Quantifying ecosystem responses to environmental and human pressures in the marine ecosystem off the west coast of Vancouver Island

Authors: Jennifer L. Boldt1\*, Elliott L. Hazen2, Mary E. Hunsicker3, Caihong Fu1, R. Ian Perry1, Xiujuan Shan4

1\* Corresponding author; [Jennifer.Boldt@dfo-mpo.gc.ca](mailto:Jennifer.Boldt@dfo-mpo.gc.ca); Fisheries and Oceans Canada, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, BC, V9T 6N7, Canada

1Fisheries and Oceans Canada, Pacific Biological Station, 3190 Hammond Bay Road, Nanaimo, BC, V9T 6N7, Canada

2Southwest Fisheries Science Center, NMFS, NOAA, 99 Pacific St., Suite 255A, Monterey, CA, U.S.A. 93940

3Northwest Fisheries Science Center, NMFS, NOAA, Hatfield Marine Science Center, 2032 S. OSU Dr., Newport, OR, U.S.A. 97365

4Yellow Sea Fisheries Research Institute, CAFS, 106 Nanjing Rd., Shinan District, Qingdao, Shandong, People's Republic of China 266071

Appendix A

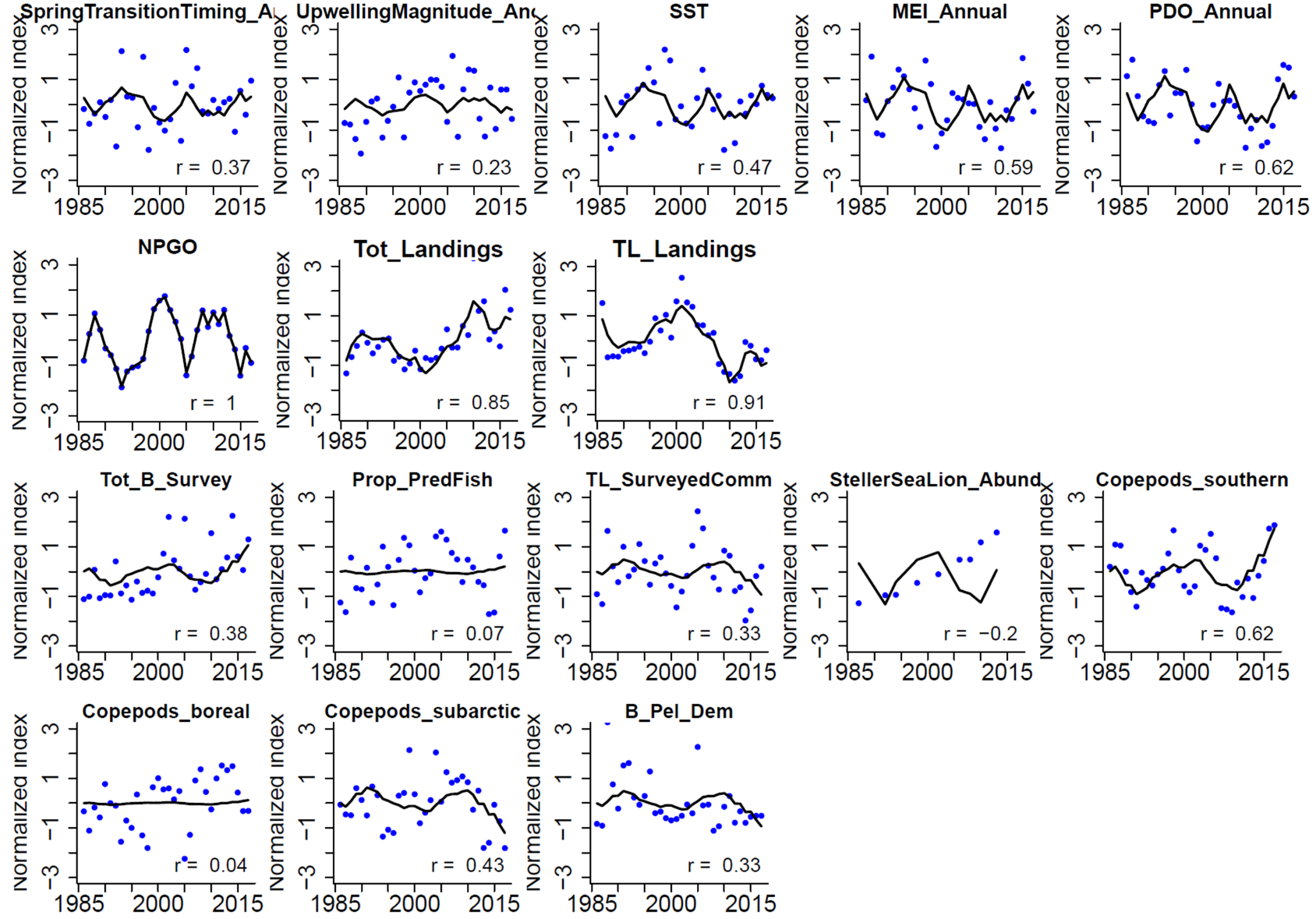


Figure A1. Model fits to the three separate DFA analyses on environment pressures (top row and left panel of second row), human pressures (second row; Tot\_Landings and TL\_Landings), ecosystem responses (bottom two rows). R-values are shown for model fits to observations. See Table 1 for definitions.



