Ignasi Arranz, Bertrand Fournier, Nigel P. Lester, Brian J. Shuter, and Pedro R. Peres-Neto. Species compositions mediate biomass conservation: the case of lake fish communities. Ecology.

Appendix S11. Influence of species compositions on biomass conservation

When we added our measures of species compositions (species Presence–Absence and Biomass data) to the environmental model, significant amounts of additional variation were accounted for: adjusted R2 values increased from 0.273 (Env alone) to 0.472 (Env + PA) to 0.769 (Env + biomass) to 0.811 (Env + PA + Biomass) (from Tables S1 to S3). An AIC comparison of models identified the (Env + PA + Biomass) model as providing the best representation of our data set (see Table S4).

In all models including species compositions, environmental factors played a very small role in accounting for observed variation in BIOCON values. From these results, we concluded that data on species compositions is far more useful in accounting for variation in BIOCON than environmental data alone (Table S5 and Fig. 2 in main text). Variance partitioning from separate analyses of shallow and deep (> 20 m) lakes produced results that were essentially the same as for all lakes, indicating that the lack of small mesh sampling in deep strata (i.e.,> 20 m) did not bias the results (see variance partitioning Table S5).

## Table S1. Regression model for the Environment + Species PA .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Regression (NB\_Slope vs Env + PA)** | | |  |  |  |  |  |
| **Variable** | **Label** | **Std. Value** | **SE(Std. Value)** | **b** | **SE(b)** | **t(632)** | ***p*-value** |
| N = | 639 |  |  |  |  |  |  |
| R2 = | 0.493 |  |  |  |  |  |  |
| Adjusted R2 = | 0.472 |  |  |  |  |  |  |
| Residual standard error = | 0.202 |  |  |  |  |  |  |
|  | Intercept |  |  | -0.894 | 0.090 | -9.953 | 0.000 |
| Mean air temperature | E1\_MAT | -0.217 | 0.066 | -0.035 | 0.011 | -3.266 | 0.001 |
| Surface area | E2\_L10Area\_ha | 0.008 | 0.042 | 0.003 | 0.018 | 0.189 | 0.850 |
| Mean depth | E2\_L10Depmn | 0.201 | 0.048 | 0.174 | 0.041 | 4.199 | 0.000 |
| Dissolved organic carbon | E3\_DOC | 0.058 | 0.043 | 0.005 | 0.003 | 1.364 | 0.173 |
| Conductivity | E3\_L10Conductivity | -0.129 | 0.036 | -0.108 | 0.030 | -3.584 | 0.000 |
|  | CPA1 | -0.373 | 0.053 | -0.335 | 0.048 | -7.015 | 0.000 |
|  | CPA2 | -0.104 | 0.052 | -0.113 | 0.057 | -1.985 | 0.048 |
|  | CPA3 | -0.009 | 0.048 | -0.013 | 0.067 | -0.199 | 0.843 |
