IUCN | French Committee

Renewable energies

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Marine Renewable Energy and Biodiversity in French overseas territories

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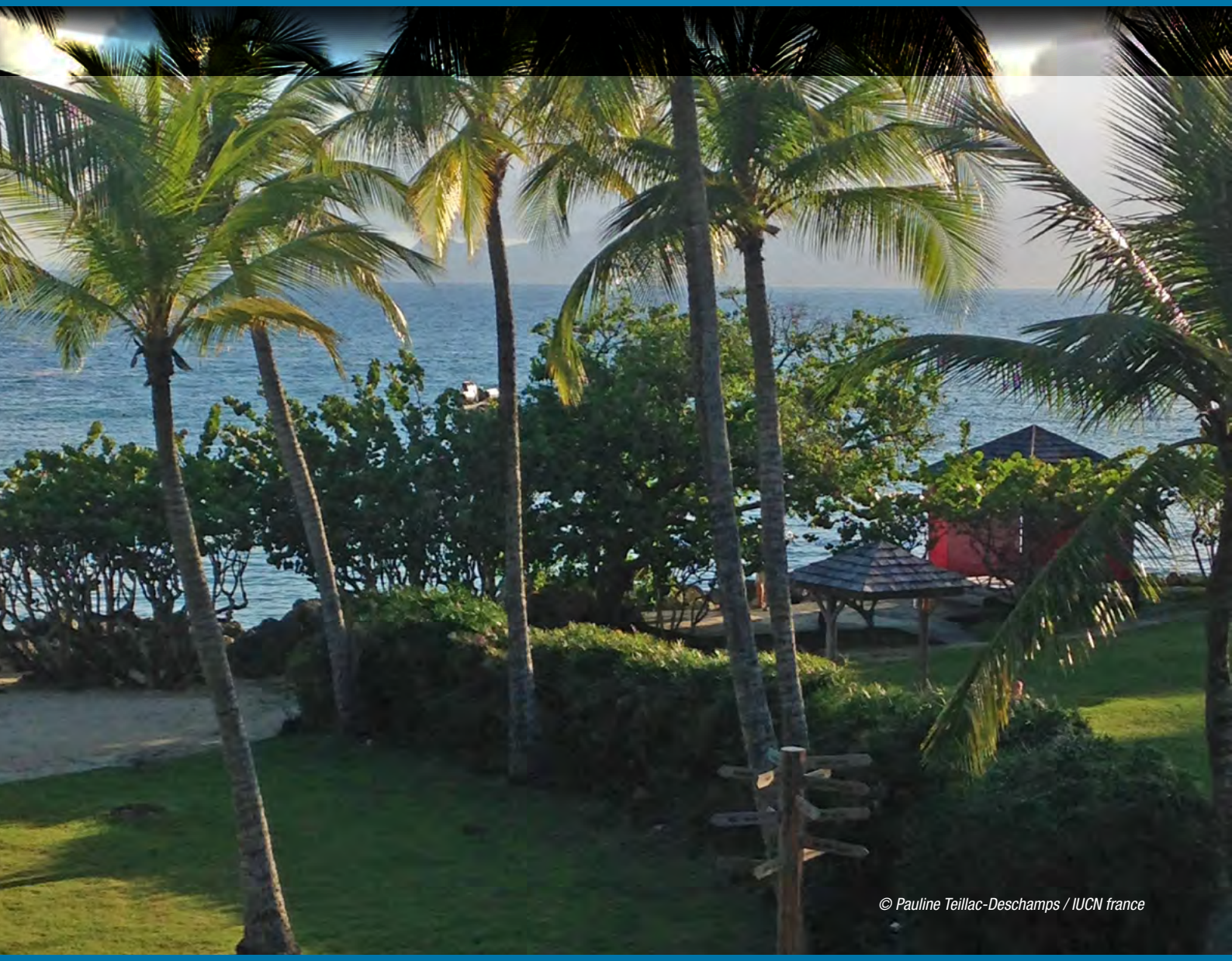

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The use of fossil fuels is harmful to the environment. Their burning contributes massively to global warming due to emissions of carbon dioxide, and their extraction often caused major impacts to ecosystems.

The French overseas territories are currently extremely dependent on fossil fuels, and are also among the areas particularly affected by the impact of climate change. Overseas territories, most of which are tropical islands, are particularly vulnerable to impacts such as acidification of the oceans, mean sea level rise, and increases in extreme weather events.

The biodiversity of the French overseas territories is particularly rich, and their marine ecosystems are still relatively well preserved. In addition, an important part of the overseas economy is reliant on the healthy conservation status of these natural resources (tourism, fishing, etc.).

The pressing need within these territories is therefore twofold: to maintain ecosystems in a healthy condition, and to commit to a reduction in greenhouse gas emissions.

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Beyond the reduction of this costly reliance, the economic development of the French overseas territories is dependent on fully meeting its growing energy needs while ensuring sustainable prices for the inhabitants.

At a national level, the law on energy transition encourages all French territories to diversify their energy mix. Discussions have highlighted the urgency of this diversification in the French overseas territories by setting ambitious targets for the use of renewable energy (RE) both on land and offshore.

In the French overseas territories, marine renewable energies are a recent development. Experience in metropolitan France has revealed potential conflicts between the development of these energy sources and the preservation of biodiversity (direct impacts on the environment and biodiversity, uses conflicts, etc.). The lack of consultation prior to the implementation of these projects has often led to environmental degradation and decreased public support for marine renewable energy (MRE) projects.

