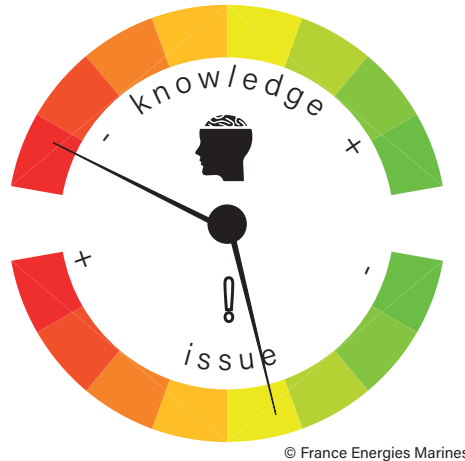


Does the colonisation of offshore renewable energy farms facilitate the introduction and spread of non-indigenous species?



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*Question deemed
"R&D issue and knowledge gap"
by the experts*

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Non-indigenous species

When a new hard substrate (e.g. a turbine foundation, pontoon, ship's hull) is introduced into the sea, this surface is colonised by living organisms (Bibliographical Atlas of Biofouling, 2018). Could offshore renewable energy (ORE) farms facilitate the introduction and spread of non-indigenous species?

For the experts, three phenomena related to the installation of ORE farms could facilitate their spread?

- **the stepping stones,**
- **ballast water discharge,**
- **the storage of ORE components in ports.**



Definitions

Adapted to the marine environment from Thévenot et al. (2013), cited by IUCN (International Union for Conservation of Nature)

INITIAL CONDITIONS

Indigenous species

An indigenous species is a species that naturally develops within a specific geographic entity and that establishes self-sustaining populations thanks to favourable environmental factors; it does so through natural processes, with no human intervention. The terms native and autochthonous are also used.

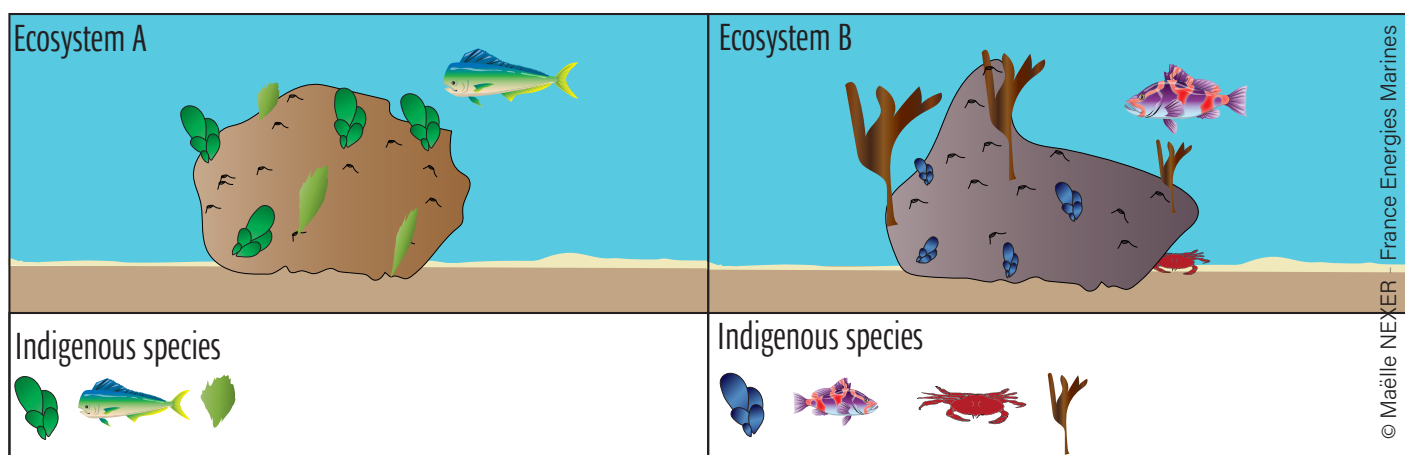
Non-indigenous species

A non-indigenous species is a species that has crossed a biogeographical barrier as a result of human

activities and is therefore outside of its original natural distribution area, in an environment where it was not initially present.