|  | CPA4 | -0.212 | 0.032 | -0.366 | 0.055 | -6.641 | 0.000 |
|  | CPA5 | 0.097 | 0.032 | 0.202 | 0.066 | 3.078 | 0.002 |
|  | CPA6 | 0.109 | 0.031 | 0.234 | 0.066 | 3.556 | 0.000 |
|  | CPA7 | 0.103 | 0.029 | 0.238 | 0.067 | 3.525 | 0.000 |
|  | CPA8 | -0.072 | 0.029 | -0.171 | 0.070 | -2.429 | 0.015 |
|  | CPA11 | -0.069 | 0.029 | -0.174 | 0.073 | -2.372 | 0.018 |
|  | CPA17 | 0.102 | 0.030 | 0.310 | 0.090 | 3.460 | 0.001 |
|  | CPA22 | 0.087 | 0.029 | 0.298 | 0.100 | 2.993 | 0.003 |
|  | CPA39 | 0.064 | 0.029 | 0.342 | 0.156 | 2.197 | 0.028 |
|  | CPA43 | 0.044 | 0.029 | 0.266 | 0.175 | 1.516 | 0.130 |
|  | CPA50 | -0.046 | 0.029 | -0.382 | 0.245 | -1.558 | 0.120 |
|  | CPA59 | 0.055 | 0.029 | 0.654 | 0.344 | 1.902 | 0.058 |
|  | CPA73 | 0.050 | 0.029 | 1.312 | 0.758 | 1.730 | 0.084 |
|  | CPA74 | 0.038 | 0.029 | 1.043 | 0.789 | 1.321 | 0.187 |
|  | CPA79 | -0.080 | 0.029 | -2.883 | 1.041 | -2.769 | 0.006 |
|  | CPA82 | 0.038 | 0.029 | 1.884 | 1.441 | 1.307 | 0.192 |
|  | CPA83 | -0.058 | 0.029 | -3.925 | 1.935 | -2.029 | 0.043 |

## Table S2 Regression model for the Environment + Species Biomass.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Regression (BIOCON vs Env+Biomass)** | | |  |  |  |  |  |
| **Variable** | **Label** | **Std. Value** | **SE(Std. Value)** | **b** | **SE(b)** | **t(632)** | ***p*-value** |
| N = | 639 |  |  |  |  |  |  |
| R2 = | 0.791 |  |  |  |  |  |  |
| Adjusted R2 = | 0.769 |  |  |  |  |  |  |
| Residual standard error = | 0.133 |  |  |  |  |  |  |
|  | Intercept |  |  | -1.123 | 0.064 | -17.662 | 0.000 |
| Mean air temperature | E1\_MAT | -0.016 | 0.044 | -0.003 | 0.007 | -0.371 | 0.711 |
| Surface area | E2\_L10Area\_ha | 0.035 | 0.029 | 0.015 | 0.012 | 1.219 | 0.223 |
| Mean depth | E2\_L10Depmn | 0.071 | 0.037 | 0.061 | 0.032 | 1.932 | 0.054 |
| Dissolved organic carbon | E3\_DOC | 0.053 | 0.030 | 0.004 | 0.002 | 1.757 | 0.079 |
| Conductivity | E3\_L10Conductivity | 0.003 | 0.026 | 0.003 | 0.022 | 0.134 | 0.894 |
|  | CBio1 | -0.497 | 0.034 | -0.428 | 0.030 | -14.452 | 0.000 |
|  | CBio2 | 0.413 | 0.032 | 0.394 | 0.031 | 12.757 | 0.000 |
|  | CBio3 | 0.255 | 0.032 | 0.317 | 0.040 | 7.955 | 0.000 |
|  | CBio4 | -0.067 | 0.029 | -0.101 | 0.043 | -2.338 | 0.020 |
|  | CBio5 | 0.175 | 0.019 | 0.319 | 0.035 | 9.097 | 0.000 |
|  | CBio6 | 0.276 | 0.020 | 0.528 | 0.037 | 14.101 | 0.000 |
|  | CBio7 | 0.057 | 0.020 | 0.117 | 0.041 | 2.853 | 0.004 |
|  | CBio8 | -0.106 | 0.020 | -0.230 | 0.044 | -5.258 | 0.000 |