Figure A2. Results from a DFA on ecosystem responses with environment pressure covariates. The trend (top left), factor loadings on the trends (top right), and model fits (bottom two rows) are shown. R-values are shown for model fits to observations. See Table 1 for definitions.

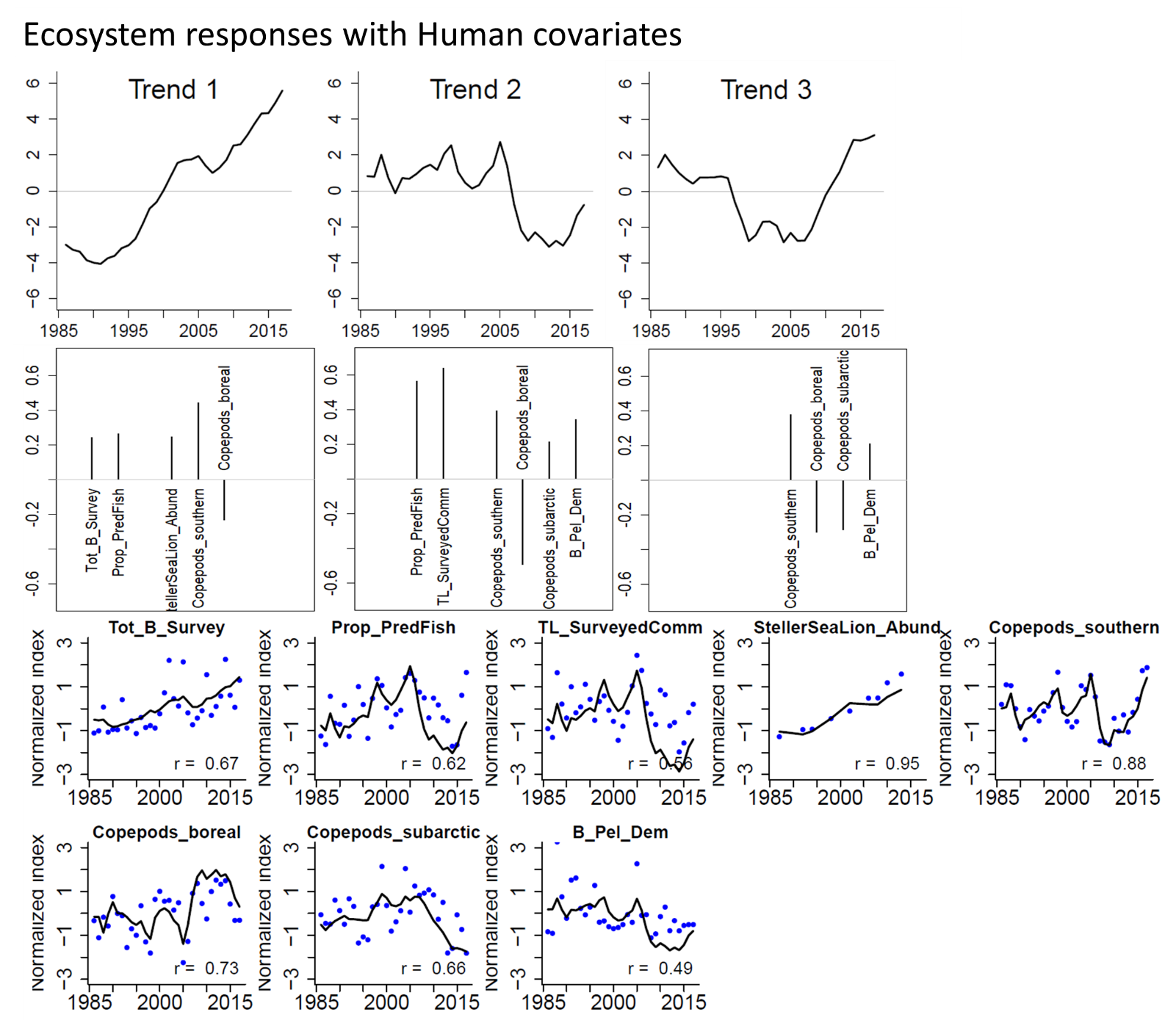


Figure A3. Results from a DFA on ecosystem responses with human pressure covariates. The trends (top row), factor loadings on those trends (second row), and model fits (bottom two rows) are shown. R-values are shown for model fits to observations. See Table 1 for definitions.

