ENGLISH

IFISC researchers examine oceanic connectivity and map hydrodynamic provinces to help designing marine reserves.

The journal "Geophysical Research Letters" publishes the results of this study based on a new approach.

Conserving and protecting natural ecosystems against the impacts of multiple human-induced stressors is of crucial importance to maintain biodiversity and to ensure their economical and societal services. The preparation of efficient conservation measures requires however a good understanding of the geographic distribution of all species and of their spatial dynamics. While this is relatively attainable over land due to the slowly evolving landscape and directly observable movements of animals, it remains complicated in the ocean. Indeed, most marine organisms have limited moving abilities as adults while they disperse large distances through the vast and turbulent oceanic environment as larvae (or other "propagules"). Larval drift through the oceanic circulation can connect distant populations, thus affecting both composition and structure of marine populations. As such, oceanic dispersal and connectivity have been identified as crucial factors for structuring marine populations and designing marine protected areas.

In a recent paper published in GRL, IFISC researchers developed a new approach to study larval dispersal by ocean currents and to characterize oceanic connectivity. This method combines for the first time two powerful tools, employed separately in the past, to study the connectivity of the entire Mediterranean basin. On the one hand, they used **surface velocity fields from a high-resolution circulation model** to construct a network of connected subareas of the Mediterranean Sea among which larvae of various marine species are being transported. On the other hand, **a state-of-the-art mathematical technique borrowed from "Graph Theory"** allows extracting from this transport network new diagnostics particularly useful for the design of marine reserves.

The **main results** include the **mapping of "hydrodynamical provinces"** that are regions well connected internally by the ocean currents but with little exchange with the surroundings. These regions are delimited by geographic barriers (such as straights and bathymetric discontinuities) as well as dynamical structures (such as oceanic eddy and fronts), both matching observed features of the Mediterranean circulation. By examining the location and persistence of these boundaries, the authors characterized **the spatial and temporal scales that control larval dispersal across the entire seascape**. Finally, three novel connectivity metrics were defined and examined for all existing reserves of the Mediterranean to quantify their **dispersal characteristics and areas of influence**. These new results are relevant for the design and management of marine protected areas and have wider ecological implications in understanding population genetics and ocean biogeography.

This research originates from the work of four IFISC researchers who are **Vincent Rossi, Enrico Ser-Giacomi, Cristóbal López y Emilio Hernández-García.**

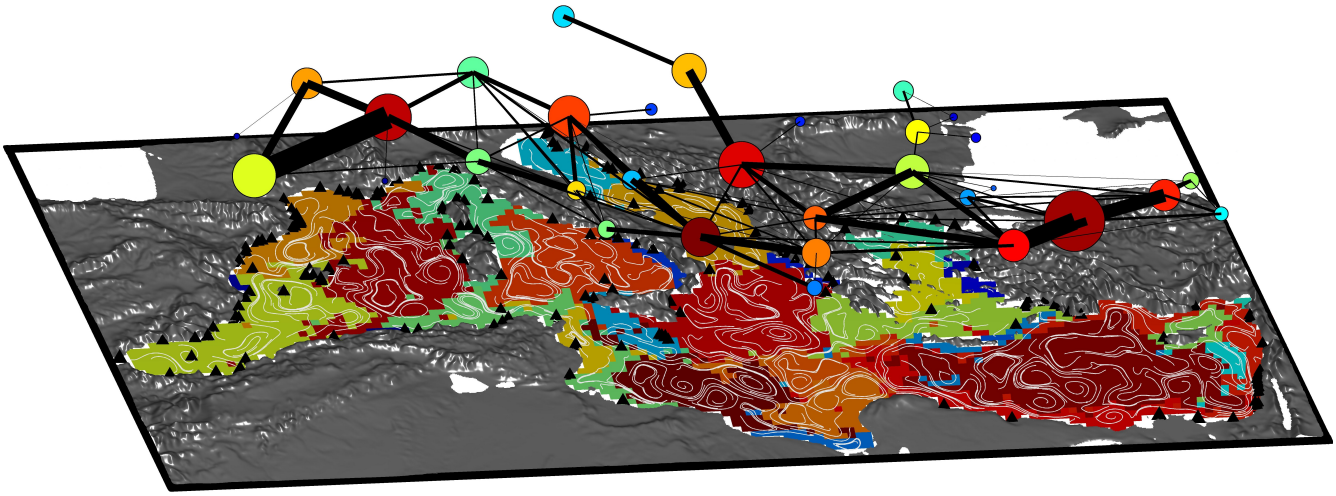

Figure: A view of the 32 hydrodynamical provinces in the Mediterranean sea extracted from a basin-scale connectivity matrix simulating the transport of larvae during 60 days in summer 2011. White streamlines represent the modeled surface flow averaged over the period of study. Those provinces, and the resulting transport network displayed above using a similar color code, organize larval dispersal and control the connectivity of marines reserves (black triangles) in the entire Mediterranean basin.

One can download the "*in press*" PDF version of the article or access the website of *Geophysical Research Letters* following this **link**.

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