|  | CBio9 | -0.103 | 0.020 | -0.235 | 0.045 | -5.266 | 0.000 |
|  | CBio10 | -0.160 | 0.019 | -0.376 | 0.046 | -8.258 | 0.000 |
|  | CBio11 | -0.039 | 0.019 | -0.105 | 0.052 | -2.003 | 0.046 |
|  | CBio12 | -0.046 | 0.020 | -0.126 | 0.056 | -2.241 | 0.025 |
|  | CBio13 | 0.120 | 0.021 | 0.349 | 0.061 | 5.701 | 0.000 |
|  | CBio14 | 0.037 | 0.020 | 0.109 | 0.058 | 1.901 | 0.058 |
|  | CBio15 | 0.069 | 0.019 | 0.212 | 0.059 | 3.562 | 0.000 |
|  | CBio17 | -0.012 | 0.020 | -0.045 | 0.074 | -0.600 | 0.549 |
|  | CBio20 | 0.036 | 0.020 | 0.158 | 0.085 | 1.851 | 0.065 |
|  | CBio21 | -0.071 | 0.019 | -0.314 | 0.085 | -3.679 | 0.000 |
|  | CBio22 | -0.096 | 0.019 | -0.434 | 0.086 | -5.021 | 0.000 |
|  | CBio23 | 0.017 | 0.019 | 0.082 | 0.092 | 0.890 | 0.374 |
|  | CBio24 | 0.038 | 0.019 | 0.185 | 0.094 | 1.964 | 0.050 |
|  | CBio26 | -0.039 | 0.019 | -0.209 | 0.102 | -2.045 | 0.041 |
|  | CBio27 | 0.046 | 0.019 | 0.259 | 0.108 | 2.391 | 0.017 |
|  | CBio29 | -0.017 | 0.019 | -0.101 | 0.115 | -0.874 | 0.382 |
|  | CBio30 | 0.080 | 0.019 | 0.496 | 0.119 | 4.182 | 0.000 |
|  | CBio31 | -0.060 | 0.019 | -0.374 | 0.119 | -3.148 | 0.002 |
|  | CBio32 | 0.028 | 0.019 | 0.191 | 0.132 | 1.449 | 0.148 |
|  | CBio33 | 0.025 | 0.019 | 0.174 | 0.137 | 1.272 | 0.204 |
|  | CBio34 | 0.030 | 0.020 | 0.221 | 0.144 | 1.536 | 0.125 |
|  | CBio35 | 0.041 | 0.019 | 0.323 | 0.151 | 2.137 | 0.033 |
|  | CBio37 | 0.023 | 0.020 | 0.195 | 0.168 | 1.161 | 0.246 |
|  | CBio39 | 0.030 | 0.019 | 0.273 | 0.172 | 1.582 | 0.114 |
|  | CBio40 | 0.013 | 0.019 | 0.130 | 0.186 | 0.700 | 0.484 |
|  | CBio41 | 0.035 | 0.019 | 0.344 | 0.189 | 1.818 | 0.070 |
|  | CBio43 | -0.032 | 0.019 | -0.368 | 0.222 | -1.659 | 0.098 |
|  | CBio44 | -0.051 | 0.019 | -0.617 | 0.231 | -2.676 | 0.008 |
|  | CBio47 | 0.015 | 0.019 | 0.211 | 0.271 | 0.778 | 0.437 |
|  | CBio48 | -0.014 | 0.019 | -0.221 | 0.297 | -0.744 | 0.457 |
|  | CBio50 | 0.016 | 0.019 | 0.282 | 0.327 | 0.863 | 0.388 |
|  | CBio53 | 0.020 | 0.019 | 0.418 | 0.407 | 1.027 | 0.305 |
|  | CBio54 | -0.019 | 0.019 | -0.495 | 0.495 | -0.999 | 0.318 |
|  | CBio55 | -0.050 | 0.019 | -1.317 | 0.504 | -2.614 | 0.009 |
|  | CBio56 | 0.027 | 0.019 | 0.752 | 0.533 | 1.410 | 0.159 |
|  | CBio57 | -0.018 | 0.019 | -0.556 | 0.594 | -0.937 | 0.349 |
|  | CBio59 | -0.017 | 0.019 | -0.578 | 0.635 | -0.911 | 0.363 |
|  | CBio60 | -0.013 | 0.019 | -0.469 | 0.701 | -0.669 | 0.504 |
|  | CBio64 | -0.035 | 0.019 | -1.511 | 0.819 | -1.845 | 0.066 |
