# Abundance not linked to survival across the end-Cretaceous mass extinction: Patterns in North American bivalves

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**Ecological studies suggest that rare taxa are more likely to go extinct than abundant ones, but the influence of abundance on survivorship in the fossil record has received little attention. An analysis of Late Maastrichtian bivalve subgenera from the North American Coastal Plain found no evidence that survivorship is tied to abundance across the end-Cretaceous mass extinction (65 million years ago), regardless of abundance metric or spatial scale examined. The fact that abundance does not promote survivorship in end-Cretaceous bivalves suggests that the factors influencing survivorship during mass extinctions in the fossil record may differ from those operating during intervals of background extinction.**

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**Table 1. Results of testing for abundance differences between victims and survivors, controlling for shell mineralogy and organic content across all localities at the subgeneric level**

| | | | Abundance metric | | |
|---|---|---|---|---|---|
| Preservation potential | Data treatment | Test | Raw | Rank | Proportional |
| Noncalcitic | Cumulative | MW | $U_{38,38} = 710, P = 0.90$ | | |
| | | KS | $D_{38,38} = 0.13, P > 0.10$ | | |
| | | *t* test | $t_{1,74} = 0.09, P = 0.93$ | $t_{1,74} = -0.04, P = 0.97$ | $t_{1,74} = 0.09, P = 0.93$ |
| | Average | MW | $U_{38,38} = 710, P = 0.90$ | $U_{38,38} = 696, P = 0.79$ | $U_{38,38} = 689, P = 0.73$ |
| | | KS | $D_{38,38} = 0.16, P > 0.10$ | $D_{38,38} = 0.13, P > 0.10$ | $D_{38,38} = 0.18, P > 0.10$ |
| | | *t* test | $t_{1,74} = 0.05, P = 0.96$ | $t_{1,74} = -0.07, P = 0.94$ | $t_{1,74} = 0.18, P = 0.86$ |
| Calcite-bearing | Cumulative | MW | $U_{26,19} = 166, P = 0.06$ | | |
| | | KS | $D_{26,19} = 0.38, P > 0.05$ | | |
| | | *t* test | $\mathbf{t_{1,43} = -2.03, P = 0.05}$ | $t_{1,43} = 1.86, P = 0.07$ | $\mathbf{t_{1,43} = -2.03, P = 0.05}$ |
| | Average | MW | $\mathbf{U_{26,19} = 161, P = 0.05}$ | $U_{26,19} = 183, P = 0.14$ | $\mathbf{U_{26,19} = 150, P = 0.03}$ |
| | | KS | $D_{26,19} = 0.38, P > 0.05$ | $D_{26,19} = 0.30, P > 0.10$ | $\mathbf{D_{26,19} = 0.42, P < 0.05}$ |
| | | *t* test | $\mathbf{t_{1,43} = -2.15, P = 0.05}$ | $t_{1,43} = 1.16, P = 0.25$ | $\mathbf{t_{1,43} = -2.32, P = 0.03}$ |
| High shell organic content | Cumulative | MW | $U_{16,16} = 99, P = 0.27$ | | |
| | | KS | $D_{16,16} = 0.31, P > 0.10$ | | |
| | | *t* test | $t_{1,30} = -1.24, P = 0.22$ | $t_{1,30} = 1.18, P = 0.25$ | $t_{1,30} = -1.25, P = 0.22$ |
| | Average | MW | $U_{16,16} = 95, P = 0.21$ | $U_{16,16} = 110, P = 0.50$ | $U_{16,16} = 90, P = 0.15$ |
| | | KS | $D_{16,16} = 0.31, P > 0.10$ | $D_{16,16} = 0.25, P > 0.10$ | $D_{16,16} = 0.38, P > 0.10$ |
| | | *t* test | $t_{1,30} = -1.39, P = 0.17$ | $t_{1,30} = 0.77, P = 0.45$ | $t_{1,30} = -1.58, P = 0.12$ |
| Low shell organic content | Cumulative | MW | $U_{38,29} = 471, P = 0.31$ | | |
| | | KS | $D_{38,29} = 0.20, P > 0.10$ | | |
| | | *t* test | $t_{1,65} = -0.97, P = 0.34$ | $t_{1,65} = 1.04, P = 0.30$ | $t_{1,65} = -0.97, P = 0.33$ |
| | Average | MW | $U_{38,29} = 464, P = 0.27$ | $U_{38,29} = 507, P = 0.57$ | $U_{38,29} = 463, P = 0.27$ |
| | | KS | $D_{38,29} = 0.26, P > 0.10$ | $D_{38,29} = 0.19, P > 0.10$ | $D_{38,29} = 0.24, P > 0.10$ |
| | | *t* test | $t_{1,65} = -1.11, P = 0.27$ | $t_{1,65} = 0.77, P = 0.45$ | $t_{1,65} = -1.04, P = 0.30$ |
| Mixed shell organic content | Cumulative | MW | $U_{10,10} = 44, P = 0.62$ | | |
| | | KS | $D_{10,10} = 0.20, P > 0.10$ | | |
| | | *t* test | $t_{1,18} = -0.49, P = 0.63$ | $t_{1,18} = 0.38, P = 0.71$ | $t_{1,18} = -0.49, P = 0.63$ |
| | Average | MW | $U_{10,10} = 47, P = 0.82$ | $U_{10,10} = 50, P = 0.99$ | $U_{10,10} = 46, P = 0.76$ |
| | | KS | $D_{10,10} = 0.20, P > 0.10$ | $D_{10,10} = 0.20, P > 0.10$ | $D_{10,10} = 0.30, P > 0.10$ |
| | | *t* test | $t_{1,18} = -0.55, P = 0.59$ | $t_{1,18} = 0.13, P = 0.90$ | $t_{1,18} = -0.31, P = 0.76$ |

Differences were assessed within shell mineralogical categories and organic content categories independently. Three abundance metrics (raw, rank, and proportional), two data treatments (cumulative and averaged), and three statistical tests [Mann–Whitney (MW), Kolmogorov–Smirnov (KS), and *t* test with data transformation] were used. Calcite-bearing victims were significantly less abundant than survivors, but this result was not robust to changes in abundance metric or statistical test. No significant relationship between abundance and survivorship was found within noncalcitic taxa or taxa in any of the shell organic categories. It should be noted that the nonparametric tests do not differentiate among the three abundance metrics when the data are treated cumulatively. Boldface indicates statistical significance.

1. M K [illegible], M. L. (1997)