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M.P. Tugores, A.P. Torres, P. Reglero, M. Martín, R. Balbín, J. Tintoré, D. Alvarez-Berastegui, 2026.

[Climate-induced shifts in swordfish spawning habitat in the Western Mediterranean](#)

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Abstract: Climate change presents huge challenge for marine ecosystems worldwide, with particularly pronounced effects on the most vulnerable species, life stages and regions. Swordfish (*Xiphias gladius*), is classified as ‘near threatened’ on the IUCN Red List, and the Mediterranean population is declining. We investigated the effects of environmental variability and climate change on the habitat of the yolk-sac larvae (YSL) of swordfish in the Balearic Islands (Western Mediterranean) through field surveys (2001–2022). We then estimated the suitability of their habitat across the Western Mediterranean, analysing the changes over more than three decades (1990–2022). The swordfish spawning ground in the Balearic Islands was identified near the salinity front (~37.5) and the surrounding warmer waters. Our models showed that, since the 1990 s the swordfish YSL habitat has increased suitability and expanded within the Western Mediterranean, mainly in response to rising temperatures. However, YSL densities (non-significant) and swordfish population in the Western Mediterranean showed a declining trend. The first occurrence of YSL, and temperatures associated with them, have shifted to earlier in the year, at a rate of 0.57 days year⁻¹, which suggests spawning is starting earlier. We also observed a significant decrease in sea surface chlorophyll-a over the Western Mediterranean since 1998. Therefore, the decline in swordfish population is not subject to a reduction in habitat suitability for YSL due to seawater warming but other factors that are unaccounted for or due to ecological cascading effects, which are either bottom-up (e.g. reduction in sea surface chlorophyll-a) or top-down (e.g. fishing pressure). These findings highlight the need for further investigation on the ecological and anthropogenic pressures affecting the Mediterranean swordfish population.

Keywords: Climate change, Ocean warming, Essential habitat modelling, Habitat indicators, Marine ecosystems, Generalized additive models, Environmental variability