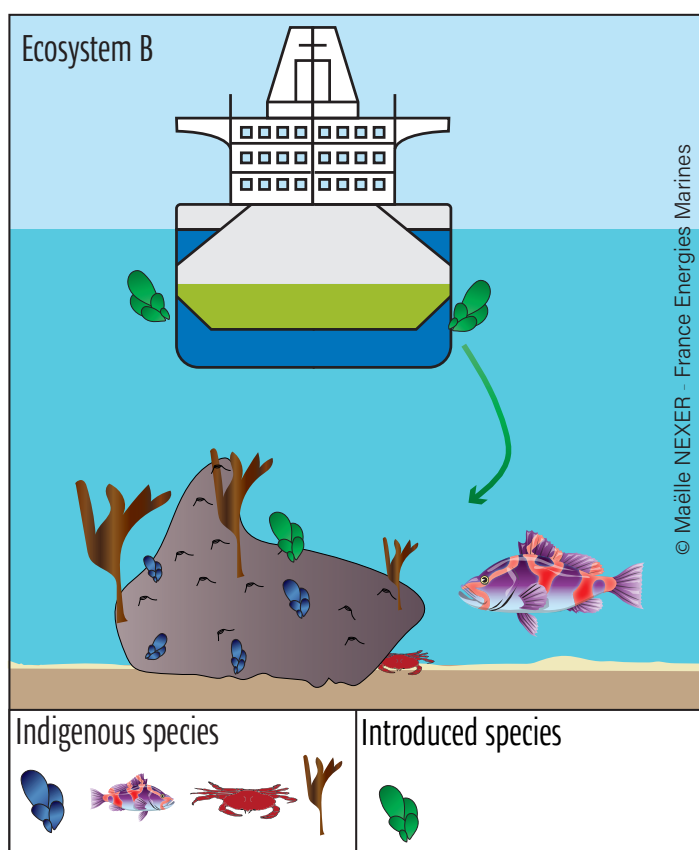
The terms non-native, allochthonous and exotic are also used.

Non-indigenous species are divided into various categories according to their mode of introduction, the degree of colonisation of the new environment, the consequences on the ecosystem and the economic impacts they have.



STAGE 1: TRANSPORTATION - INTRODUCTION

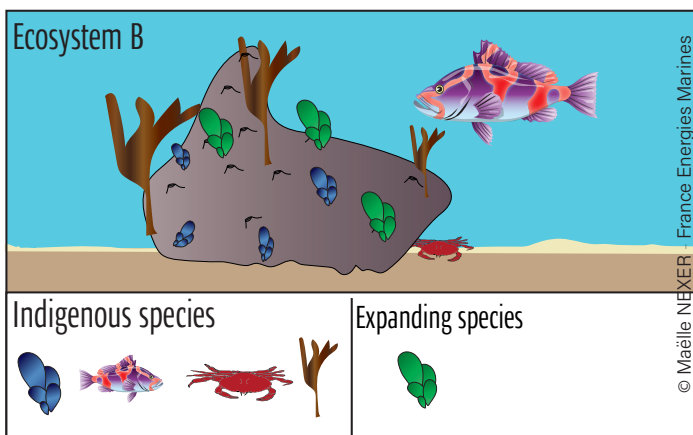
(crossing the biogeographical barrier between ecosystem A and ecosystem B)



Introduced species

Non-indigenous species intentionally or accidentally introduced by human action outside of its distribution area (shipping, aquaculture, fishkeeping, etc.).

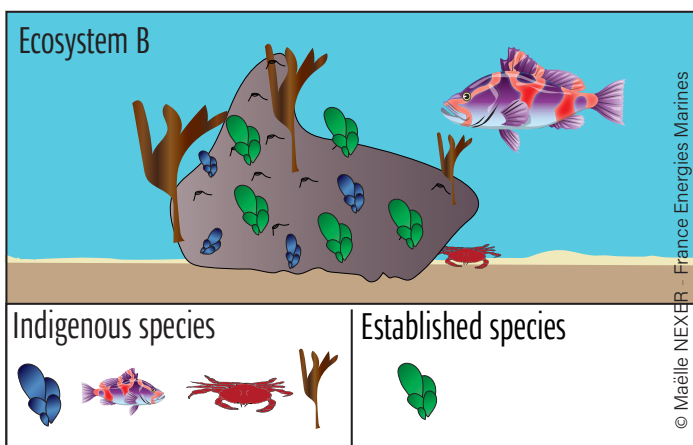
STAGE 2: EXPANSION



Expanding species

Species extending its area of distribution through its life history, adaptation or plasticity traits, or under the effect of environmental changes, or else spontaneously, under the effect of genetic mixing for instance.

