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, 2026.

[Evidence of increased hydrodynamic retention in the spawning grounds of large pelagic fishes in the western Mediterranean](#)

. Front. Mar. Sci., 17 April 2026. Sec. Physical Oceanography. Volume 13, 2026.

<https://doi.org/10.3389/fmars.2026.1705858>

Abstract: Hydrography shapes the reproductive and early life ecology of migratory large pelagics such as Atlantic bluefin tuna. While their spawning grounds have traditionally been linked to areas with suitable temperature, low productivity, and moderate surface mixing, other oceanographic processes are likely crucial to ensure that early life stages remain in favorable habitats. We hypothesize that retentive oceanographic patterns are a defining feature of these spawning areas, distinguishing them from surrounding regions. To test this hypothesis, we first evaluated the skill of a high-resolution, data-assimilative hydrodynamic model to represent the ocean surface circulation around the Balearic Islands, where the main spawning ground of the Western Mediterranean is located. We then used Lagrangian particle tracking to investigate retention and dispersion patterns at the regional scale during the reproductive season of Atlantic bluefin tuna, albacore tuna, and swordfish. Retention and dispersion analyses revealed that, during the reproductive season, surface circulation favors particle transport towards the spawning ground, where particles tend to remain. This shows that the Western Mediterranean spawning ground is governed by basin-scale hydrodynamic regimes that aggregate particles from neighboring regions, providing a mechanistic basis for their persistence over time despite occasional anomalous years.

Keywords: high-resolution regional reanalysis, hydrodynamic modeling, interannual variability,

Lagrangian analysis, large pelagics, retention processes, spawning ecology, Western Mediterranean Sea