The need to diversify the energy mix in French overseas territories

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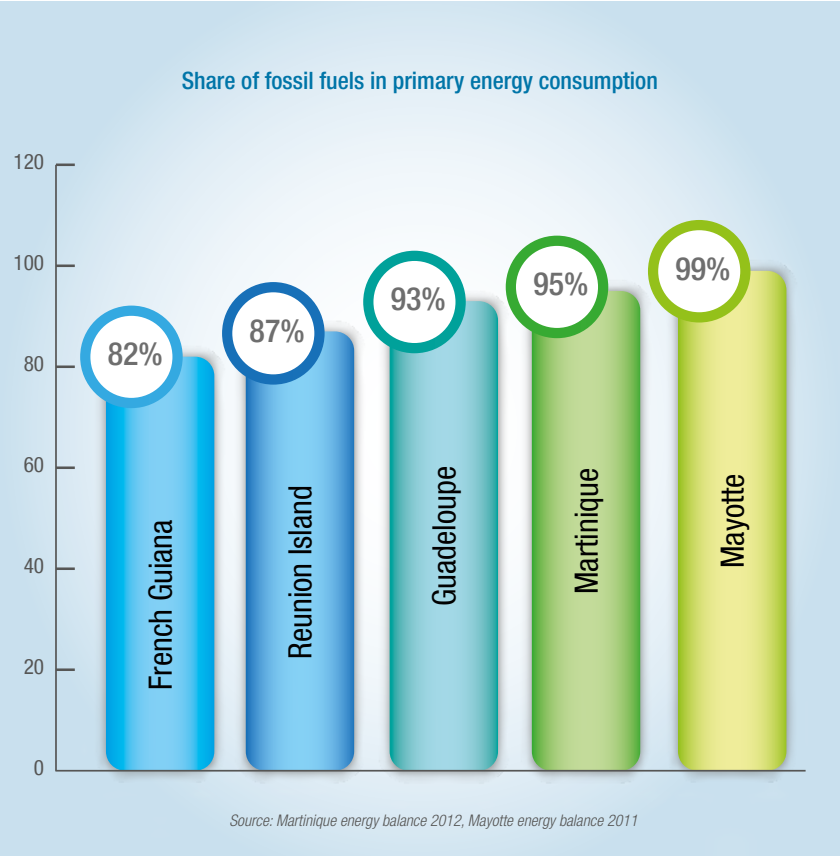
A heavy reliance on fossil fuels

Due to their largely insular nature, the French overseas territories have constraints in the supply and production of energy. Supply is mainly based on fossil fuels, which account for between 87% (Reunion Island) and 99% (Mayotte) of the primary energy mix.

The preponderance of fossil fuels in the 'mix' introduces vulnerabilities in the energy supply in these territories. A break in the import chain of petroleum products would jeopardize their energy supply, and consequently the functioning of basic services such as hospitals or schools. While this hypothesis remains unlikely, a sharp rise in the price per barrel, which is conceivable, would have detrimental consequences for the overseas territories due to the current lack of alternative energy sources.

In order to reduce the vulnerability of overseas energy systems, the diversification of energy supply sources should be a priority, based as much as possible on local resources.



Source: Martinique energy balance 2012, Mayotte energy balance 2011

A vulnerable electricity supply

Security of energy supply also depends on the reliability of the electricity system. To ensure the latter, electricity supply and demand must be constantly balanced. French overseas territories have small electrical grids (100 to 1,000 times smaller than the size of the metropolitan network). They are also 'non-interconnected areas' (NIAs), so cannot be backed-up by production facilities located outside their territory. Due to geographical constraints, the French overseas Communities must rely on their own production resources to ensure the security of their electricity supply.

These characteristics create constraints in terms of production and storage capacity.

In addition to this unavoidable constraint, a fragility is also inherited from the past: built on the centralized metropolitan model, the overseas electricity network nevertheless has a less dense mesh than in the metropolitan grid. It is often linear and does not offer any redundancy features. The power supply to some areas often depends on a single power line or source station, so in the event of a failure, power cuts are inevitable. **The development of local energy production and consumption facilities would help to avoid this over-reliance on centralized production.**

The combination of the two factors (the insularity and weakness of the electrical networks), explains why the French overseas territories experience a less reliable electrical supply. This results in particular in an average outage time that is much higher than that of the metropolitan area.

