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► To cite this version:

Alexandre Girard, Florian Barnier, Françoise Claro, Marc Girondot. A synthetic indicator based on nesting trend to inform the general public about the status of sea turtle in France and its overseas territories. Internation Sea Turtle Symposium, Mar 2023, Cartagena (Colombia), Colombia. mnhn-04119615

HAL Id: mnhn-04119615

<https://mnhn.hal.science/mnhn-04119615v1>

Submitted on 6 Jun 2023

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A synthetic indicator based on nesting trend to inform the general public about the status of sea turtle in France and its overseas territories



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Context

France and its overseas territories is hosting 6 species of sea turtles : the leatherback turtle (*Dermochelys coriacea*), the Loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the Olive Ridley (*Lepidochelys olivacea*), and the Hawksbill turtle (*Eretmochelys imbricata*), the Kemp Ridley (*Lepidochelys kempii*). The first five are observed on nesting sites (see the Map).

Method

Based on SWOT Minimum Standard, the Groupe Tortues Marines France (GTMF) established in 2015 a national monitoring scheme through which all the actors are implementing morning patrols to counts trawls on nesting beaches. Monitoring effort is adapted by actors in the field according to SWOT recommendation based on Pr. Marc Girondot's works to optimize nesting phenology modeling.

Data are then analyzed thank to R package Phenology (function Phenology and fitRMU) to produce trends taking into account possible shift in nesting effort along time.

As nesting activity trends is a proxy of nesting female abundance, trends obtained for each species on every French territory hosting sea turtle nestings are then valorized to inform a synthetic indicator describing the overall trends of adult nesting female in France. Only the site-species were the time series of standard monitoring are covering at least 5 out of the last 7 nesting season are included.

Results

25 species-sites are known, of which 9 are considered as primary (Table 2 and Map) i.e. representing significant contribution to the world population for the species of concern.

Out of the 25 species-sites, 9 meet the indicator requirement (data of at least 5 year during the last 7 seasons to allow for assessing a trend on 7 years) (Table 1).

Among major sites, 8 out of 9 are included. 16 species sites are not included (Table 2 and Figure 2).

For 7 out of the 9 documented sites, the trend in steady.

For one species sites, the 7 year trends is decreasing (Leatherback in French Guiana). And an increasing trend is observed for Green turtle in Tromelin (Eparses Island in the Mozambican channel).

The synthetic indicator is therefore presented as follows

« On 11% of the nesting sites frequented by sea turtles and documented, nesting activities have decreased over the last 7 years.

On 78% of sites, the trend is not different from a stable state (7 out of 9 sites)

On 11% of sites (1 site out of 9) the trend is increasing » (Figures 1A & 1B).

Discussion - perspectives

This synthetic indicator gives an insight of the global situation of the reproductive female population in France where 5 species are observed nesting in territories dispersed all over the world in 3 Oceans.

It is meant to communicate toward general public in the official French website: <https://naturefrance.fr/>

The sea turtle synthetic indicators will be a doorway to detail further specific situation according to species and territories.

Next improvement steps will include: i) To acquire traditionnal knowledge and historical sources to put recent nesting activities and trends in perspective with historical levels; ii) To document additional species x sites pairs and primary the last major nesting site not included in the indicator at this stage: Loggerheads in New-Caledonia; iii) To include new emerging nesting sites: Wallis et Futuna and French mediterranean coast.