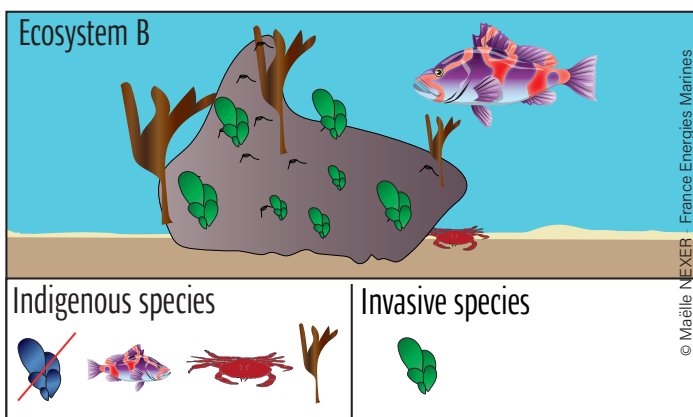
STAGE 3: ESTABLISHMENT



Established species

Non-indigenous species that has colonised and developed self-sustaining populations in a geographic entity outside of its own natural area of distribution. The term "self-sustaining" implies the reproductive autonomy of the population. An established species remains as such as long as it does not cause ecosystem, health or economic damage.

STAGE 4: PROLIFERATION



Invasive species

A non-indigenous species established in a biogeographical area that is not naturally its own, where, through its proliferation in this environment, it causes significant changes in the ecosystem's behaviour, structure or functioning. This generally implies a negative impact on the environment, health or the economy.

Fig. 1 Stages of biological invasion

1. Can ORE farms promote the introduction and spread of non-indigenous species by creating a stepping stones?

STATEMENT

Certain marine organisms that are sessile (i.e. attached to a substrate) at adult stage produce pelagic larvae (living in the water column). These larvae move passively under the influence of currents before finding a hard substrate to attach to and develop. For these species, offshore wind farms can provide new hard substrate habitats where sessile organisms develop and in turn reproduce. The larvae produced disperse from this new point and can thus reach new rocky areas: this is the so-called stepping stones. In order to illustrate the stepping stones that wind turbines could have at sea, we chose to take a simple example: a rocky reef at a certain distance from other reefs. A wind farm is built between the reef and the rocky areas.

Initial conditions

The organisms on the reefs in ecosystem A produce larvae. The maximum larval dispersal distance means that they cannot reach the rocky reefs in ecosystem B.

With the wind farm in place

The organisms on the natural reef in ecosystem A produce larvae. The wind turbine foundations and moorings, and floats in the case of floating wind turbines, act as an artificial reef. Larvae attach themselves to and colonise the wind turbine foundations. Once attached, if conditions are conducive, the organisms will develop and reproduce, in turn releasing pelagic larvae into the water column. Carried by favourable currents, the larvae will reach the rocky reefs of ecosystem B, where the species was initially absent. This is what is referred to as the stepping stones. In this way, the larvae of organisms in ecosystem A, which cannot directly colonise ecosystem B, may possibly do so in the presence of wind turbines.