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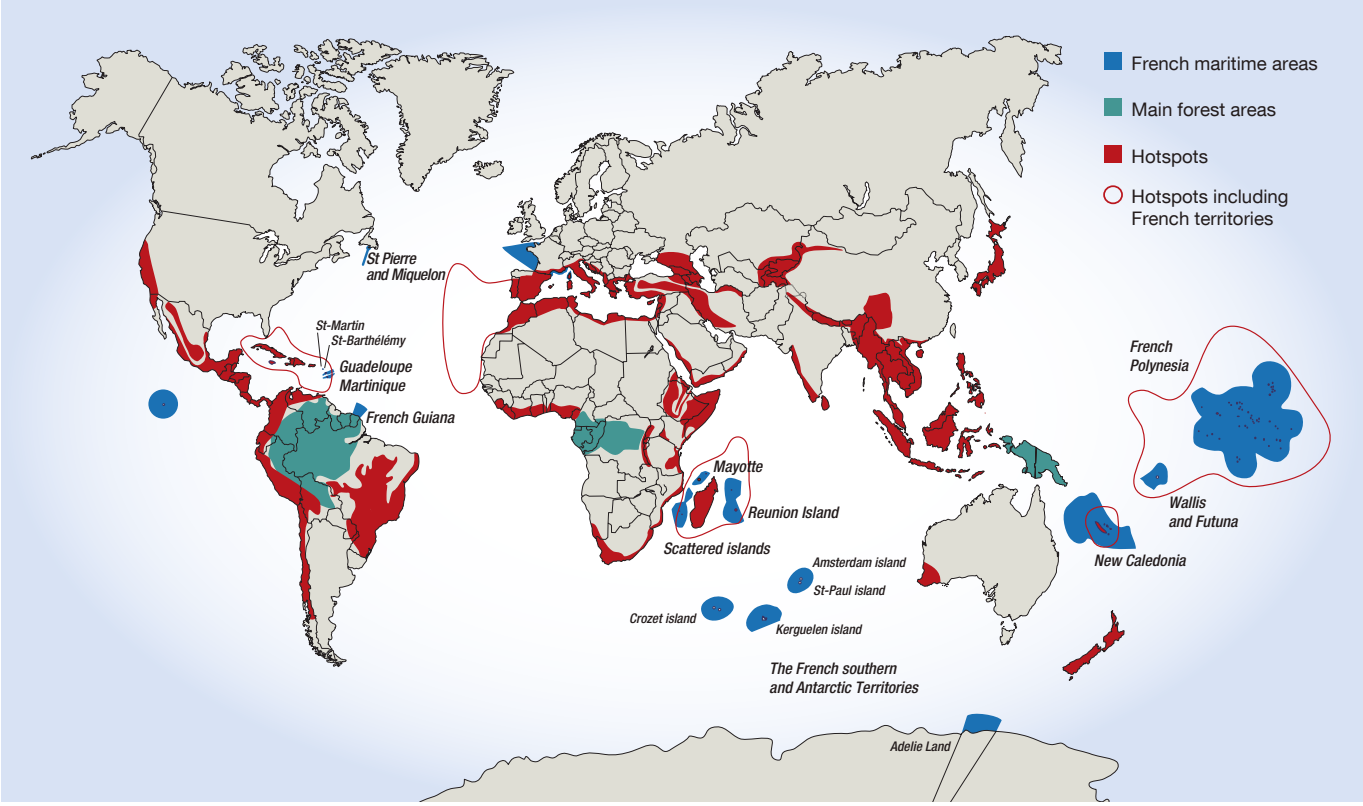
French overseas territories: significant potential for renewable energies



French maritime areas and biodiversity hotspots around the world © IUCN France, from Conservation International

With an appropriate mix of solar, wind, geothermal, wave, and heat energy, all overseas territories have renewable energy resources that could, in the long term, enable them to achieve complete self-sufficiency in terms of energy (not just electricity).

With this potential, overseas territories are developing renewable energies (permanent or intermittent) to varying degrees in order to reduce the cost of energy. This is likely to increase with the rise in fossil energy costs.

The development of intermittent renewable energies can be accompanied by storage solutions such as pumped energy transfer stations (STEPs).

© Marion Péguin / CPIE Côte provençale - Atelier bleu

Terrestrial renewable energies: significant potential from a variety of sources, but with land constraints

Terrestrial resources are clearly more accessible, such as sun, wind, and biomass. However, access to these resources in all cases requires space, while lack of land is already a major issue on all of the islands. Thus, the use of renewable energies often remains marginal (except for Reunion Island and French Guiana).

Renewable energy in the territories is mostly or in some cases entirely land-based. The following is the share of production from renewable energy sources in relation to overall production:

- Antilles: 15% en Guadeloupe, 6% Martinique
- French Guiana: 45% with hydroelectric dams
- Indian Ocean: 1% in Mayotte (Solar), 35% in Reunion Island (hydroelectric and biomass)
- Saint Pierre and Miquelon: 13% (wind power)
- French Polynesia: NC
- New Caledonia: NC
- Wallis and Futuna: 3 %

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The various renewable energy sectors used or under development in the French overseas territories

Legend

Colour code: Currently used / Planned or under development

Type of RE: Terrestrial wind turbine, Solar, Biomass, Hydroelectric, Geothermal, MRE

Saint Pierre and Miquelon

Guadeloupe

Martinique

Saint Barthélemy

Saint Martin

French Guiana

Reunion island

Mayotte

New Caledonia

Wallis and Futuna

French Polynesia

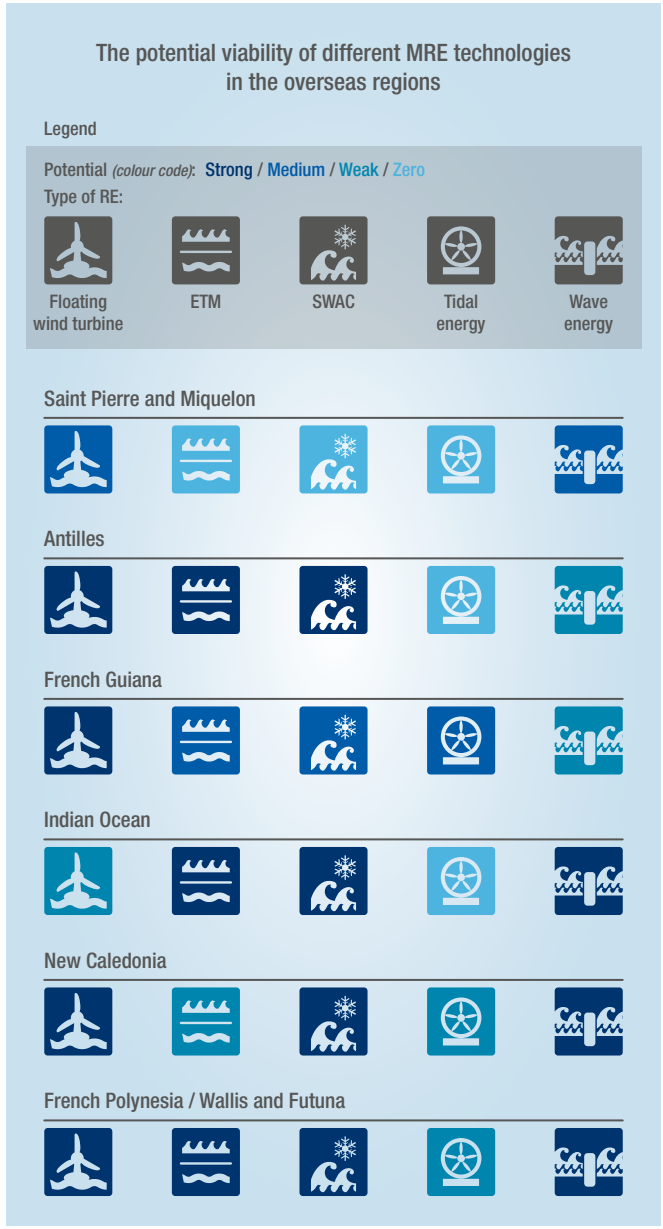
MRE: a potential response to energy and development needs