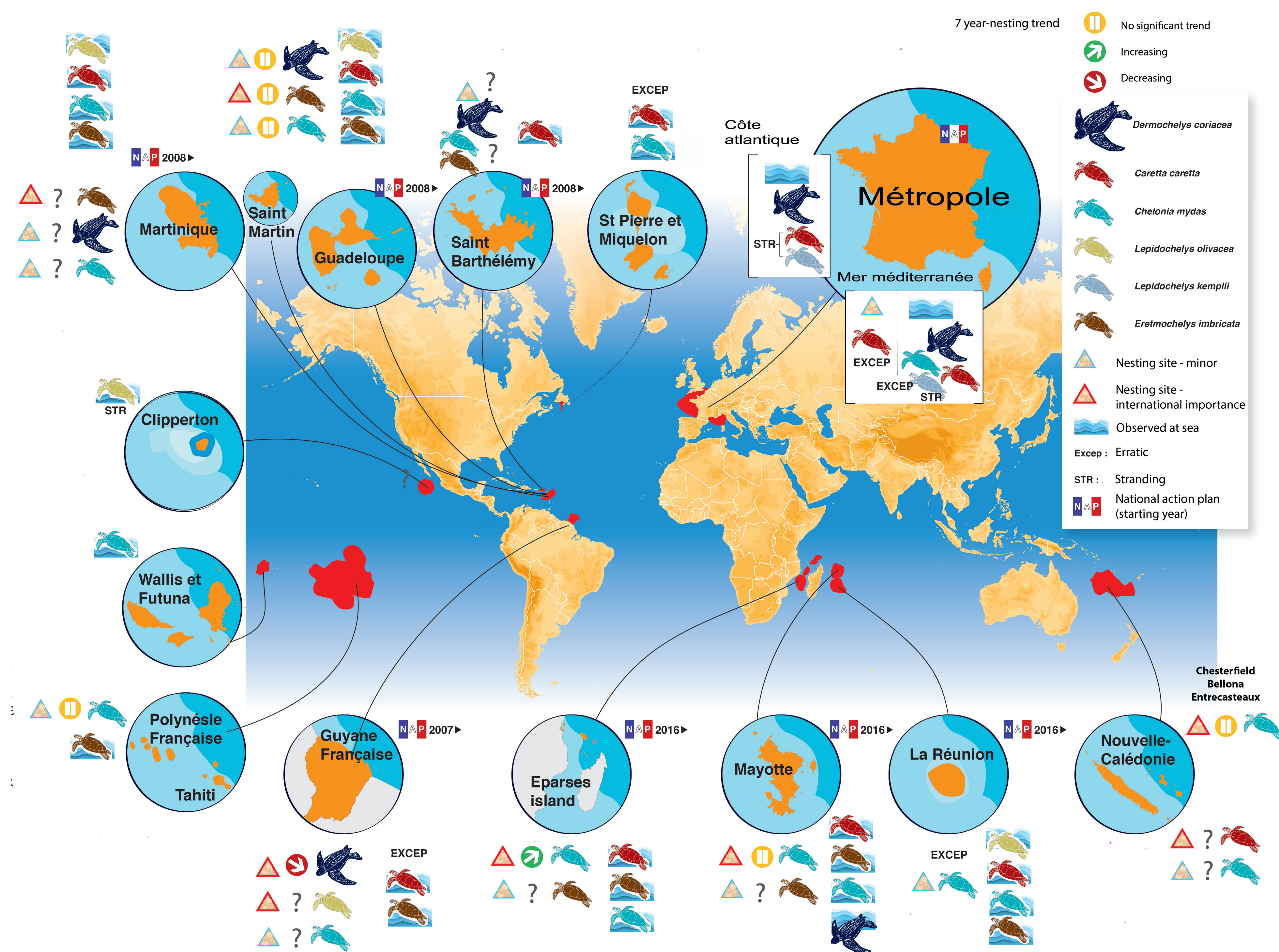
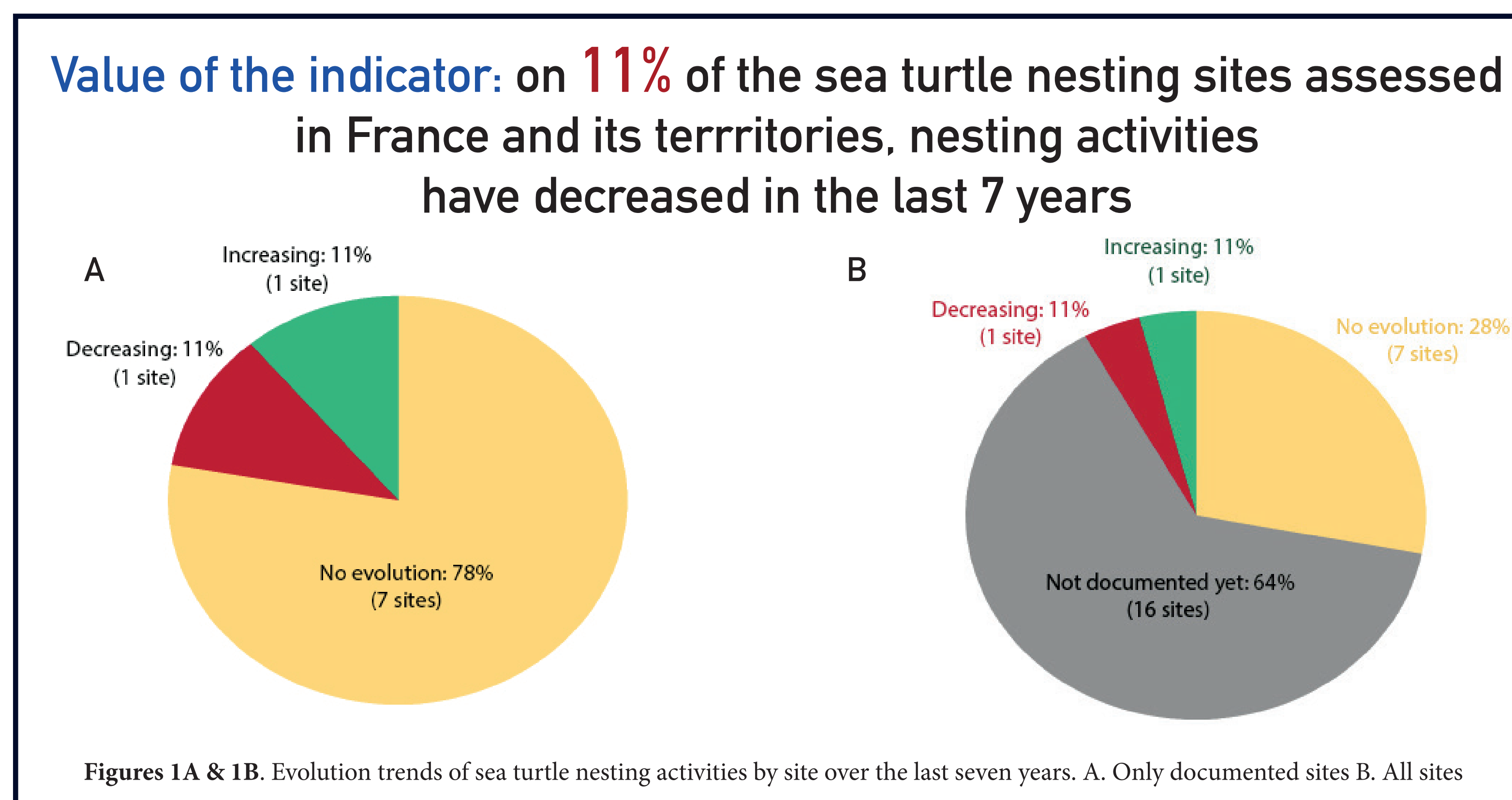