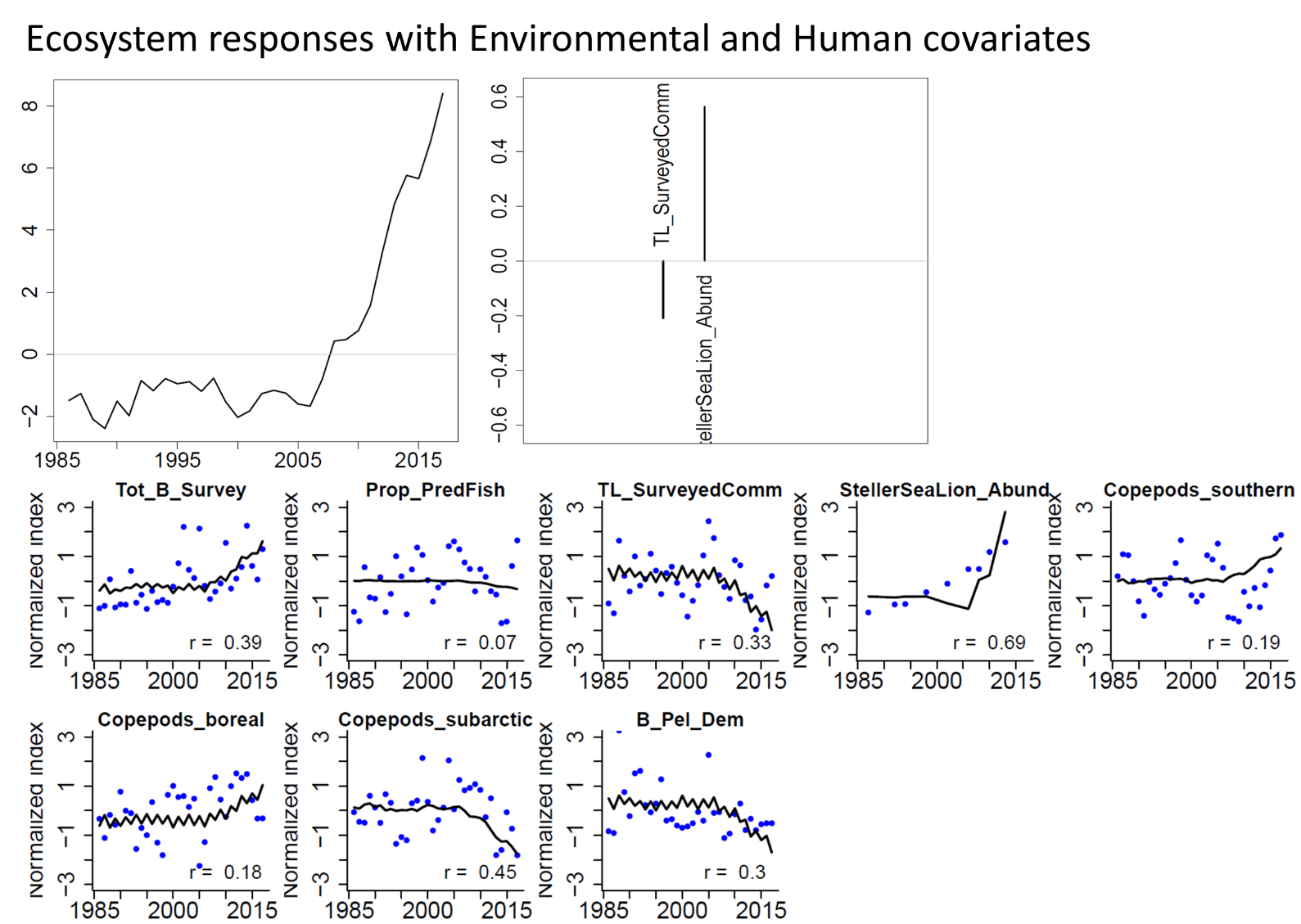


Figure A4. Results from a DFA on ecosystem responses with both environment and human pressure covariates. The trend (top left), factor loadings on the trends (top right), and model fits (bottom two rows) are shown. R-values are shown for model fits to observations. See Table 1 for definitions.