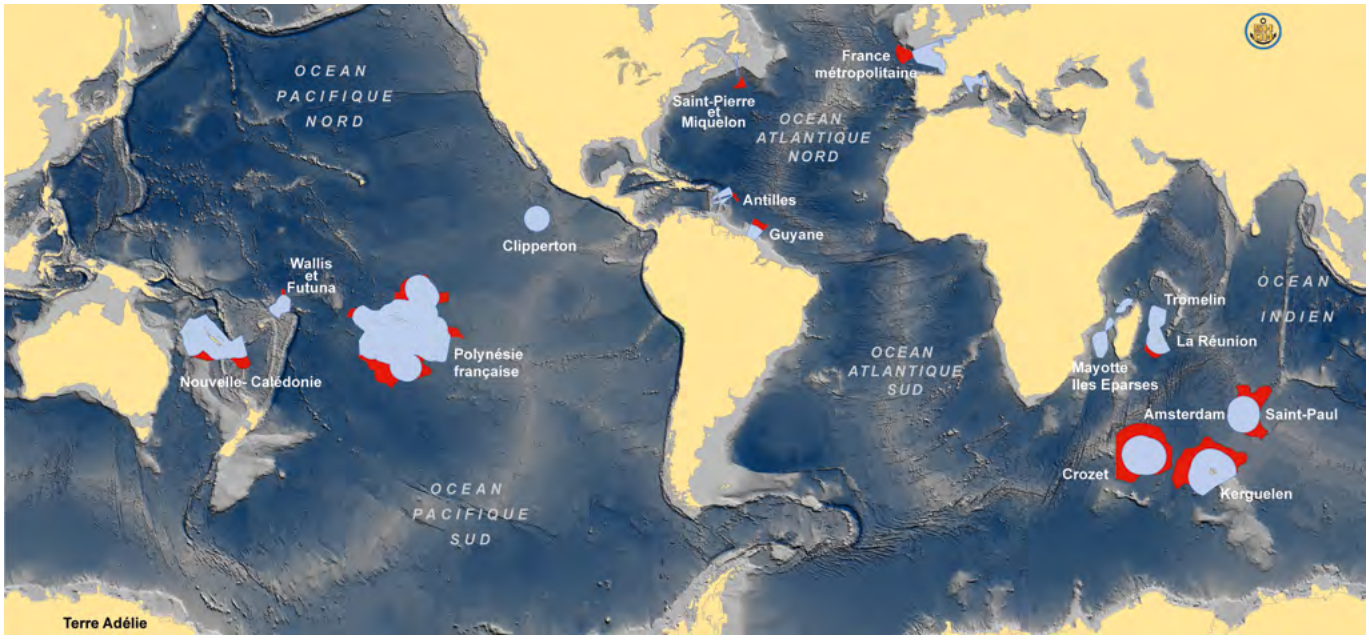
All of the French overseas territories include maritime areas, which provide access to wind energy (floating turbines), wave and swell energy (wave energy converters) and thermal energy from the ocean (cold or hot water, allowing for continuous air conditioning or electricity generation, 24 hours a day). The surface extent of marine areas surrounding island territories greatly exceeds that of the islands themselves. They offer energy resources to these territories that far exceed their needs and reduce competition between uses, which quickly decreases at sea as one moves away from the coast.

Local control of these energies would contribute to energy self-reliance in the islands, and would allow local social and economic development. It would also enable the development of local expertise that could be exported initially in the region, but also world-wide.

For a detailed description of the different technologies, we encourage the reader to consult the IUCN report on renewable energy sources[1].

These technologies are at varying stages of development and therefore will be available at varying times in the future. Some technologies have already been industrialised (coastal heat pumps, SWAC, hydro turbines and even floating wind turbines), while others are currently being demonstrated or tested, in particular for ocean thermal energy conversion (OTEC). The potential usability of these different technologies in the overseas territories is shown in the adjacent graphic. In particular, it reflects the degree of favourability of meteorological and oceanographic conditions (particularly in inter-tropical areas).