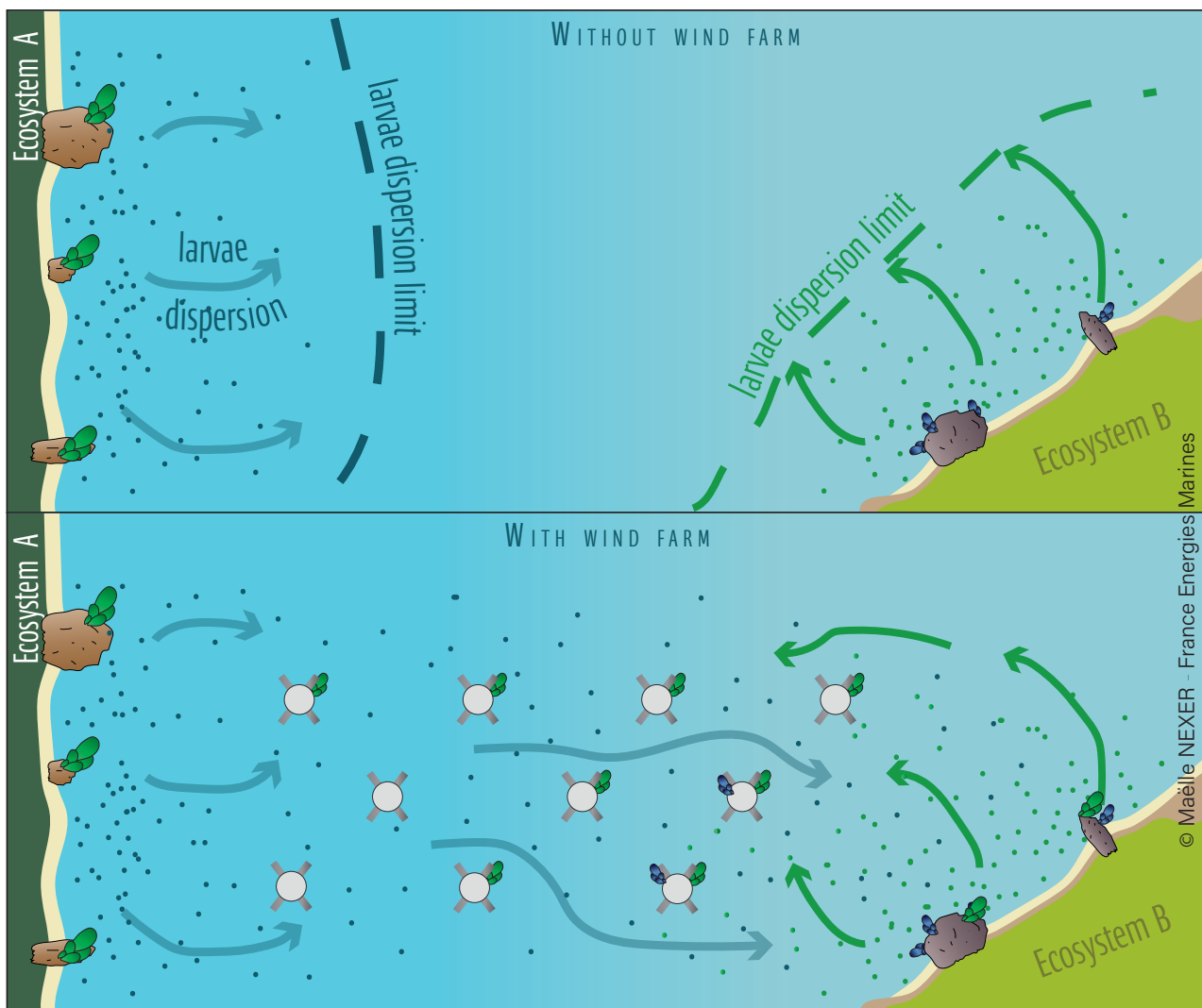


Fig. 2 Stepping stones mechanisms with and without a wind farm

THE SITUATION IN FRANCE

French offshore wind farms are located close to the French coastline; there is therefore a low risk of creating a stepping stones between the English and French coasts for example.

The stepping stones at the scale of the French coasts would have little impact as many other structures and activities transport species or already act as a relay on this scale (shipping traffic, aquaculture, buoys, etc.). The risk of non-indigenous species spreading through the stepping stones produced by French wind farms appears limited.

RECOMMENDATIONS

The experts recommend developing a turbine foundation monitoring plan in order to develop an understanding of the introduction and spread of non-indigenous species.

