

ENVIRONMENTAL DETERMINANTS OF ENDEMISM AND SYMPATRY FOR THE DARWIN FINCHES IN THE GALÁPAGOS ARCHIPELAGO. Terrell H. Hamilton and Ira Rubinoff, Department of Zoology, The University of Texas, and Harvard Biological Laboratories.

We have recently used multiple regression analysis to consider the general evolutionary problem of the relative importance of the various factors governing the proliferation of related subspecies or species on member islands of an archipelago. For the Darwin finches (Geospizinae) in the Galápagos Archipelago, we ask the question: Why, in this bird group of restricted distribution and of monophyletic origin, is there a tendency for many species and few endemic subspecies to occur on some islands, and for few species but more endemics to occur on other islands? The question relates to the negative relation (correlation coefficient or $r = -0.60$) between insular number of species and insular number of endemic subspecies.

By the method of least squares, the following factors are tested for their values in predicting either insular numbers of geospizid species or endemic subspecies: (A) insular area, (P) plant diversity as measured by insular number of land plant species, (IN) isolation as measured by distance from nearest island, and (IC) isolation as measured by distance from Indefatigable Island, near the center of the archipelago. For predicting numbers of geospizids on individual islands, these multiple regression equations have been found:

$$\begin{aligned} \text{insular no. of species} &= 9.8 + 0xA + 0xP - 0.1xIN - 0.02xIC \\ \text{insular no. of endemics} &= 0.2 + 0xA + 0xP + 0.09xIN + 0xIC \end{aligned}$$

These conclusions are drawn from the multiple regression analysis:

1. Insular area (A) and number of land plant species (P) are of no value in accounting for insular variations in numbers of either species or endemic subspecies.
2. Only isolation (IN), as measured by shore-to-shore distance from nearest island, is of significant value in predicting insular numbers of endemics. Such is confirmed by analysis of variance. This is not surprising since r for insular numbers of endemics and IN is $+0.91$. For such numbers and IC, r is $+0.44$.
3. For predicting insular number of species, both IN and IC are useful, with the former being the more important according to analysis of variance. Together the two factors leave unexplained a significant part of the variance of insular number of species. This is attributed either to error in our measurements and techniques or to factors not here considered.
4. That isolation (IN) positively predicts best variation in insular numbers of endemic subspecies confirms Lack's conclusion (1947), and negates Bowman's differing conclusion (1961), that the more isolated islands tend to produce more endemic subspecies than the less isolated ones.
5. Our findings demonstrate the fundamental importance of geographic isolation as a factor which controls endemism and, to a lesser degree, insular variations in the number of sympatric forms for a monophyletic group radiating within an isolated archipelago.