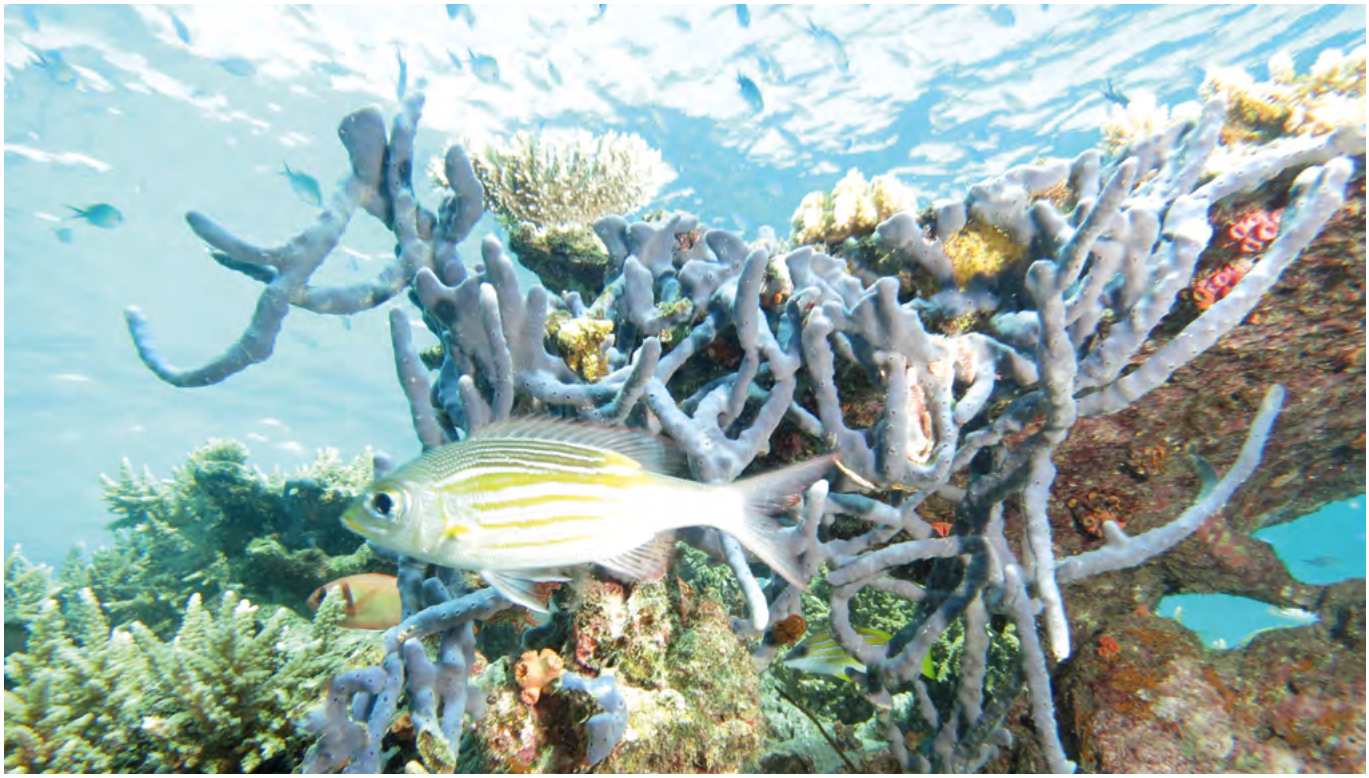




Map of maritime areas under national jurisdiction (in blue) and extensions under request (red) © SHOM

1 | UICN France (2014). Marine renewable energies developpement and biodiversity preservation. Summary for stakeholders. Paris, France.

Marine biodiversity conservarion challenges in French overseas territories



*Golden perch or striated emperor (*Gnathodentex aurolineatus*) in front of corals and sponges © Jérôme Paillet / Marine Protected Areas Agency*

The richness and diversity of natural areas in the French overseas territories give France a unique place in the world in terms of biodiversity.

The French overseas territories comprises a very diverse range of areas in both hemispheres, in four oceans (Atlantic, Pacific, Indian, Southern), and in contrasting bioclimatic regions (from subarctic to Antarctic, including tropical and equatorial areas).

The diversity of ecosystems, the total number of species and ecosystems, and the number of endemic species, i.e. those that are restricted to these regions, are very high. For instance, 10% of the world's coral reefs are located in French waters.

France's natural heritage is recognized worldwide and extends over 5 of the 34 regions with the highest biodiversity ('hot spots'), 4 of which are in French overseas territories.

However, this natural heritage is fragile. Threats of habitat destruction, over-exploitation, pollution and invasive alien species proliferation are significant, and these threats are likely to be further exacerbated in the coming decades by the likely effects of climate change.

In order to better meet the challenges of conserving and managing this exceptional natural heritage, France has chosen, within its national biodiversity strategy, to work in partnership with local authorities to draw up defined action plans outlining the priority actions to protect biodiversity in each French overseas territory. Thus, concrete actions are gradually being implemented.

The State is strongly committed to promoting the integration of biodiversity into sectoral policies:

- Integration of biodiversity into all development programmes (urbanisation, economy, transport, agriculture, energy, etc.)
- Strengthening of local and international cooperation.

The French overseas territories possess great potential for the diversification of their energy mix and developing renewable marine energies, due to the size of their marine areas. But they also present the biggest challenges for France in terms of preserving biodiversity. The development of MREs, although necessary for the French overseas territories, could lead to further loss of biodiversity. The alignment of policy objectives is therefore essential to ensure the sustainable development of these territories.

In order to reconcile these two crucial issues in these areas, and to lay the foundations for reconciling two potentially conflicting environmental commitments, it is necessary to recognise the needs, identify the challenges, and develop solutions in an integrated approach.

Knowledge of the potential impacts of the various marine renewable energy technologies on natural environments is therefore an essential prerequisite for a sustainable development strategy for these energy sources.

Potential impacts of marine renewable energy production on natural environments

© Alexendra Gigou / Marine Protected Areas Agency

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In the absence of specific independent studies in the French overseas territories, assumptions of the impact of MREs are based on the metropolitan experience. Their direct application to these areas, however, is problematic. Indeed, the physical characteristics of the environment are very different from one territory to another, and involve different choices in terms of energy production technology.

