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ISLAND-BIOGEOGRAPHY THEORY AND THE PREDICTION OF THE NUMBER OF FLATWORMS ON A STONE

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ABSTRACT

The purpose of this study was to test whether island-biogeography theory could be used to predict the number of flatworms (*Phagocota gracilis*) on a stone. We predicted that number of flatworms should directly covary with the area of the stone on which they are found. We conducted our study at Petersburg Spring (Petersburg, Pennsylvania) where flatworms are abundant on stones of various sizes. Flatworm number and stone area were positively correlated. The generality of this pattern remains to be tested in other species and habitats.

Keywords: flatworms, Island-Biogeography Theory, Petersburg Spring, Phagocota gracilis, *Species-Area Relationship.*

INTRODUCTION

One major aspect of island-biogeography theory, the species-area relationship, states that the number of species on an island increases with increasing island area (Gotelli 1998). We tested whether the species-area relationship is applicable to the abundance of a single species, as well as to the total number of species in an area. Specifically we tested whether number of flatworms is related to the area of the stones they inhabit.

Freshwater flatworms (*Phagocota gracilis*) are abundant on the bottom of stones during the day, because they prefer to feed and move about in the darkness to avoid predators. They move across the stone and leave a sticky trail to catch their food. If the flatworm abundance is high on a stone, more sticky trails will be laid which will possibly maximize their food quantity. Taking this into account, we predicted that there should be more flatworms on larger stones.

METHODS AND MATERIALS

We chose Petersburg Spring (Huntingdon County, Pennsylvania) as our study site because flatworms are abundant there. On March 25, 2001, over 100 stones of varying sizes were collected randomly. The total number of flatworms was counted on each stone. The perimeter of each stone was traced on waterproof paper, and the resulting area (cm^2) was calculated using a Lasico planimeter. The planimeter was calibrated by tracing the circumference of a compass-drawn circle with a known area (πr^2), which was then used to calculate the constant used in the following equation:

$$\text{Area} = \text{Constant} \times (\text{Average of planimeter measurements})$$

Log_{10} flatworm number was compared with $\log_{10}$ stone area using correlation and regression analyses.

RESULTS

Flatworm number was positively correlated with stone area (r^2 = 4.0%, n = 101, P = 0.045). This relationship was described by the power function

$$N = 0.843A^{0.219}$$

derived from the linear regression shown in Figure 1 (N = number of flatworms and A = stone area), following Gotelli (1998).

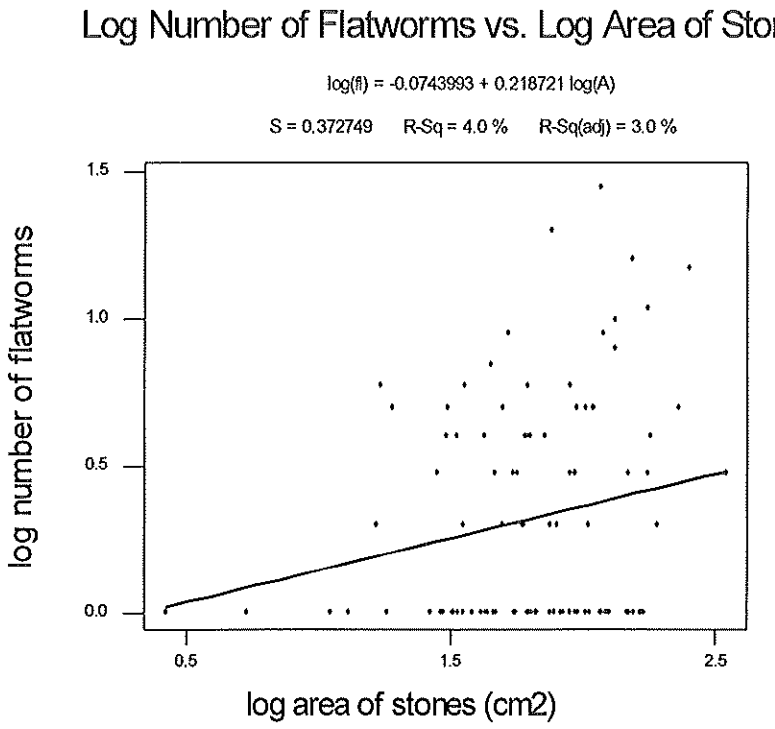

Figure 1. Log_{10} number of flatworms in relation to log_{10} stone area. The regression line and its equation are shown

DISCUSSION

Although number of flatworms was positively correlated with stone area, the relationship was weak. Most (96%) of the variation in flatworm numbers was unexplained. This could be due to other factors in the spring not related to stone area, such as stone texture and composition, varying water-flow rate, and possible effects of flatworm immigration between stones. Deleting stones with no flatworms resulted in a nonsignificant abundance-area correlation (r^2 = 5.4%, n = 50, P = 0.105), but the regression line was similar. Therefore, the species-area relationship of island-biogeography theory appears applicable to abundance-area relationships. Both relationships can be described by predictive power functions. However, stones in a spring are not exactly comparable to oceanic islands, because flatworms can move freely between their stone 'islands'. Further studies are needed to test the generality of our abundance-area relationship in other species and habitats.

LITERATURE CITED

Gotelli, N.J. 1998. A primer of ecology. Sinauer Associates, Sunderland, Massachusetts, USA.