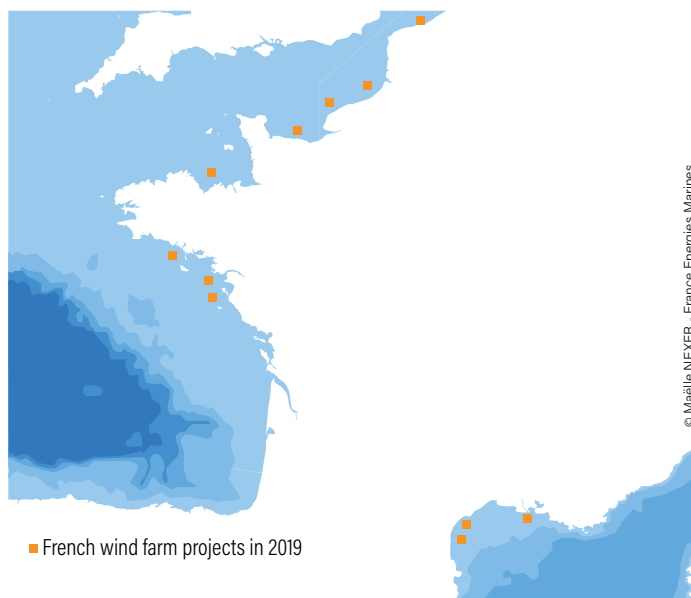


Fig. 3 Map showing offshore wind farm projects in France in 2019

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IN SHORT:

The risk of non-indigenous species spreading through the installation of ORE farms in France appears limited but not negligible. The experts recommend developing a protocol for monitoring turbine foundations in order to observe and report the development of non-indigenous species.