Table A1. All single pressure-response models (see Table 1 for acronyms). GAMM = general additive mixed models; LMAC = linear with autocorrelation; GAM = general additive model (GAM); AICc = Akaike’s Information Criterion (corrected for small sample size); logLik = log-likelihood ratio test to compare GAMMs (with autocorrelated error structure) vs GAMs (with normal error structure) with a p.ac value < 0.05 indicating temporal autocorrelation existed and model evaluation was carried out on GAMM vs LMAC; dev.expl = deviance explained, edf = estimated degrees of freedom; GCV = generalized cross validation score; diff.dev.expl = difference in deviance explained between GAMM and LMAC or between GAM and linear models. As in Samhouri et al. (2017), supportive evidence for nonlinear models (vs. linear models) was based on these criteria: i) edf ≥2 (Zuur et al. 2009), ii) delta.AICc values ≥2 (Burnham and Anderson 2002), and iii) for GAMs vs. linear models, a lower GCV (Wood 2004). Models in bold font were significant (p < 0.05) with R2 > 0.2.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| GAMM | B\_Pel\_Dem | PDO\_Annual | 67.977 | -28.989 | 0.211 | 2.189 | 0.127 | 0.151 | NA | 0.838 | 0.205 |
| LMAC | B\_Pel\_Dem | PDO\_Annual | 69.638 | -29.819 | 0.006 | 30.000 | 0.814 | -0.027 | NA | NA | NA |
| GAM | B\_Pel\_Dem | PDO\_Annual | 63.312 | -26.747 | 0.201 | 1.756 | 0.043 | 0.153 | 0.373 | NA | 0.193 |
| Linear | B\_Pel\_Dem | PDO\_Annual | 66.845 | -30.215 | 0.007 | 30.000 | 0.642 | -0.026 | 0.440 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(MEI\_Annual+1) | 18.946 | -4.473 | -0.022 | 1.000 | 0.214 | -0.056 | NA | 0.373 | 0.000 |
| LMAC | log(B\_Pel\_Dem+1) | log(MEI\_Annual+1) | 18.946 | -4.473 | -0.022 | 30.000 | 0.221 | -0.056 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(MEI\_Annual+1) | 18.538 | -6.115 | 0.000 | 0.000 | 0.838 | 0.000 | 0.091 | NA | -0.004 |
| Linear | log(B\_Pel\_Dem+1) | log(MEI\_Annual+1) | 18.529 | -6.057 | 0.004 | 30.000 | 0.744 | -0.030 | 0.097 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(NPGO+1) | 15.102 | -2.551 | 0.053 | 1.000 | 0.261 | 0.013 | NA | 0.824 | 0.000 |
| LMAC | log(B\_Pel\_Dem+1) | log(NPGO+1) | 15.102 | -2.551 | 0.053 | 24.000 | 0.270 | 0.013 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(NPGO+1) | 13.756 | -3.124 | 0.023 | 0.254 | 0.258 | 0.013 | 0.082 | NA | -0.029 |
| Linear | log(B\_Pel\_Dem+1) | log(NPGO+1) | 11.974 | -2.726 | 0.053 | 24.000 | 0.258 | 0.013 | 0.085 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(SpringTransitionTiming\_Anom+1) | 19.413 | -4.707 | 0.028 | 1.000 | 0.370 | -0.004 | NA | 0.380 | 0.000 |
| LMAC | log(B\_Pel\_Dem+1) | log(SpringTransitionTiming\_Anom+1) | 19.413 | -4.707 | 0.028 | 30.000 | 0.378 | -0.004 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(SpringTransitionTiming\_Anom+1) | 18.491 | -5.852 | 0.016 | 0.239 | 0.324 | 0.009 | 0.091 | NA | -0.013 |
| Linear | log(B\_Pel\_Dem+1) | log(SpringTransitionTiming\_Anom+1) | 17.682 | -5.634 | 0.030 | 30.000 | 0.346 | -0.003 | 0.095 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(SST+1) | 20.252 | -5.126 | 0.001 | 1.000 | 0.947 | -0.032 | NA | 0.373 | 0.000 |
| LMAC | log(B\_Pel\_Dem+1) | log(SST+1) | 20.252 | -5.126 | 0.001 | 30.000 | 0.948 | -0.032 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(SST+1) | 18.538 | -6.115 | 0.000 | 0.000 | 0.684 | 0.000 | 0.091 | NA | -0.006 |
