible, to designate them as Wetlands of International Importance (Ramsar Sites), based on Criterion 2 of the Convention's Criteria for Identifying Wetlands of International Importance, and to strengthen this designation through the promulgation of the appropriate protective measures in accordance with their legislation and the availability of resources, in particular through the creation of marine protected areas, as appropriate;

18. ENCOURAGES the Contracting Parties to develop and implement management plans for these sites, by integrating specific means for the conservation, protection or restoration of coastal habitats for the different marine turtle species, and to integrate these site management plans with coastal zone management plans;

19. ENCOURAGES the Contracting Parties to consult each other, and work through existing regional agreements, MoUs and action plans, such as those mentioned in paragraph 4 of the present Resolution, to protect habitats in networks that allow for greater safety for marine turtles during their life cycle and in their movements;

20. STRESSES the urgent need to take the measures required, whenever possible, to reduce threats to nesting areas, such as noise and light pollution and beach erosion, and to control native predators and eradicate introduced predators at these sites, to develop best practices to guide the interaction of humans and marine turtles by raising the awareness of inhabitants of and visitors to coastal zones, leveraging the prestigious Ramsar brand and the Convention's communication, capacity building, education, participation and awareness (CEPA) programme;

21. ENCOURAGES Contracting Parties with marine turtle habitats to promote the wise use of these wetlands by working with local communities, relevant stakeholders and institutions to raise awareness of the importance of conserving marine turtles, their nests and their habitats, and to halt poaching and the exploitation of marine turtle products, including through, *inter alia*, fostering alternative sustainable livelihoods, including sustainable eco-tourism;

22. ENCOURAGES Contracting Parties to review their Ramsar Site management plans to seek to ensure they include marine turtle conservation actions, as appropriate; and RECOMMENDS enhancement of synergies and better coordination with Ramsar Regional Initiatives and existing networks rather than establishment of new arrangements;

23. URGES Contracting Parties to undertake collaborative research on impacts of climate change on marine turtles and their wetland habitats; and REQUESTS the Scientific and Technical Review Panel, consistent with its scope, mandate and priority thematic work areas for 2019-2021, in developing its proposed work plan for presentation at the 57th meeting of the Standing Committee, to consider developing methods to rapidly assess climate vulnerability of wetlands, particularly those important as habitats for marine turtles; and

24. REQUESTS the Secretariat to work with the Secretariats of the Inter-American Convention for the Protection and Conservation of Sea Turtles and the Convention on the Conservation of Migratory Species of Wild Animals as well as their respective memoranda of understanding, (including the the CMS MoUs on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia and on Conservation Measures for Marine Turtles of the Atlantic Coast of Africa) to enhance marine turtle conservation in Ramsar Sites; and ALSO REQUESTS that, where possible and subject to the availability of resources, these Secretariats work with Ramsar Contracting Parties to include marine turtle conservation actions in their Ramsar Site management plans.

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Emergence of green turtle hatchlings on the Polynesian Tetiaroa beach embryonic development habitat
(© Te mana o te moana)

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