Tropical shrubby hydrozoans

© Frédéric Ducarme

2. Can ballast water discharge near offshore wind farms promote the introduction and spread of non-indigenous species?

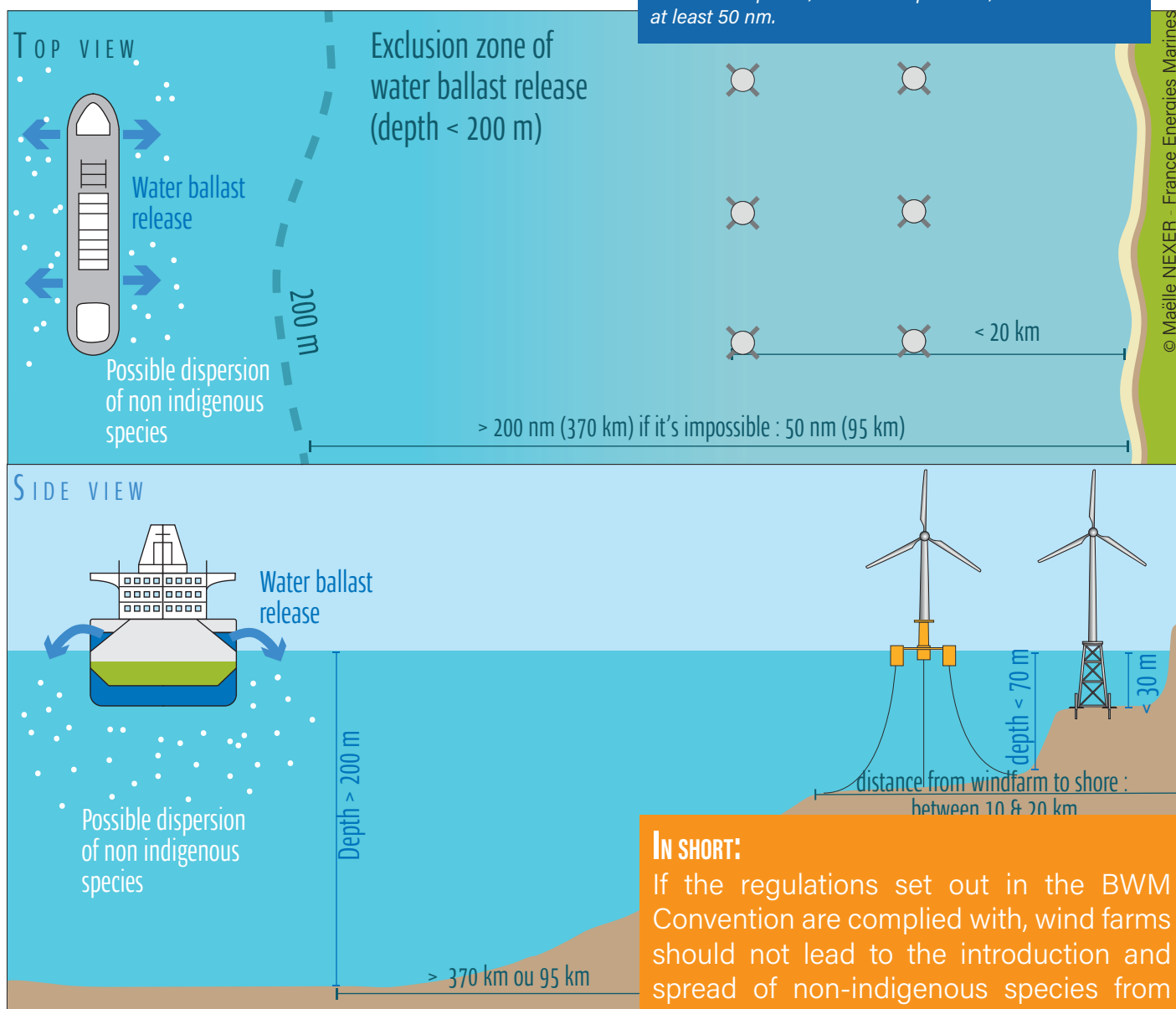
STATEMENT

Ballast water may be taken onboard by ships for stability. It can contain thousands of aquatic or marine microbes, plants and animals, which are then carried across the globe. These organisms may be released when the ballast water is discharged. The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted in 2004. It entered into force in 2017 to introduce global regulations to control the transfer of potentially invasive species. As a temporary solution, pending the installation of an on-board ballast water treatment system,

ships should exchange ballast water mid-ocean. If regulations are complied with, untreated ballast water should not be discharged near wind farms. The convention requires ships to discharge ballast water at a considerable distance from the coast (see text box and diagram below) to prevent the spread of non-indigenous species.

The international Ballast Water Management (BWM) Convention in force since 2017 requires ships to:

- Implement a ballast water management plan
- Conduct ballast water exchange at least 200 nautical miles (nm) from the nearest land and in water at least 200 m in depth or, if this is impossible, at a distance of at least 50 nm.



IN SHORT:

If the regulations set out in the BWM Convention are complied with, wind farms should not lead to the introduction and spread of non-indigenous species from ballast water along the French coastline.

Fig. 4 Location of offshore ballast water discharges near a wind farm

3. Can the storage of ORE components in ports promote the introduction and spread of non-indigenous species?

STATEMENT

Several types of offshore renewable energy (ORE) farm components are built, stored and maintained in ports (e.g. gravity foundations, floats) before being transported to their area of operation. Certain components are then brought back to port for maintenance. As ports are international shipping hubs, they are colonised by non-indigenous species. These

organisms could colonise turbine components, which constitute bare substrates. During the transportation and installation of these components in the environment, species attached to their surface could be dispersed in the environment.