Table 1. Evolution of nesting sea turtle population
Proportion of sites frequented by sea turtles and recently documented, on which nesting activities have decreased over the last 7 years

Site	Territory	Species	Mean annual number of nesting activities	7 year-trend
Entrecasteau	New-Caledonia	Green	39 181	No detectable adverse evolution
Chesterfield et Bellona	New-Caledonia	Green	28 364	No detectable adverse evolution
Europa	Eparses islands	Green	14 453	No detectable adverse evolution
Moya-Saziley	Mayotte	Green	11 035	No detectable adverse evolution
Tromelin	Eparses islands	Green	9 898	Increasing
Guadeloupe et Saint Martin	Guadeloupe & Saint Martin	Hawksbill	5 916	No detectable adverse evolution
Guadeloupe et Saint Martin	Guadeloupe & Saint Martin	Green	3 050	No detectable adverse evolution
Yalimapo Guyane	French Guiana	Leatherback	2 732	Decreasing
Guadeloupe et Saint Martin	Guadeloupe & Saint Martin	Leatherback	495	No detectable adverse evolution
			Nombre de sites les plus fréquentés	9
			Number of species x sites on which nesting activities have decreased	1
			Proportion of sites with declining nesting activities	11%

Note: To be integrated, a site must have been tracked for 5 years in the last 7 years. The 7-year trends represent short-term trends for sea turtles. Source : Groupe Tortues Marines France (GTMF) / PatriNat (OFB-MNHN), Paris France.