| Linear | log(B\_Pel\_Dem+1) | log(SST+1) | 18.463 | -6.025 | 0.006 | 30.000 | 0.683 | -0.028 | 0.097 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(TL\_Landings+1) | 20.252 | -5.126 | -0.002 | 1.000 | 0.947 | -0.035 | NA | 0.373 | 0.000 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | log(B\_Pel\_Dem+1) | log(TL\_Landings+1) | 20.252 | -5.126 | -0.002 | 30.000 | 0.948 | -0.035 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(TL\_Landings+1) | 18.538 | -6.115 | 0.000 | 0.000 | 0.510 | 0.000 | 0.091 | NA | -0.002 |
| Linear | log(B\_Pel\_Dem+1) | log(TL\_Landings+1) | 18.572 | -6.079 | 0.002 | 30.000 | 0.797 | -0.031 | 0.097 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(Tot\_Landings+1) | 20.252 | -5.126 | -0.002 | 1.000 | 0.947 | -0.035 | NA | 0.373 | 0.000 |
| LMAC | log(B\_Pel\_Dem+1) | log(Tot\_Landings+1) | 20.252 | -5.126 | -0.002 | 30.000 | 0.948 | -0.035 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(Tot\_Landings+1) | 18.538 | -6.115 | 0.000 | 0.000 | 0.510 | 0.000 | 0.091 | NA | -0.002 |
| Linear | log(B\_Pel\_Dem+1) | log(Tot\_Landings+1) | 18.572 | -6.079 | 0.002 | 30.000 | 0.797 | -0.031 | 0.097 | NA | NA |
| GAMM | log(B\_Pel\_Dem+1) | log(UpwellingMagnitude\_Anom+1) | 10.783 | -0.392 | -0.001 | 1.000 | 0.904 | -0.042 | NA | 0.447 | 0.000 |
| LMAC | log(B\_Pel\_Dem+1) | log(UpwellingMagnitude\_Anom+1) | 10.783 | -0.392 | -0.001 | 24.000 | 0.906 | -0.042 | NA | NA | NA |
| GAM | log(B\_Pel\_Dem+1) | log(UpwellingMagnitude\_Anom+1) | 11.875 | 0.167 | 0.204 | 2.604 | 0.159 | 0.111 | 0.078 | NA | 0.204 |
| Linear | log(B\_Pel\_Dem+1) | log(UpwellingMagnitude\_Anom+1) | 12.104 | -2.791 | 0.000 | 24.000 | 0.984 | -0.042 | 0.085 | NA | NA |
| Linear | Copepods\_boreal | MEI\_Annual | -1.443 | 3.928 | 0.203 | 30.000 | 0.010 | 0.176 | 0.052 | NA | NA |
| GAMM | Copepods\_boreal | MEI\_Annual | -2.679 | 6.340 | 0.201 | 1.000 | 0.012 | 0.174 | NA | 0.084 | 0.000 |
| LMAC | Copepods\_boreal | MEI\_Annual | -2.679 | 6.340 | 0.201 | 30.000 | 0.014 | 0.174 | NA | NA | NA |
| GAM | Copepods\_boreal | MEI\_Annual | 0.328 | 3.859 | 0.199 | 0.869 | 0.010 | 0.176 | 0.052 | NA | -0.003 |
| **Linear** | **Copepods\_boreal** | **NPGO** | **-4.495** | **5.455** | **0.275** | **30.000** | **0.002** | **0.251** | **0.047** | **NA** | **NA** |
| GAMM | Copepods\_boreal | NPGO | -3.980 | 6.990 | 0.275 | 1.000 | 0.005 | 0.251 | NA | 0.217 | 0.000 |
| LMAC | Copepods\_boreal | NPGO | -3.980 | 6.990 | 0.275 | 30.000 | 0.006 | 0.251 | NA | NA | NA |
| GAM | Copepods\_boreal | NPGO | -2.683 | 5.408 | 0.273 | 0.912 | 0.002 | 0.251 | 0.047 | NA | -0.002 |
| **Linear** | **Copepods\_boreal** | **PDO\_Annual** | **-3.518** | **4.966** | **0.253** | **30.000** | **0.003** | **0.228** | **0.049** | **NA** | **NA** |
| GAMM | Copepods\_boreal | PDO\_Annual | -4.203 | 7.101 | 0.253 | 1.000 | 0.005 | 0.228 | NA | 0.534 | 0.000 |
| LMAC | Copepods\_boreal | PDO\_Annual | -4.203 | 7.101 | 0.253 | 30.000 | 0.006 | 0.228 | NA | NA | NA |
| GAM | Copepods\_boreal | PDO\_Annual | -4.410 | 8.835 | 0.413 | 3.476 | 0.003 | 0.339 | 0.046 | NA | 0.160 |
| **GAM** | **Copepods\_boreal** | **SpringTransitionTiming\_Anom** | **-4.971** | **8.294** | **0.393** | **2.654** | **0.002** | **0.336** | **0.044** | **NA** | **0.262** |
| GAMM | Copepods\_boreal | SpringTransitionTiming\_Anom | -2.033 | 6.017 | 0.319 | 2.318 | 0.018 | 0.264 | NA | 0.070 | 0.194 |
| LMAC | Copepods\_boreal | SpringTransitionTiming\_Anom | -0.978 | 5.489 | 0.125 | 30.000 | 0.035 | 0.096 | NA | NA | NA |
| Linear | Copepods\_boreal | SpringTransitionTiming\_Anom | 1.310 | 2.552 | 0.131 | 30.000 | 0.042 | 0.102 | 0.057 | NA | NA |
| GAMM | Copepods\_boreal | SST | 1.853 | 4.073 | 0.098 | 1.000 | 0.159 | 0.068 | NA | 0.320 | 0.000 |
| LMAC | Copepods\_boreal | SST | 1.853 | 4.073 | 0.098 | 30.000 | 0.166 | 0.068 | NA | NA | NA |