Natural environments and biodiversity are not only very different but are more vulnerable in the overseas regions than in metropolitan France. These characteristics should therefore be considered in any risk analysis.

The metropolitan experience mainly concerns offshore wind farm projects, with other technologies still at the trial stage. Therefore little evidence has yet been gathered on the impacts of these other technologies. Moreover, the experience acquired in metropolitan France does not always reflect the impact of these projects in overseas territories.

The potential impacts[1] of different technologies exploiting renewable marine energy on biodiversity vary according to the different phases of the project and the technology itself. Moreover, not all technologies have the same scale of impact.

• During the survey and preparation phases of the siting areas, the vibrations and noise associated with surveys and possible drilling have significant consequences on marine biodiversity. In addition, these operations often result in disturbance of the seabed and hydro-sedimentary flows as well as increased water turbidity.
Solutions designed to avoid or reduce these impacts as much as possible require improved impact studies, in particular by mapping areas that are highly sensitive for biodiversity (habitats/species/migration, etc.) and by developing technologies and techniques with a reduced impact.

• During the construction phase, noise and vibrations, particularly associated with pile-driving, have an impact on biodiversity. In addition to these two effects, there are also changes in the seabed, disruption of hydro-sedimentary flows, increase of water turbidity together with the harmful effects of the use of biocides or anti-corrosion methods. Finally, the destruction of natural habitats is one of the major potential impacts of the construction of marine renewable energy projects. Other impacts (more important in the operating phase but not necessarily in the construction phase) are the risk of collisions, the barrier effects, and the consequences of lighting.
These impacts on biodiversity can be avoided by limiting technologies that modify the bottom (working on floating technologies and anchors), mapping migration corridors, and choosing materials and coatings that are less harmful to the environment. This should be the general practice in the French overseas territories where bathymetry should favour floating or semi-submerged techniques.

• During the operational phase, the major impacts are linked to the effects of physical barriers (birds, chiropterans, marine fauna, etc.), and habitat modifications (turbidity, temperature, artificial upwelling for OTECs). In addition to these direct impacts, there are cumulative effects from the entire operation, related to lighting, noise, and vibrations generated by turbines and other moving devices.
In order to avoid and reduce these impacts, solutions should involve the development of techniques that generate a minimum of noise and vibration in the environment, accompanied by acoustic barriers.

• Finally, the potential impacts associated with electricity connections are related to emitted electromagnetic radiations, habitat destruction along the connections, and barrier effects.
In order to avoid and reduce these impacts, it is necessary to limit modications to the seabed, to consider the positioning of the infrastructure and its connections from the production site to the coast in terms of the potential impacts, and to develop techniques that generate low levels of electromagnetic emissions.

In addition to the potential impacts of the different MRE technologies at the different project phases, it is essential to assess and deal with the cumulative impacts of all projects, as well as the cumulative effect of the facilities and their connections.

The French committee of IUCN considers that MREs can make a significant and positive contribution to energy supply. However, different types of MRE technologies result in different impacts on biodiversity. It is therefore advisable to favour sectors with high energy potential and low impacts on biodiversity (for all phases of the project, from prospecting to connection, while integrating the cumulative effects of the installations). These include floating wind turbines and wave power, which appear to have significant potential for both overseas and metropolitan France with low or limited impacts on biodiversity.

Conclusions from the discussions

The following key ideas emerged from the discussions and presentations:

Improving governance for the implementation of MRE projects in the French overseas territories

Strengthening knowledge

Establishing a strategy

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Improving governance for the establishment of MRE projects in French overseas territories

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The overseas territories are keen to be involved in the national energy development process while taking into account their specific characteristics. Thus, while it is clear that these territories can serve as testing grounds for the development of renewable energies in general, it is still necessary to formulate a national strategy for the development of marine renewable energies that highlights the overseas territories' potential in this area. This strategy may form a sectoral component of the future national strategy for the sea and coastline. For each overseas territory, this strategy could be included in the strategic documents for the territorial marine area, the preparation of which is the responsibility of local authorities with the support of the State[2].

The development of MRE projects in the French overseas territories is influenced by governance issues at the level of the regions that wish to embark on an energy transition. Indeed, the prerequisite for any commitment to an ambitious energy policy in terms of reducing greenhouse gas (GHG) emissions is a clear and comprehensible energy governance which requires, in particular, the acknowledgement of energy-related jurisdiction within the territories. In the French overseas territories, only Guadeloupe has recently obtained the power to legislate in the area of energy and Martinique has also made a request to this effect. Here, the importance of delegating decision-making to the community level is evident.

Thus, obtaining legislative power over energy matters appears to be a necessary prerequisite for the development of MREs in the French overseas territories. Consideration should be given to the use of overseas territory maritime basin councils[3] to establish coherent governance for all uses of the sea at the level of each territory.

In addition to energy governance, improving the governance of the maritime zone is an essential step in the integrated development of MREs in the French overseas territories.

Beyond governance issues, all stakeholders agree on the importance of communicating with the general public regarding the various challenges of developing marine renewable energy and preserving biodiversity. This can be done in particular through the sharing of information (information documents), public meetings and public surveys.

Existing regulatory tools, such as the various planning documents (eg. SRCAE, SAR, SMVM), could support potential MRE development strategies in overseas France. An MRE development scheme should be developed for each territory and attached to the SRCAE (Regional scheme for climate, air and energy).
Finally, specific regulations for MREs must be developed (e. g. regulations for platforms associated with OTEC, or for floating wind turbines).

