Some like it hot – Erythraean bioinvasions into the Mediterranean Sea

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More multicellular non-indigenous species (NIS) have been recorded along the Israeli coast than anywhere in the Mediterranean Sea. When reckoned per coastline length, the number is of calamitous proportions. A recent update increased the recorded number to **464** species, nearly 90% are considered to have been introduced through the Suez Canal (Erythraean NIS). In the past 3 years alone (2019-2021) 72 NIS were newly described from the Israeli coast. The extraordinarily large number of records highlights the role of the southern Levant as a "hotspot", a beachhead and dispersal hub for secondary spread.

It has long been assumed that populations of NIS introduced through the shallow Suez Canal into the Mediterranean will be restricted to the upper shelf. Indeed, until the 1970s the Erythraean NIS were largely confined to habitats shallower than 50 m. Post-millenial enlargements increased the canal's cross-section and hence water volume and through-current velocities, and likely increased propagule pressure of deeper living biota at the time rising sea-water temperature facilitated their establishment. A survey along the 200 m isobath collected Erythraean fish, and an Erythraean swimming crab, *Charybdis longicollis*, was collected at 250 m. The descent of Erythraean NIS to the upper slope reveals that thermal niche estimations based on the species' native environment likely underestimated their thermal tolerance, and thus their bathymetric and geographic expansion. Comparison of native molluscan richness in living and death assemblages revealed that only 12% and 5% of species present in the latter were live-collected recently on the shallow subtidal soft and hard substrates, respectively. About 60% of the shallow subtidal native species do not reach reproductive size. As climate warms, it is likely native biodiversity collapse will intensify. Comparison of the abundance-weighted trait composition, and functional diversity of native and non-indigenous molluscs revealed they differed persistently. Thus, rising NIS dominance has already altered the functional properties of shallow-water molluscan assemblages.

The prevalent positive relationship between time since first record and extent of their spread across the Mediterranean, indicates that Erythraean NIS are not be at equilibrium. Thus, the surging NIS numbers of the past half century augur a sizable invasion debt. Already the accrued Erythraean debt is extensive – 84 and 32% of species recorded off the Israeli coast prior to 1960 spread across the Levant Basin and Central Mediterranean respectively, as compared to 51 and 18% of those recorded post 1990 – **here today, (nearly) everywhere tomorrow**.

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