Note. In the two-character code for model, the first character denotes origination and the second extinction; C = continuous, P = pulsed. A bullet means the expression applies to either model for the corresponding process. \( N_0 \) is the true standing diversity at the start of the interval; because all relevant numbers scale to \( N_0 \), this can be arbitrarily set to unity.

a Foote 2000z, eqq. [6b] and [6c].
b Foote 2000a, eq. [27b].
c Foote 2000a, eq. [28b].
d Foote 2000a, eqq. [29b] and [29c].
e Let \( z \) represent time within an interval of duration \( t \), where \( z = 0 \) and \( z = t \) are the beginning and end of the interval, respectively. By assumption, there is no extinction until the end of the interval. Thus, the density of origination at time \( z \) is equal to \( e^{z}\left|z^0 - 1\right| \) (cf. Foote 2001z, eq. [3]). Because all lineages originating within the interval extend to the end, the probability of preservation, given origin at \( z \) and extinction at \( t \), is equal to \( 1 - e^{-z^t - z^t} \). It is necessary to integrate the density of origination times the probability of preservation over all values of \( z \). Thus, \( p_{tz} = \int_0^t \left|z^0 - 1\right| e^{z^t} e^{z^t} dz \), which is equal to the expression in the table once \( t \) is set to unity.

i Derived as in the foregoing footnote, with origination and extinction reversed.
Figure 4. Temporal variation in extinction risk under various extinction models. Risk, scaled to the species level (see Appendix), is the probability of extinction per lineage per 0.1 m.y. Hypothetical time series spanning 200 m.y. (2000 steps) are shown, with risk for each step randomly drawn from the corresponding distribution. Note that the mean risk of all time series is the same (0.025) and that all are plotted to the same scale. A, Time-homogeneous model, in which risk is constant. B, Exponential model (eq. 1). Risk is more variable than in A, but rarely exceeds more than a few times mean risk. C, Episodic model represented by equation 2. Many times of near-zero risk alternate with few times of high risk. The frequency with which risk approaches unity is probably unrealistically high. D, Raup's (1991) empirically derived relationship (kill curve). In terms of variation in risk, this model falls between those in B and C. Models in B and C are used in preference to the kill curve because they can be scaled to mean risk alone.

Foote 1994
Figure 6. Edge effects on taxonomic diversity. Figure shows number of observed taxa in relation to distance of the interval from beginning or end of fossil record. In all cases $p = q$, $r = q$, and interval length is equal to $0.5/q$. The height of curves depends on the value of $r$. The effect decays exponentially and the distance from the edge at which the curves level off is a function of the taxonomic rates (see text for further explanation).
Edge effects
True rates constant

![Graphs showing edge effects on taxonomic rate metrics. In all cases $p = q$, $r = q$, and interval length is equal to $0.5/q$. Solid line, extinction metric; dotted line, origination metric. All rate metrics except estimated per-capita rate are affected at both edges.](image)
Effect of short-lived increase in extinction rate
(‘Signor–Lipps Effect’)

Per-capita rate

Time interval (arbitrary units)

- True extinction
- Apparent extinction: high sampling
- Apparent extinction: intermediate sampling
- Apparent extinction: low sampling
Figure 4. Effect of preservation rate on observed numbers of taxa within an interval. Preservation is time-homogeneous and there are no edge effects. Interval length is fixed at $0.5/q$, and preservation rate $r$ is expressed as multiples of extinction rate $q$. Solid, dashed, and dotted lines are as in Figure 2. Most categories of observed taxa increase monotonically with preservation rate, but the number of observed singletons is disproportionately large when preservation rate is low.

Foote 2000
Figure 5. Effects of preservation rate on extinction metrics. Similar effects obtain for origination metrics. See Figure 4 for explanation. Because of the inclusion of singletons, the per-taxon rate and the Van Valen metric are strongly influenced by preservation. If singletons are excluded, the Van Valen metric is independent of preservation rate, but it is sensitive to the difference between origination and extinction rates.
Effect of short-lived change in sampling rate

- Sampling
- True extinction
- Apparent extinction

Per-capita rate vs. Time interval (arbitrary units)