2 | French Environmental Code, Article L219-6
3 | 'Antilles' including Guadeloupe, Martinique, Saint-Martin and Saint-Barthélemy, 'South Indian Ocean' including Reunion Island, the French Southern and Antarctic Territories and Mayotte, 'Guyana' and 'Saint Pierre and Miquelon'.

Strengthening knowledge...

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...of biodiversity issues and their dissemination

Protection of biodiversity must be integrated into the development of renewable marine energy projects, regardless of the current state of knowledge of natural environments. A lack of knowledge should not prevent it from being considered.

Integrating biodiversity concerns at the earliest possible stage of development will ensure that impacts on biodiversity and ecosystems are avoided as much as possible (before considering reduction and offsetting as required by law).
This requires: (i) improving the knowledge of species and ecosystems, as well as the transfer of this knowledge; and (ii) adopting an ecosystem-based approach to impact analysis.

The ARO (Avoide – Reduce – Offset) approach requires the assessment of direct, indirect and cumulative impacts (effects of the entire system, connections, etc.) for each project.

The essential integration of biodiversity concerns will require the development of maps that identify the various issues, even if they initially just reflect expert opinion. These maps should integrate the three dimensional marine environment (2 horizontal as well as the vertical dimension).
To this end, it is essential to identify and sectorize not only significant species but also ecosystems and their functioning.
Improving the exchange of knowledge will require mapping the different areas that are important for species, their movements, and all of the natural habitats essential for their life history (breeding, feeding, dispersal, etc.).

Finally, the consideration of biodiversity at all levels (type of MRE, specific techniques, interconnections, etc.) is the key to successful planning. To this end, it is necessary to establish data acquisition and biodiversity monitoring protocols for the different types of MRE.

...of the energy potentials

The development of MRE requires knowledge of the potential of each area, not only in terms of energy resources but especially in terms of technically exploitable potential (TEP).
This assessment requires knowledge of the physical and technological constraints of the different MRE sources for each territory.
In addition to the technical and economic aspects, it is essential to take into account the restrictions, rights-of-way and specific uses that exist in the area.

The evaluation must therefore be carried out specifically for each area and pilot site but also as a forerunner of whether or not an industrial production capacity exists.

It is recommended that strategies consider the specific energy, socio-economic and environmental characteristics of each area.

Setting up a strategy...

Mangroves, Mirereni © Aurélie Bocquet / IUCN France

...that considers biodiversity issues, MRE potential and other marine uses

In order to integrate the challenges of protecting marine biodiversity and developing marine renewable energy, it is essential to inform, share and have the means to objectively assess the issues and their relative importance.
Stakeholder involvement and public support will therefore be encouraged.

The implementation of such a strategy requires the knowledge and understanding of the degree of importance of all the issues (biodiversity, energy potential and existing uses), which is based on the essential sharing of information.
The mapping and overlay of these different issues constitute the cornerstone of consultation. By sharing information and having the means to objectively assess the issues and their relative importance, the involvement of stakeholders, and public support, will be facilitated. Cooperation between the overseas territories in this field should be developed.

It is therefore advisable that this strategy should consist of a sectoral approach at the scale of the sea basin or even regional level of the national strategy for the sea and coastline, and should ensure that the issues, objectives and stakeholders are integrated.

The deployment of MRE systems depends on the specific characteristics of the areas; therefore, cooperation between the energy and biodiversity sectors must be considered. It could thus be based on the sharing of information and the development of cooperation between overseas territories.

...to allow the establishment of MRE industries and access to fundings

The development of MRE requires the creation of technological systems that take into account the development potential of each area, but also the existing industrial structure and previous experiences at both the national and international level.

It is therefore recommended that the process of creating MREs industries should be based on the exchange of knowledge between overseas territories and also with metropolitan territories in order to capitalise on experience and skills in the same sector.

The objective for MREs is to provide an alternative solution to energy needs while ensuring that their impacts on biodiversity are limited. As they exploit the sea, which is a public asset, their development is supervised by the State at both regulatory and contractual levels (call for tenders or expressions of interest).

It is therefore recommended that, in an approach that integrates biodiversity and energy issues, environmental sustainability should be included as a criterion for selecting projects and included in the consultations initiated by the authorities.

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Summary of recommendations

In order to integrate the challenges of protecting marine biodiversity and developing renewable marine energies in the overseas territories, four areas of action should be addressed by decision-makers, energy stakeholders and biodiversity stakeholders:

1 | **Identify the governance issues** that affect the integration of marine renewable energy development in the overseas territories, and the conservation of their outstanding marine biodiversity. This governance must clarify the roles of the various stakeholders and must allow the pooling of instruments and skills in the fields of energy and biodiversity. In addition to the energy and ecosystem protection issues, the governance of the sea and coastline must allow the consideration of the specific characteristics of each of the territories. This should include not only environmental and energy issues but also social and economic issues related to the use of the sea.
Thus, as mentioned previously, it is essential to ensure alignment with the various regional and local schemes. The future overseas territory maritime councils will have an essential role in this respect.

2 | **Improve knowledge of natural environments on the one hand and energy potential on the other.**
Discussions during the workshop highlighted the importance of strengthening knowledge of the biological and biophysical components of the marine environments. The importance of sharing resources for the acquisition of knowledge of energy potential and biodiversity was also stressed.
The identification of biodiversity conservation issues should integrate ecological functions and not just focus on lists of species.
Improving knowledge on energy potential and biodiversity protection should lead to improved sharing of information.