| GAM | Copepods\_boreal | SST | 0.647 | 4.522 | 0.232 | 1.691 | 0.020 | 0.188 | 0.053 | NA | 0.126 |
| Linear | Copepods\_boreal | SST | 2.231 | 2.091 | 0.106 | 30.000 | 0.069 | 0.076 | 0.058 | NA | NA |
| GAMM | Copepods\_boreal | TL\_Landings | 3.776 | 3.112 | 0.009 | 1.000 | 0.777 | -0.023 | NA | 0.229 | 0.000 |
| LMAC | Copepods\_boreal | TL\_Landings | 3.776 | 3.112 | 0.009 | 30.000 | 0.781 | -0.023 | NA | NA | NA |
| GAM | Copepods\_boreal | TL\_Landings | 4.757 | 2.151 | 0.109 | 1.376 | 0.169 | 0.068 | 0.060 | NA | 0.097 |
| Linear | Copepods\_boreal | TL\_Landings | 5.424 | 0.495 | 0.012 | 30.000 | 0.550 | -0.021 | 0.065 | NA | NA |
| GAMM | Copepods\_boreal | Tot\_Landings | 3.807 | 3.096 | -0.015 | 1.000 | 0.809 | -0.049 | NA | 0.063 | 0.000 |
| LMAC | Copepods\_boreal | Tot\_Landings | 3.807 | 3.096 | -0.015 | 30.000 | 0.812 | -0.049 | NA | NA | NA |
| GAM | Copepods\_boreal | Tot\_Landings | 5.705 | 0.301 | 0.000 | 0.000 | 0.402 | 0.000 | 0.061 | NA | -0.020 |
| Linear | Copepods\_boreal | Tot\_Landings | 5.181 | 0.616 | 0.020 | 30.000 | 0.446 | -0.013 | 0.064 | NA | NA |
| GAMM | Copepods\_boreal | UpwellingMagnitude\_Anom | 3.513 | 3.243 | 0.019 | 1.000 | 0.565 | -0.014 | NA | 0.064 | 0.000 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | Copepods\_boreal | UpwellingMagnitude\_Anom | 3.513 | 3.243 | 0.019 | 30.000 | 0.571 | -0.014 | NA | NA | NA |
| GAM | Copepods\_boreal | UpwellingMagnitude\_Anom | 5.687 | 0.420 | 0.007 | 0.110 | 0.313 | 0.004 | 0.061 | NA | -0.014 |
| Linear | Copepods\_boreal | UpwellingMagnitude\_Anom | 5.106 | 0.654 | 0.022 | 30.000 | 0.420 | -0.011 | 0.064 | NA | NA |
| GAMM | Copepods\_southern | MEI\_Annual | -25.588 | 17.794 | 0.089 | 1.000 | 0.168 | 0.067 | NA | 0.003 | 0.000 |
| LMAC | Copepods\_southern | MEI\_Annual | -25.588 | 17.794 | 0.089 | 30.000 | 0.174 | 0.067 | NA | NA | NA |
| GAM | Copepods\_southern | MEI\_Annual | -15.912 | 11.867 | 0.114 | 0.757 | 0.051 | 0.092 | 0.031 | NA | -0.007 |
| Linear | Copepods\_southern | MEI\_Annual | -17.579 | 11.996 | 0.121 | 30.000 | 0.051 | 0.092 | 0.031 | NA | NA |
| GAMM | Copepods\_southern | NPGO | -24.140 | 17.070 | 0.056 | 1.000 | 0.456 | 0.030 | NA | 0.002 | 0.000 |
| LMAC | Copepods\_southern | NPGO | -24.140 | 17.070 | 0.056 | 30.000 | 0.464 | 0.030 | NA | NA | NA |
| GAM | Copepods\_southern | NPGO | -14.506 | 11.008 | 0.065 | 0.601 | 0.124 | 0.046 | 0.033 | NA | -0.012 |
| Linear | Copepods\_southern | NPGO | -16.024 | 11.219 | 0.077 | 30.000 | 0.124 | 0.046 | 0.033 | NA | NA |
| **GAM** | **Copepods\_southern** | **PDO\_Annual** | **-35.409** | **23.736** | **0.578** | **2.877** | **0.000** | **0.535** | **0.017** | **NA** | **0.197** |
| GAMM | Copepods\_southern | PDO\_Annual | -31.464 | 20.732 | 0.475 | 2.776 | 0.006 | 0.425 | NA | 0.069 | 0.111 |
| LMAC | Copepods\_southern | PDO\_Annual | -32.235 | 21.118 | 0.364 | 30.000 | 0.003 | 0.344 | NA | NA | NA |
| Linear | Copepods\_southern | PDO\_Annual | -28.781 | 17.597 | 0.381 | 30.000 | 0.000 | 0.360 | 0.022 | NA | NA |
| GAMM | Copepods\_southern | SpringTransitionTiming\_Anom | -23.671 | 16.835 | -0.013 | 1.000 | 0.798 | -0.037 | NA | 0.001 | 0.000 |
| LMAC | Copepods\_southern | SpringTransitionTiming\_Anom | -23.671 | 16.835 | -0.013 | 30.000 | 0.802 | -0.037 | NA | NA | NA |
| GAM | Copepods\_southern | SpringTransitionTiming\_Anom | -14.214 | 11.338 | 0.084 | 1.077 | 0.203 | 0.051 | 0.033 | NA | 0.082 |
| Linear | Copepods\_southern | SpringTransitionTiming\_Anom | -13.530 | 9.972 | 0.002 | 30.000 | 0.796 | -0.031 | 0.036 | NA | NA |
| GAMM | Copepods\_southern | SST | -24.751 | 17.376 | 0.039 | 1.000 | 0.529 | 0.015 | NA | 0.005 | 0.000 |