|  | CBio67 | 0.012 | 0.019 | 0.605 | 0.985 | 0.614 | 0.539 |
|  | CBio68 | -0.025 | 0.019 | -1.409 | 1.060 | -1.329 | 0.184 |
|  | CBio69 | -0.025 | 0.019 | -1.575 | 1.226 | -1.284 | 0.200 |
|  | CBio74 | 0.014 | 0.019 | 1.438 | 1.943 | 0.740 | 0.459 |
|  | CBio75 | 0.026 | 0.019 | 3.296 | 2.421 | 1.362 | 0.174 |
|  | CBio77 | -0.016 | 0.019 | -2.476 | 2.914 | -0.850 | 0.396 |
|  | CBio79 | 0.037 | 0.019 | 9.403 | 4.803 | 1.958 | 0.051 |
|  | CBio80 | 0.037 | 0.019 | 12.668 | 6.493 | 1.951 | 0.052 |
|  | CBio82 | 0.015 | 0.019 | 7.978 | 10.228 | 0.780 | 0.436 |

## Table S3. Regression model for the Environment + Species PA + Species Biomass.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Regression (NB\_Slope vs Env+PA+Biomass)** | | | |  |  |  |  |
| N = | 639 |  |  |  |  |  |  |
| R2 = | 0.807 |  |  |  |  |  |  |
| Adjusted R2 = | 0.779 |  |  |  |  |  |  |
| Residual standard error = | 0.131 |  |  |  |  |  |  |
| **Variable** | **Label** | **Std. Value** | **SE(Std. Value)** | **b** | **SE(b)** | **t(632)** | ***p*-value** |
|  | Intercept |  |  | -1.143 | 0.065 | -17.549 | 0.000 |
| Mean air temperature | E1\_MAT | 0.002 | 0.049 | 0.000 | 0.008 | 0.039 | 0.969 |
| Surface area | E2\_L10Area\_ha | 0.037 | 0.030 | 0.015 | 0.013 | 1.222 | 0.222 |
| Mean depth | E2\_L10Depmn | 0.080 | 0.037 | 0.069 | 0.032 | 2.144 | 0.032 |
| Dissolved organic carbon | E3\_DOC | 0.054 | 0.030 | 0.004 | 0.002 | 1.793 | 0.073 |
| Conductivity | E3\_L10Conductivity | 0.004 | 0.027 | 0.004 | 0.022 | 0.161 | 0.872 |
|  | CBio1 | -0.386 | 0.078 | -0.332 | 0.067 | -4.956 | 0.000 |
|  | CBio2 | 0.589 | 0.057 | 0.562 | 0.054 | 10.380 | 0.000 |
|  | CBio3 | 0.215 | 0.060 | 0.267 | 0.075 | 3.561 | 0.000 |
|  | CBio4 | -0.075 | 0.041 | -0.113 | 0.061 | -1.858 | 0.064 |
|  | CBio5 | 0.241 | 0.029 | 0.438 | 0.052 | 8.406 | 0.000 |
|  | CBio6 | 0.282 | 0.031 | 0.539 | 0.059 | 9.106 | 0.000 |
|  | CBio7 | 0.091 | 0.025 | 0.188 | 0.052 | 3.626 | 0.000 |
|  | CBio8 | -0.093 | 0.024 | -0.201 | 0.053 | -3.816 | 0.000 |
|  | CBio9 | -0.100 | 0.025 | -0.228 | 0.058 | -3.956 | 0.000 |
|  | CBio10 | -0.194 | 0.030 | -0.456 | 0.071 | -6.381 | 0.000 |
|  | CBio11 | -0.044 | 0.021 | -0.120 | 0.056 | -2.134 | 0.033 |
|  | CBio12 | -0.111 | 0.026 | -0.309 | 0.073 | -4.210 | 0.000 |
|  | CBio13 | 0.164 | 0.028 | 0.479 | 0.081 | 5.908 | 0.000 |
|  | CBio14 | 0.068 | 0.026 | 0.199 | 0.078 | 2.570 | 0.010 |
|  | CBio15 | 0.111 | 0.021 | 0.342 | 0.066 | 5.180 | 0.000 |
|  | CBio17 | -0.002 | 0.022 | -0.008 | 0.081 | -0.096 | 0.924 |