3 | **Implement a coherent strategy** that integrates biodiversity conservation, renewable energy development, and competition for marine space from other sectors.
Such a strategy should be based on an overlay of biodiversity and energy issues for each territory. It should also map out the size of the projects as well as their arrangement in terms of requirements and the overall footprint of the projects over their entire cycle (planning, construction and decommissioning).
Finally, this strategy should be based on modifications to laws to reflect both the specific characteristics of overseas territories and new marine renewable energy technologies.
The key to the success of the establishment of such a strategy, decided jointly by the local authorities and the State, is the active involvement of all stakeholders: public authorities (local authorities, the State), and stakeholders in the marine sector, energy, environmental protection and civil society.

4 | **Exploit the advantages provided by the presence of terrestrial renewable energy sectors within these territories.** It is indeed possible for marine renewable energy sectors to capitalise on innovations such as improved energy storage or by increasing the current upper limit of 30% of RE in the network. The development of these energies in the French overseas territories could particularly benefit from tax support mechanisms, and the creation of small-scale systems that would allow for self-supply and feed-back into the power grid where appropriate.
Finally, it is crucial to integrate environmental sustainability as a selection criterion in calls for tenders, including the acquisition and dissemination of data on species and ecosystems.

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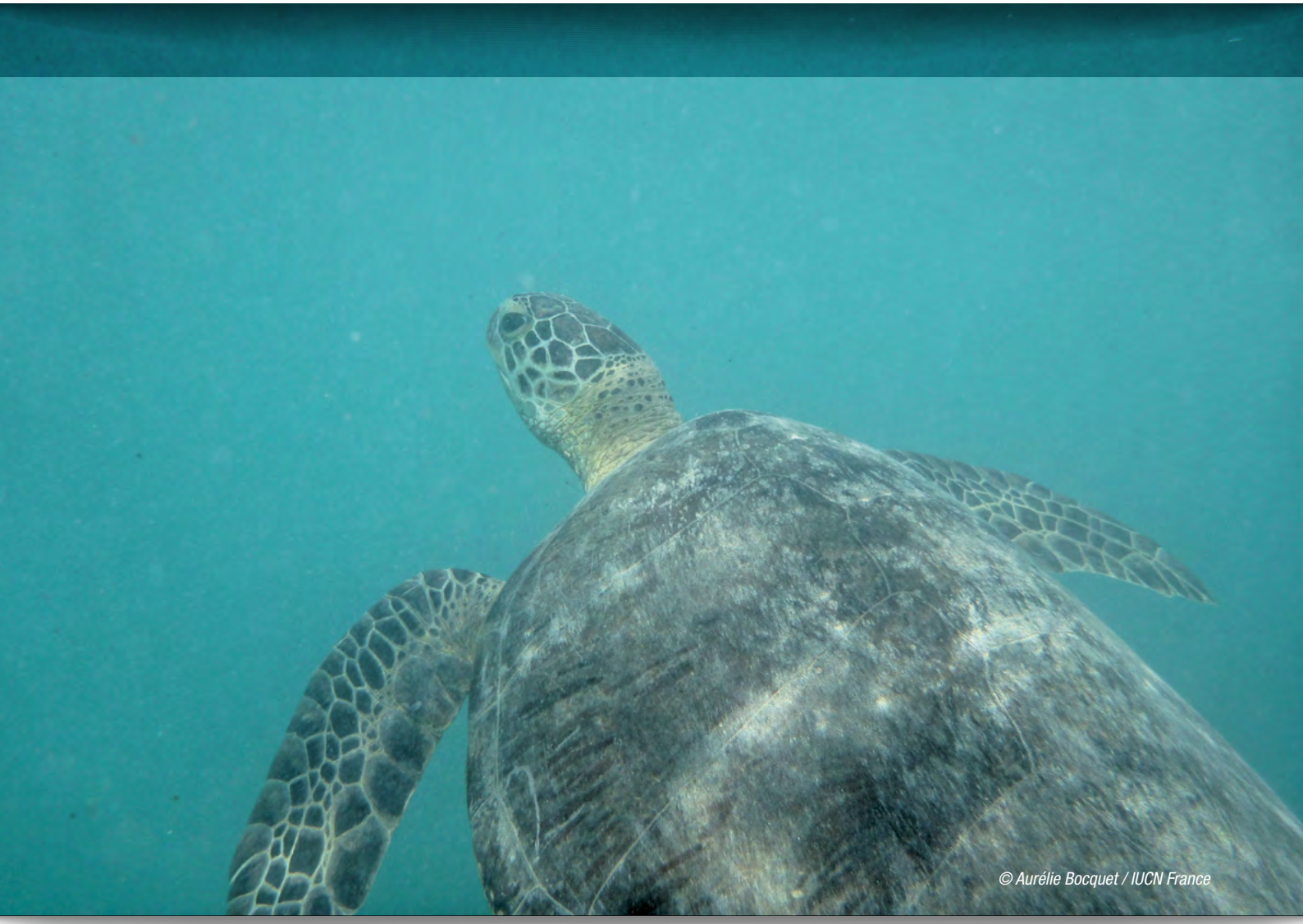
Bernard Cressens, IUCN France
Michel Porcher, IUCN France
Aurélie Bocquet, IUCN France
Pauline Teillac-Deschamps, IUCN France

The presentations of the speakers at the seminar can be downloaded
from the website of the French Committee of IUCN : https://uicn.fr/energies-renouvelables-biodiversite/

French Committee of IUCN

International Union for Conservation of Nature

Created in 1992, the French Committee of IUCN is the network of members and experts of the International Union for Conservation of Nature in France. It brings together, in a unique partnership, 2 ministries, 8 public bodies, 42 non-governmental organizations and more than 250 experts, gathered in specialized commissions and thematic working groups. It has two main missions: to address biodiversity issues in France and to promote French expertise at the international level.
Through this diverse membership, the French Committee of IUCN is a unique platform for dialogue and expertise on biodiversity issues, and also involves businesses and local authorities.



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