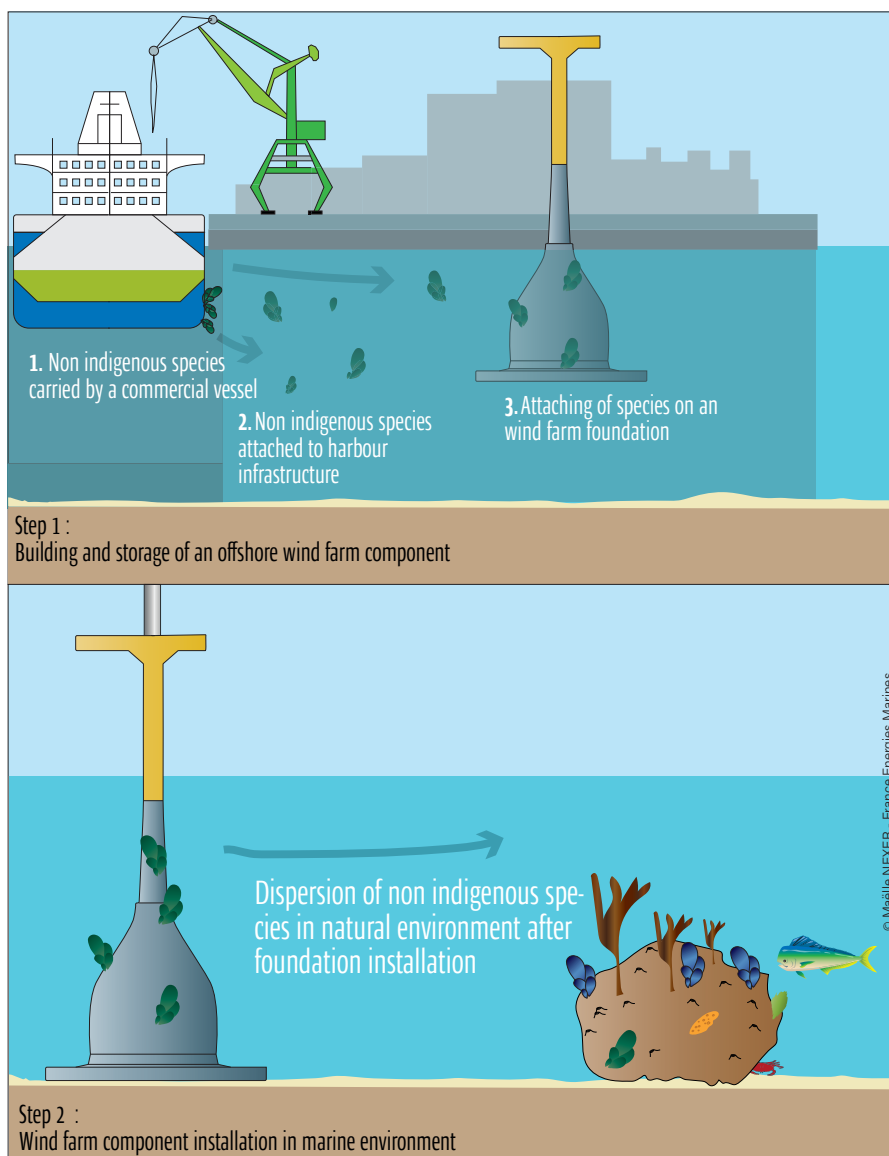


Fig. 5 Risk of the development of non-indigenous species on ORE farm components; example of a wind turbine gravity foundation

RECOMMENDATIONS

Stage 1

Quickly transport ORE components on site to reduce exposure time to non-indigenous species more commonly present in areas close to ports and on the shoreline.

Stage 2

Implement a protocol for monitoring turbine foundations or floats in order to observe and report the development of non-indigenous species.

IN SHORT:

There is a risk of non-indigenous species spreading through the construction and storage of ORE components in ports. This risk can be limited by establishing simple protocols (e.g. storage time in ports).

Conclusions

Stepping stones

Limited issue and knowledge gap

There is a low risk of French wind farms generating a stepping stones; many other offshore structures and activities already play this role. The risk of non-indigenous species spreading through the installation of ORE farms in France appears limited but not negligible.

Recommendations

Conduct regular monitoring of subsea ORE components, from installation to dismantling. This would provide knowledge on the development potential of new species.

Ballast water discharge

No issue if regulations are complied with

The BWM Convention sets out rules on the discharge of ballast water from ships in international traffic. If these regulations are complied with, untreated ballast water will not be discharged near future wind farms.

Storage of ORE components in ports

Issue and knowledge gap

Certain ORE farm components are built, stored and maintained in ports before being transported to their area of operation. In ports, they offer bare surfaces for colonisation. Once installed in the natural environment, colonised ORE components could become sources for the spread of non-indigenous species.

Recommendations

To prevent the development of non-indigenous species on ORE structures (e.g. gravity foundations, floats), the experts made several recommendations: limit component storage times in ports and transport them quickly to the offshore site. Once installed in the natural environment, it is recommended that monitoring of these ORE components be implemented.

In order to gain as much knowledge as possible on this subject, the experts recommend setting up regular monitoring of ORE component colonisation.



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