| LMAC | Copepods\_southern | SST | -24.751 | 17.376 | 0.039 | 30.000 | 0.536 | 0.015 | NA | NA | NA |
| GAM | Copepods\_southern | SST | -16.057 | 11.843 | 0.079 | 0.660 | 0.096 | 0.059 | 0.031 | NA | -0.010 |
| Linear | Copepods\_southern | SST | -17.632 | 12.023 | 0.089 | 30.000 | 0.096 | 0.059 | 0.031 | NA | NA |
| GAMM | Copepods\_southern | TL\_Landings | -23.700 | 16.850 | -0.036 | 1.000 | 0.750 | -0.059 | NA | 0.006 | 0.000 |
| LMAC | Copepods\_southern | TL\_Landings | -23.700 | 16.850 | -0.036 | 30.000 | 0.754 | -0.059 | NA | NA | NA |
| GAM | Copepods\_southern | TL\_Landings | -14.448 | 11.596 | 0.099 | 1.218 | 0.170 | 0.062 | 0.033 | NA | 0.074 |
| Linear | Copepods\_southern | TL\_Landings | -14.239 | 10.326 | 0.024 | 30.000 | 0.396 | -0.008 | 0.035 | NA | NA |
| LMAC | Copepods\_southern | Tot\_Landings | -27.618 | 18.809 | -0.126 | 30.000 | 0.044 | -0.144 | NA | NA | NA |
| GAMM | Copepods\_southern | Tot\_Landings | -27.618 | 18.809 | -0.126 | 1.000 | 0.040 | -0.144 | NA | 0.001 | 0.000 |
| GAM | Copepods\_southern | Tot\_Landings | -13.563 | 9.936 | 0.000 | 0.000 | 0.794 | 0.000 | 0.034 | NA | 0.000 |
| Linear | Copepods\_southern | Tot\_Landings | -13.457 | 9.936 | 0.000 | 30.000 | 0.990 | -0.033 | 0.036 | NA | NA |
| GAMM | Copepods\_southern | UpwellingMagnitude\_Anom | -23.603 | 16.802 | -0.009 | 1.000 | 0.995 | -0.033 | NA | 0.001 | 0.000 |
| LMAC | Copepods\_southern | UpwellingMagnitude\_Anom | -23.603 | 16.802 | -0.009 | 30.000 | 0.995 | -0.033 | NA | NA | NA |
| GAM | Copepods\_southern | UpwellingMagnitude\_Anom | -13.563 | 9.936 | 0.000 | 0.000 | 0.777 | 0.000 | 0.034 | NA | -0.006 |
| Linear | Copepods\_southern | UpwellingMagnitude\_Anom | -13.659 | 10.036 | 0.006 | 30.000 | 0.667 | -0.027 | 0.036 | NA | NA |
| GAMM | Copepods\_subarctic | MEI\_Annual | -35.337 | 22.668 | -0.015 | 1.000 | 0.798 | -0.047 | NA | 0.104 | 0.000 |
| LMAC | Copepods\_subarctic | MEI\_Annual | -35.337 | 22.668 | -0.015 | 30.000 | 0.801 | -0.047 | NA | NA | NA |
| GAM | Copepods\_subarctic | MEI\_Annual | -34.447 | 20.378 | 0.000 | 0.000 | 0.526 | 0.000 | 0.017 | NA | -0.016 |
| Linear | Copepods\_subarctic | MEI\_Annual | -34.872 | 20.643 | 0.016 | 30.000 | 0.484 | -0.016 | 0.018 | NA | NA |
| GAMM | Copepods\_subarctic | NPGO | -36.756 | 23.378 | 0.079 | 1.000 | 0.221 | 0.049 | NA | 0.180 | 0.000 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | Copepods\_subarctic | NPGO | -36.756 | 23.378 | 0.079 | 30.000 | 0.228 | 0.049 | NA | NA | NA |
| GAM | Copepods\_subarctic | NPGO | -35.778 | 21.805 | 0.085 | 0.762 | 0.101 | 0.062 | 0.017 | NA | 0.005 |
| Linear | Copepods\_subarctic | NPGO | -37.022 | 21.718 | 0.080 | 30.000 | 0.116 | 0.050 | 0.017 | NA | NA |
| GAMM | Copepods\_subarctic | PDO\_Annual | -35.625 | 22.812 | 0.052 | 1.000 | 0.505 | 0.021 | NA | 0.226 | 0.000 |
| LMAC | Copepods\_subarctic | PDO\_Annual | -35.625 | 22.812 | 0.052 | 30.000 | 0.512 | 0.021 | NA | NA | NA |
| GAM | Copepods\_subarctic | PDO\_Annual | -35.210 | 21.322 | 0.057 | 0.563 | 0.141 | 0.040 | 0.017 | NA | -0.014 |
| Linear | Copepods\_subarctic | PDO\_Annual | -36.692 | 21.553 | 0.071 | 30.000 | 0.141 | 0.040 | 0.017 | NA | NA |
| GAMM | Copepods\_subarctic | SpringTransitionTiming\_Anom | -35.358 | 22.679 | -0.002 | 1.000 | 0.782 | -0.034 | NA | 0.104 | 0.000 |
| LMAC | Copepods\_subarctic | SpringTransitionTiming\_Anom | -35.358 | 22.679 | -0.002 | 30.000 | 0.786 | -0.034 | NA | NA | NA |
| GAM | Copepods\_subarctic | SpringTransitionTiming\_Anom | -34.447 | 20.378 | 0.000 | 0.000 | 0.769 | 0.000 | 0.017 | NA | 0.000 |
| Linear | Copepods\_subarctic | SpringTransitionTiming\_Anom | -34.348 | 20.381 | 0.000 | 30.000 | 0.938 | -0.033 | 0.019 | NA | NA |
