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# A meta-analysis of mainland and island populations suggests a general isolation syndrome affecting traits, demography, and genetic diversity

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## Abstract

Oceanic (geographical) islands, due to their geographically isolated evolutionary histories and the general paucity of interacting populations, are extreme cases of geographic isolation. Populations of plants and animals on islands are subject to strong selection pressures that lead to important changes in their life history strategies, when compared with their mainland counterparts. While the island syndrome may be an extreme case of insularity, isolation syndrome can also emerge across various ecological islands on the mainland. We assessed the generality of the biogeographic mechanisms of isolation-by-distance and isolation-by-environment by developing the "GEOPOP: Geography of Populations" database, which currently contains 13500 population-level measurements of genetic, morphological and demography traits (7529 entries from oceanic islands and 6042 entries from the mainland) for 2035 georeferenced populations of plants and animals published in 160 studies. Using this database we extended the "island syndrome" concept to the "isolation syndrome", and tested to what extent the "isolation syndrome" is a general biogeographic driver of trait variation in mainland and island systems. Specifically, we tested to what extent differences in the mean and variability of traits, demography, and genetic diversity of populations were predicted by the geographic distance and the environmental distance between populations, and whether the effect of the isolation by distance is stronger within island systems. Our preliminary results support predictions from the "isolation syndrome", i.e. higher differentiation between populations with increasing geographic and environmental distances between populations. While these effects were found in both island and mainland systems, island populations had

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higher differentiations between populations when compared to mainland systems, highlighting the clearer isolation effects in island systems. The isolation-by-distance underlying the island syndrome is a particular case of the general isolation-by-distance biogeographic mechanism. Expanding the "island" concept from isolated physical land or water bodies to more general, ecological-evolutionary processes paves the way towards a conceptual unification of the phenomenon of insularity across marine and terrestrial systems of ecological islands.

**Keywords:** ecological islands, environmental distance, fragmentation, GEOPOP, insularity, island syndrome