Table 2. List and details of pairs species x site in France and its overseas territories

Species	Scientific name	Territory	Site	Primary (of international importance) or secondary site for the species	Mean number of nesting activities on 7 year	Time serie's trend
Green	<i>Chelonia mydas</i>	New-Caledonia	Entrecasteau	Primary	39 181	No detectable adverse evolution
Green	<i>Chelonia mydas</i>	New-Caledonia	Chesterfield et Bellona	Primary	28 364	No detectable adverse evolution
Green	<i>Chelonia mydas</i>	Eparses islands (Mozambic channel)	Europa	Primary	14 453	No detectable adverse evolution
Green	<i>Chelonia mydas</i>	Mayotte	Moya-Saziley	Primary	11 035	No detectable adverse evolution
Green	<i>Chelonia mydas</i>	Eparses islands (Mozambic channel)	Tromelin	Primary	9 898	Increasing
Hawksbill	<i>Eretmochelys imbricata</i>	Guadeloupe & Saint Martin	Guadeloupe et Saint Martin	secondary/Primary	5 916	No detectable adverse evolution
Green	<i>Chelonia mydas</i>	Guadeloupe & Saint Martin	Guadeloupe et Saint Martin	secondary	3 050	No detectable adverse evolution
Leatherback	<i>Dermochelys coriacea</i>	French Guiana	Yalimapo Guyane	Primary	2 732	Decreasing
Leatherback	<i>Dermochelys coriacea</i>	Guadeloupe & Saint Martin	Guadeloupe et Saint Martin	secondary	495	No detectable adverse evolution
Hawksbill	<i>Eretmochelys imbricata</i>	Mayotte	Mayotte	secondary	Monitored, trend not assessed yet	Not documented
Hawksbill	<i>Eretmochelys imbricata</i>	Eparses islands (Mozambic channel)	Tromelin	secondary	Monitored, trend not assessed yet	Not documented
Hawksbill	<i>Eretmochelys imbricata</i>	Eparses islands (Mozambic channel)	Europa	secondary	Monitored, trend not assessed yet	Not documented
Green	<i>Chelonia mydas</i>	Eparses islands (Mozambic channel)	Glorieuse	Primary	Monitored, trend not assessed yet	Not documented
Hawksbill	<i>Eretmochelys imbricata</i>	Eparses islands (Mozambic channel)	Glorieuse	secondary	Monitored, trend not assessed yet	Not documented
Green	<i>Chelonia mydas</i>	Saint Barthélemy	Saint Barthélemy	secondary	Monitored, trend not assessed yet	Not documented
Hawksbill	<i>Eretmochelys imbricata</i>	Saint Barthélemy	Saint Barthélemy	secondary	Monitored, trend not assessed yet	Not documented
Leatherback	<i>Dermochelys coriacea</i>	Saint Barthélemy	Saint Barthélemy	secondary	Monitored, trend not assessed yet	Not documented
Green	<i>Chelonia mydas</i>	Martinique	Martinique	secondary	Monitored, trend not assessed yet	Not documented
Leatherback	<i>Eretmochelys imbricata</i>	Martinique	Martinique	secondary	Monitored, trend not assessed yet	Not documented
Leatherback	<i>Dermochelys coriacea</i>	Martinique	Martinique	secondary	Monitored, trend not assessed yet	Not documented
Olive Ridley	<i>Lepidochelys olivacea</i>	French Guiana	Guyane	Primary	Monitored, trend not assessed yet	Not documented
Green	<i>Chelonia mydas</i>	French Guiana	Guyane	secondary	Monitored, trend not assessed yet	Not documented
Loggerhead	<i>Caretta caretta</i>	New-Caledonia	Roche percée	Primary	Monitored, trend not assessed yet	Not documented
Green	<i>Chelonia mydas</i>	New-Caledonia	Grand Lagon sud	secondary	Monitored, trend not assessed yet	Not documented
Green	<i>Chelonia mydas</i>	French Polynesia	Tetiaora	secondary	Monitored, trend not assessed yet	Not documented
Loggerhead	<i>Caretta caretta</i>	Continental France and Corsica	French mediterranean coast (continental and Corsica)	secondary	Emerging nesting site	From erratic to regular nesting (Emerging nesting site)

Note : Pour être intégré, un site doit avoir été suivi 5 années au cours des 7 dernières années. Les tendances à 7 ans représentent des tendances à court terme pour les tortues marines. Source : Groupe Tortues Marines France (GTMF) / PatriNat (OFB-MNHN)