## WHAT IS THE OCEAN MICROBIOME?



Every liter of water contains between 10 and 100 billion microorganisms, classified in 4 populations: phytoplankton, protists, bacteria, and viruses. This classification does not reflect the immensely rich biodiversity of plankton, nor their numerous ecological interactions: symbiosis, parasitism, predation, and protection.



The Microbiome Mission will help us understand WHO DOES WHAT, AND HOW, in an environment in constant mutation due to climate change

**JUST AS** 

to be discovered.

THE HUMAN

MICROBIOME

CONTRIBUTES TO OUR WELL-BEING.

It structures, produces and protects.

THE OCEAN MICROBIOME CONTRIBUTES

The microbiome influences the entire oceanic

ecosystem, and thus the climate of our planet.

The microbiome is an indicator of the Ocean's

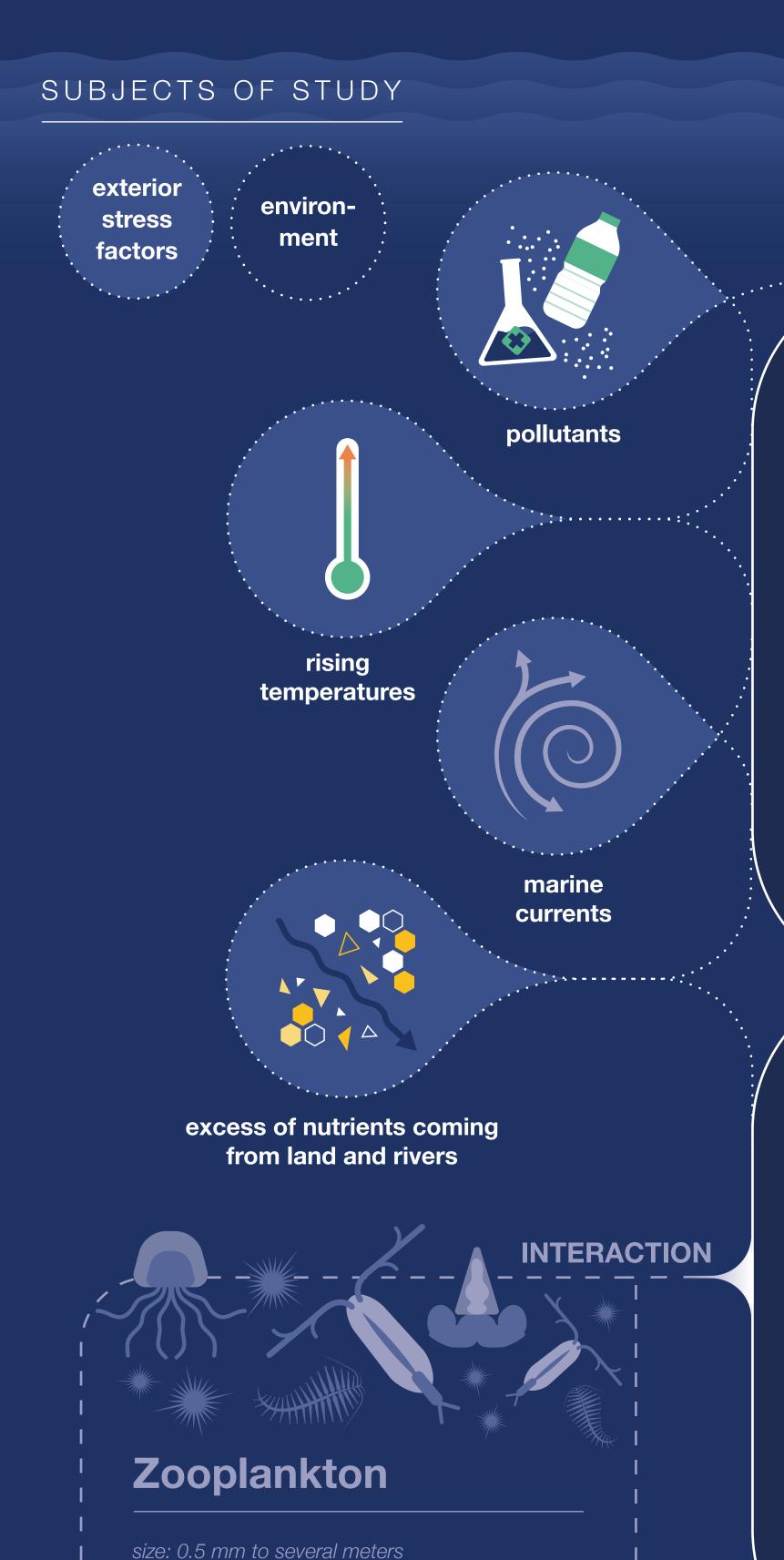
well-studied. In contrast, more than 60% of