|  | CBio20 | 0.043 | 0.023 | 0.188 | 0.099 | 1.909 | 0.057 |
|  | CBio21 | -0.074 | 0.022 | -0.326 | 0.096 | -3.397 | 0.001 |
|  | CBio22 | -0.110 | 0.021 | -0.498 | 0.095 | -5.241 | 0.000 |
|  | CBio23 | 0.011 | 0.021 | 0.052 | 0.099 | 0.526 | 0.599 |
|  | CBio24 | 0.041 | 0.021 | 0.199 | 0.100 | 1.984 | 0.048 |
|  | CBio26 | -0.014 | 0.020 | -0.074 | 0.106 | -0.696 | 0.487 |
|  | CBio27 | 0.038 | 0.023 | 0.214 | 0.132 | 1.625 | 0.105 |
|  | CBio29 | -0.018 | 0.021 | -0.106 | 0.124 | -0.856 | 0.392 |
|  | CBio30 | 0.102 | 0.021 | 0.630 | 0.131 | 4.817 | 0.000 |
|  | CBio31 | -0.070 | 0.020 | -0.436 | 0.127 | -3.425 | 0.001 |
|  | CBio32 | 0.055 | 0.021 | 0.375 | 0.142 | 2.636 | 0.009 |
|  | CBio33 | 0.003 | 0.020 | 0.022 | 0.143 | 0.155 | 0.877 |
|  | CBio34 | 0.022 | 0.021 | 0.162 | 0.155 | 1.048 | 0.295 |
|  | CBio35 | 0.043 | 0.020 | 0.344 | 0.160 | 2.155 | 0.032 |
|  | CBio37 | 0.007 | 0.020 | 0.060 | 0.174 | 0.345 | 0.730 |
|  | CBio39 | 0.024 | 0.020 | 0.211 | 0.177 | 1.196 | 0.232 |
|  | CBio40 | -0.000 | 0.021 | -0.002 | 0.201 | -0.012 | 0.991 |
|  | CBio41 | 0.041 | 0.021 | 0.406 | 0.208 | 1.952 | 0.051 |
|  | CBio43 | -0.043 | 0.020 | -0.494 | 0.226 | -2.184 | 0.029 |
|  | CBio44 | -0.048 | 0.020 | -0.580 | 0.247 | -2.350 | 0.019 |
|  | CBio47 | 0.018 | 0.019 | 0.262 | 0.271 | 0.968 | 0.333 |
|  | CBio48 | -0.004 | 0.023 | -0.057 | 0.353 | -0.163 | 0.871 |
|  | CBio50 | 0.010 | 0.020 | 0.174 | 0.341 | 0.509 | 0.611 |
|  | CBio53 | 0.013 | 0.022 | 0.283 | 0.456 | 0.620 | 0.536 |
|  | CBio54 | -0.016 | 0.019 | -0.410 | 0.504 | -0.813 | 0.417 |
|  | CBio55 | -0.061 | 0.020 | -1.594 | 0.534 | -2.987 | 0.003 |
|  | CBio56 | 0.004 | 0.028 | 0.103 | 0.778 | 0.133 | 0.895 |
|  | CBio57 | -0.014 | 0.021 | -0.442 | 0.659 | -0.670 | 0.503 |
|  | CBio59 | -0.016 | 0.022 | -0.515 | 0.716 | -0.719 | 0.472 |
|  | CBio60 | -0.002 | 0.024 | -0.083 | 0.887 | -0.094 | 0.925 |
|  | CBio64 | -0.030 | 0.019 | -1.285 | 0.823 | -1.562 | 0.119 |
|  | CBio67 | 0.003 | 0.021 | 0.180 | 1.087 | 0.165 | 0.869 |
|  | CBio68 | -0.018 | 0.020 | -0.984 | 1.091 | -0.902 | 0.368 |
|  | CBio69 | -0.021 | 0.032 | -1.340 | 2.015 | -0.665 | 0.506 |
|  | CBio74 | 0.025 | 0.021 | 2.533 | 2.103 | 1.204 | 0.229 |
|  | CBio75 | 0.010 | 0.029 | 1.235 | 3.689 | 0.335 | 0.738 |
|  | CBio77 | -0.022 | 0.021 | -3.291 | 3.184 | -1.033 | 0.302 |
|  | CBio79 | 0.091 | 0.075 | 22.995 | 18.867 | 1.219 | 0.223 |
|  | CBio80 | 0.017 | 0.040 | 5.742 | 13.714 | 0.419 | 0.676 |
