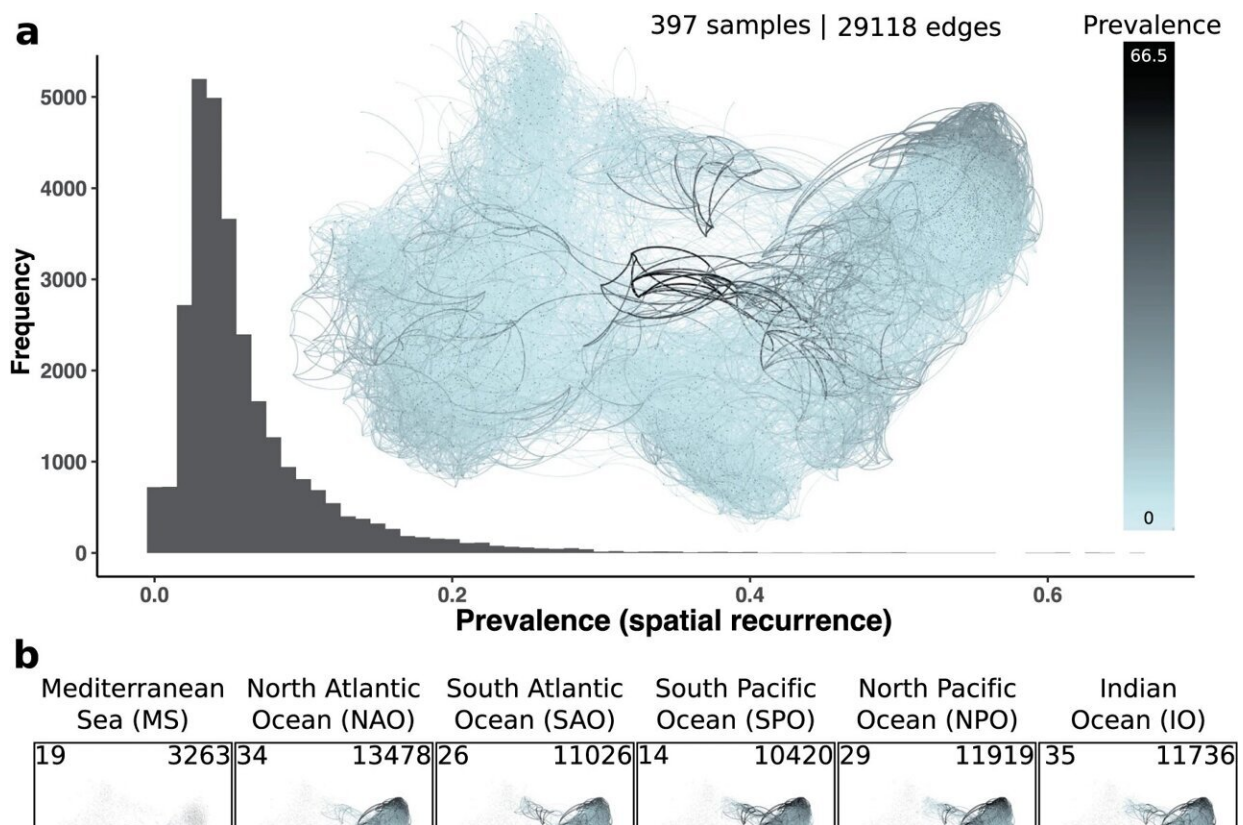


Scientists uncover ocean's intricate web of microbial interactions across different depths

January 11 2024



Spatial recurrence of potential microbial interactions. **a** Association prevalence, that is, the fraction of subnetworks (samples) in which an association appeared considering all depth layers across the tropical and subtropical global ocean and the Mediterranean Sea. Associations that occurred more often (black) appeared in the middle of the single static network visualization. Most edges had a low prevalence (blue) 0% in the upper right corner, and the depth range in the lower right corner (in m below surface). Note that the prevalence rises to 100% in **b** vs. 66.5% in **a**. Source data are provided in the GitHub/Zenodo³⁷ repositories

(sections 02_NetworkConstruction and 04_Prevalence; see Data Availability).
Credit: *Nature Communications* (2024). DOI: 10.1038/s41467-023-44550-y

An international team of scientists led by researchers from the Institut de Ciències del Mar (ICM-CSIC) in Barcelona has uncovered the ocean's intricate web of microbial interactions across different depths. The research, which provides crucial insights into the functioning of ocean ecosystems, is published in the journal [*Nature Communications*](#).

"This research marks a significant advance in our understanding of how [microbial interactions](#) in the ocean's vast ecosystems operate across different depths and regions," states the ICM-CSIC researcher Ramiro Logares, who highlights the key role of marine microscopic microorganisms in the cycling of various nutrients and [carbon fixation](#), as well as in the functioning of marine food webs in general.

Until now, only the microbial associations in the surface waters of the ocean, at a global scale, have been explored. This study further explores how microbial interactions may change from the surface to deep sea waters across several tropical and subtropical global ocean locations and the Mediterranean Sea.

The study uses cutting-edge association networks to explore the ecological interactions among archaea, bacteria, and picoeukaryotes in the marine microbiome. It reveals that potential ocean microbial interactions vary significantly with depth and geographical location.

Ocean depth, a key factor

One crucial finding is that while some interactions are global, occurring consistently across various regions at the same depth, a significant

proportion (11–36%) are regional and specific to certain depths. For example, the deepest zones show the least global associations.

"The bathypelagic zone, the deepest part of the ocean, exhibits the lowest proportion of global associations, with regional associations increasing with depth," adds in this regard Dra Ina M. Deutschmann, an expert in biomathematics.

Conversely, surface associations do not persist deeper into the ocean despite the vertical dispersal of microbes, which transfers surface cells into deep sea waters.

To carry out the study, the scientific team used innovative association network approaches that allowed them to predict ecological interactions among microbes in individual samples. This permitted them to quantify the dynamics of networks across the vertical and horizontal dimensions of the ocean.

All in all, the research is pivotal in enhancing our understanding of the ocean's microbial interactions or interactome. By mapping the intricate web of microbial interactions, the study provides crucial insights into the functioning of [ocean](#) ecosystems, which are essential for the planet's health.

The findings could have significant implications for society, as they can help predict the effects of climate change on oceanic ecosystems by assessing how association networks respond to [environmental changes](#).

More information: Ina M. Deutschmann et al, Disentangling microbial networks across pelagic zones in the tropical and subtropical global ocean, *Nature Communications* (2024). [DOI: 10.1038/s41467-023-44550-y](https://doi.org/10.1038/s41467-023-44550-y)

Provided by Spanish National Research Council

Citation: Scientists uncover ocean's intricate web of microbial interactions across different depths (2024, January 11) retrieved 28 April 2024 from <https://phys.org/news/2024-01-scientists-uncover-ocean-intricate-web.html>

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