Ecological Archives **M081-006-A1**

John F. Bruno, Stephen P. Ellner, Ivana Vu, Kiho Kim, and C. Drew Harvell.
2011. Impacts of aspergillosis on sea fan coral demography: modeling a moving target. Ecological Monographs 81:123–139.

Appendix A. Estimating height-area relationships.

The population model's individual size variable is x=(healthy tissue area)$^{1/3}$. For some comparisons with data we converted predicted size distributions $n(x)$ to the corresponding area or height distributions, as follows. The number of colonies with area A less than some value a is the number with size x less than $a^{1/3}$. The distribution for area is therefore

$$N(a) = \frac{d}{da}\int_0^{a^{1/3}} n(x)dx = \tfrac{1}{3}a^{-2/3}n(a^{1/3}). \qquad \text{(A.1)}$$

We estimated the relationship between area and height using 257 fans at the Half Moon and Yal Ku, Yucatan sites ranging from 3 to 74 cm in height, for which simultaneous measurements of height and area were taken. These data were fitted well by the allometric relationship

$$\log(\text{Height})=0.25 + 0.5 \times \log(\text{Area}) \qquad \text{(A.2)}$$

with height in cm, area in cm^2 (the coefficients in Eq. A.2 were obtained by linear regression on log-log scale, followed by a small rounding off of insignificant digits). On arithmetic scale, the relationship is (again rounding off insignificant digits)

$$\text{Height}=1.3\sqrt{\text{Area}}\,. \qquad \text{(A.3)}$$

Equation A.3 is the relationship between height (major axis) and area for an ellipse with major axis about 40% longer than the minor axis. Using Eq. A.3 the number of colonies with height H less than some value h is the number with $1.3\sqrt{\text{Area}} = 1.3x^{3/2}$ less than h, which is the number with x less than $\left(\frac{h}{1.3}\right)^{2/3} = 0.67h^{2/3}$. The distribution for h is therefore

$$N(h) = \frac{d}{dh} \int_0^{0.67h^{2/3}} n(x)dx = 0.67 \times \tfrac{2}{3} h^{-1/3} n(0.67h^{2/3}) \approx 0.45h^{-1/3} n(0.67h^{2/3}) \ . \qquad \text{(A.4)}$$