|  | CBio82 | 0.015 | 0.027 | 8.173 | 14.477 | 0.565 | 0.573 |
|  | CPA1 | -0.131 | 0.084 | -0.118 | 0.076 | -1.563 | 0.119 |
|  | CPA2 | -0.155 | 0.069 | -0.167 | 0.074 | -2.249 | 0.025 |
|  | CPA3 | -0.014 | 0.048 | -0.021 | 0.067 | -0.304 | 0.761 |
|  | CPA4 | 0.095 | 0.038 | 0.165 | 0.065 | 2.531 | 0.012 |
|  | CPA5 | -0.077 | 0.031 | -0.159 | 0.065 | -2.436 | 0.015 |
|  | CPA6 | -0.068 | 0.029 | -0.146 | 0.063 | -2.342 | 0.020 |
|  | CPA7 | -0.085 | 0.032 | -0.197 | 0.075 | -2.645 | 0.008 |
|  | CPA8 | 0.075 | 0.034 | 0.179 | 0.082 | 2.185 | 0.029 |
|  | CPA11 | 0.012 | 0.025 | 0.031 | 0.065 | 0.483 | 0.629 |
|  | CPA17 | -0.039 | 0.025 | -0.118 | 0.075 | -1.566 | 0.118 |
|  | CPA22 | -0.050 | 0.024 | -0.171 | 0.082 | -2.085 | 0.038 |
|  | CPA39 | 0.022 | 0.026 | 0.120 | 0.138 | 0.867 | 0.386 |
|  | CPA43 | 0.041 | 0.030 | 0.250 | 0.184 | 1.355 | 0.176 |
|  | CPA50 | 0.003 | 0.031 | 0.028 | 0.262 | 0.109 | 0.914 |
|  | CPA59 | 0.010 | 0.028 | 0.113 | 0.330 | 0.344 | 0.731 |
|  | CPA73 | 0.011 | 0.028 | 0.299 | 0.746 | 0.401 | 0.689 |
|  | CPA74 | 0.022 | 0.026 | 0.593 | 0.723 | 0.820 | 0.413 |
|  | CPA79 | 0.060 | 0.076 | 2.173 | 2.743 | 0.792 | 0.428 |
|  | CPA82 | 0.023 | 0.052 | 1.145 | 2.575 | 0.445 | 0.657 |
|  | CPA83 | -0.006 | 0.020 | -0.378 | 1.322 | -0.286 | 0.775 |

## Table S4. Calculation of AIC for different models. The [Env+PA+Bio] is identified as the ‘best’ model.

|  |  |  |
| --- | --- | --- |
| **Model** | **Nlakes** | **delta AICc** |
| Env | 639 | 691.99 |
| Env+PA | 639 | 506.70 |
| Env+Bio | 639 | 12.20 |
| Env+PA+Bio | 639 | 0.00 |
| PA+Bio | 639 | 0.90 |
| Bio | 639 | 9.90 |
| PA | 639 | 535.70 |

## Table S5. Variance partitioning among the environment and species compositions in various models for shallow and deep lakes. Columns show the total adjusted R2 (aR2), the independent contributions from the environment and species compositions, and their shared contribution. Results are shown separately to shallow lakes (<= 20 m) and deep lakes (> 20 m).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Set of Lakes** | **Model** | **aR2 Env Independent** | **aR2 Species Independent** | **aR2 Shared** |
| **Shallow** | Env+PA | 0.0402 | 0.1305 | 0.2687 |
| (<= 20 m) | Env+Bio | 0.0060 | 0.4333 | 0.3028 |
| N = 281 | Env+PA+ Bio | 0.0002 | 0.4666 | 0.3087 |
| **Deep** | Env+PA | 0.0633 | 0.2555 | 0.1755 |
| (> 20 m) | Env+Bio | 0.0000 | 0.5427 | 0.2420 |
| N = 358 | Env+PA+Bio | 0.0000 | 0.5568 | 0.2471 |