microbial genes present in the ocean remain

state of health. Today the human microbiome is

**HUMAN MICROBIOME** 

POSITIVELY TO THE HEALTH OF THE PLANET



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Phytoplankton<sup>(\*)</sup>

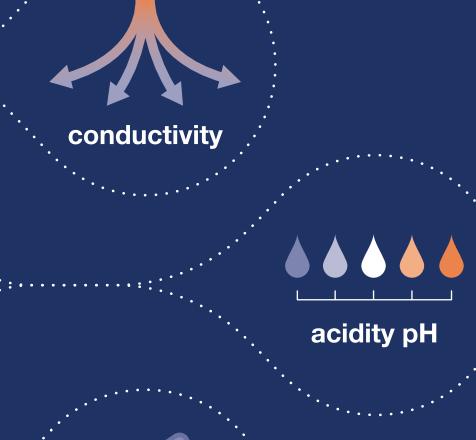
size in micrometers: 0.1 à 10 µm

Phytoplankton consists of all microscopic single-cell algae — the micro-algae. Certain bacteria and protists are phytoplankton. These microorganisms, thanks to chlorophyll pigments, use CO<sub>2</sub> to produce organic matter and generate oxygen. They are equivalent to plants on land.

**Protists** 

size in millimeters: 0.8 to 10 mm

Protists are complex unicellular organisms with a nucleus and sometimes skeletons of glass, stone, or organic matter in extraordinary shapes. Certain are capable of photosynthesis — the phytoplankton. Fueled by solar energy, they produce living matter from carbon dioxide (CO<sub>2</sub>), water, and mineral salts. Some of this organic carbon sinks to the bottom of the oceans, sequestering atmospheric CO<sub>2</sub> there for thousands of years.



salinity

temperature

nitrogen level

nutrients

oxygen level

**OCCEAN MICROBIOME** 

SYMBIOSIS



size in micrometers: 0.1 à 2 µm

Bacteria are simple unicellular organisms with nuclei. Some participate in the photosynthetic activity of the oceans (cyanobacteria). Others recycle dead plankton into nutritive elements and thus participate in the 'breathing' mechanism of the oceans. Still others live in symbiosis with protists and planktonic animals (zooplankton), providing them vital elements.

size in micrometers: 0.01 to 1 µm

**Viruses** 

Extraordinarily numerous and varied, viruses need a host in order to multiply. Sometimes they provoke the mass death of bacteria, protists or zooplankton, especially those that are multiplying too rapidly in the ecosystem. Most often, they penetrate their hosts without killing them, contributing new genes and participating in the microbiome's equilibrium.

Studying the microbiome..... means...

These are multicellular organisms—the animals

they show complex behavior, including massive

vertical migrations several hundred meters deep. Every night krill, copepods and fish larvae rise to the Ocean's surface to feed without being seen.

in plankton. Often transparent and gelatinous,

Zooplankton is in constant interaction with

the microbiome.



determining understanding a global system what affects its functioning



quantifying the impact of rivers stress factors



plastic pollution



assessing the distribution of the microbiome in ocean currents

in a common environment: the Ocean

