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Temperature unravels the variability in life-history traits observed between non-indigenous and native fish species in the Mediterranean Sea

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Abstract:

Marine non-indigenous species (NIS) represent a serious ecological threat that may cause significant habitat alterations, distributional shifts of native aquatic species, along with quantitative and qualitative losses in the ecosystem services. The introduction, and the subsequent establishment of NIS to new areas have been attributed to various factors, such as climate change and anthropogenic maritime activities (e.g., shipping and aquaculture). In the present study, we investigated the variability patterns of life-history traits between NIS and native fish species (MED) of the Mediterranean. We gathered data from FishBase on 13 life-history traits of 343 MED and 107 NIS fishes, which cover all the aspects of a fish species' biology: 1) Maximum length, 2) k coefficient, 3) Life span, 4) Age at maturity, 5) Length at maturity, 6) parameters a and b (7) of the length at weight relationship, 8) Generation time, 9) Trophic level, 10) Asymptotic length and 11-13) Minimum, mean and maximum temperature of preference. Species with a full dataset of the 13 traits were included in subsequent analyses. We standardized (i.e., zero mean value; standard deviation equals one) the aforementioned trait data and we estimated the variance (σ^2) of each trait at the family level, to explore the range of preference per family for both groups of species (i.e., MED/NIS). We explored whether there was difference in trait variability between groups: i) in the whole dataset and ii) in the dataset containing only common families (i.e., occurrence in both groups) via non-parametric statistical procedures. Following the (i) and (ii) approach, mean and maximum temperature were the only statistically significant variables when comparing the two groups. NIS species exhibited higher values of mean and maximum temperature, but with narrower variance range, compared to MED species. Subsequently, NIS may be considered as more competitively advantageous due to their preference in higher temperatures, also showing narrower temperature range in comparison to their native counterparts under a changing climate scenario. Surprisingly, the other traits examined did not show any difference between groups, thus highlighting the importance of temperature as a crucial parameter shaping the distribution of species under shifted environmental regimes; a finding in line with the ongoing temperature increase in the Mediterranean and its subsequent tropicalization. This study was undertaken in the frame of the project 4ALIEN: Biology and the potential economic exploitation of four alien species in the Hellenic Seas, funded by the NRSF 2017-2020 (MIS (OPΣ): 5049511).

Keywords: Non-indigenous species, fishbase traits, variance analysis, Mediterranean fishes.

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