| GAMM | Copepods\_subarctic | SST | -35.388 | 22.694 | -0.005 | 1.000 | 0.744 | -0.038 | NA | 0.104 | 0.000 |
| LMAC | Copepods\_subarctic | SST | -35.388 | 22.694 | -0.005 | 30.000 | 0.748 | -0.038 | NA | NA | NA |
| GAM | Copepods\_subarctic | SST | -34.447 | 20.378 | 0.000 | 0.000 | 0.935 | 0.000 | 0.017 | NA | 0.000 |
| Linear | Copepods\_subarctic | SST | -34.343 | 20.378 | 0.000 | 30.000 | 0.969 | -0.033 | 0.019 | NA | NA |
| GAMM | Copepods\_subarctic | TL\_Landings | -37.435 | 23.718 | -0.124 | 1.000 | 0.082 | -0.159 | NA | 0.104 | 0.000 |
| LMAC | Copepods\_subarctic | TL\_Landings | -37.435 | 23.718 | -0.124 | 30.000 | 0.087 | -0.159 | NA | NA | NA |
| GAM | Copepods\_subarctic | TL\_Landings | -34.447 | 20.378 | 0.000 | 0.000 | 1.000 | 0.000 | 0.017 | NA | -0.003 |
| Linear | Copepods\_subarctic | TL\_Landings | -34.423 | 20.418 | 0.003 | 30.000 | 0.784 | -0.031 | 0.019 | NA | NA |
| GAMM | Copepods\_subarctic | Tot\_Landings | -35.310 | 22.655 | -0.003 | 1.000 | 0.862 | -0.036 | NA | 0.104 | 0.000 |
| LMAC | Copepods\_subarctic | Tot\_Landings | -35.310 | 22.655 | -0.003 | 30.000 | 0.864 | -0.036 | NA | NA | NA |
| GAM | Copepods\_subarctic | Tot\_Landings | -34.447 | 20.378 | 0.000 | 0.000 | 0.820 | 0.000 | 0.017 | NA | 0.000 |
| Linear | Copepods\_subarctic | Tot\_Landings | -34.349 | 20.382 | 0.000 | 30.000 | 0.932 | -0.033 | 0.019 | NA | NA |
| GAMM | Copepods\_subarctic | UpwellingMagnitude\_Anom | -35.984 | 22.992 | 0.137 | 1.754 | 0.274 | 0.086 | NA | 0.156 | 0.102 |
| LMAC | Copepods\_subarctic | UpwellingMagnitude\_Anom | -35.857 | 22.929 | 0.036 | 30.000 | 0.456 | 0.004 | NA | NA | NA |
| GAM | Copepods\_subarctic | UpwellingMagnitude\_Anom | -37.301 | 23.456 | 0.175 | 1.652 | 0.062 | 0.129 | 0.016 | NA | 0.131 |
| Linear | Copepods\_subarctic | UpwellingMagnitude\_Anom | -35.775 | 21.094 | 0.044 | 30.000 | 0.250 | 0.012 | 0.018 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(MEI\_Annual+1) | 66.918 | -28.459 | 0.002 | 1.000 | 0.686 | -0.031 | NA | 0.028 | 0.000 |
| LMAC | log(Tot\_B\_Survey+1) | log(MEI\_Annual+1) | 66.918 | -28.459 | 0.002 | 30.000 | 0.691 | -0.031 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(MEI\_Annual+1) | 70.522 | -32.107 | 0.000 | 0.000 | 0.558 | 0.000 | 0.464 | NA | -0.003 |
| Linear | log(Tot\_B\_Survey+1) | log(MEI\_Annual+1) | 70.542 | -32.064 | 0.003 | 30.000 | 0.778 | -0.031 | 0.494 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(NPGO+1) | 51.208 | -20.604 | -0.009 | 1.000 | 0.919 | -0.049 | NA | 0.011 | 0.000 |
| LMAC | log(Tot\_B\_Survey+1) | log(NPGO+1) | 51.208 | -20.604 | -0.009 | 24.000 | 0.921 | -0.049 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(NPGO+1) | 57.182 | -25.091 | 0.000 | 0.000 | 0.403 | 0.000 | 0.436 | NA | -0.027 |
| Linear | log(Tot\_B\_Survey+1) | log(NPGO+1) | 55.993 | -24.736 | 0.027 | 24.000 | 0.423 | -0.014 | 0.461 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(PDO\_Annual+1) | 62.887 | -26.444 | 0.013 | 1.433 | 0.670 | -0.042 | NA | 0.050 | 0.015 |
| LMAC | log(Tot\_B\_Survey+1) | log(PDO\_Annual+1) | 62.889 | -26.444 | -0.002 | 26.000 | 0.955 | -0.040 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(PDO\_Annual+1) | 65.592 | -29.432 | 0.000 | 0.000 | 1.000 | 0.000 | 0.515 | NA | -0.003 |
| Linear | log(Tot\_B\_Survey+1) | log(PDO\_Annual+1) | 65.249 | -29.385 | 0.003 | 26.000 | 0.768 | -0.035 | 0.554 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(SpringTransitionTiming\_Anom+1) | 57.824 | -23.912 | -0.031 | 1.000 | 0.484 | -0.071 | NA | 0.058 | 0.000 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | log(Tot\_B\_Survey+1) | log(SpringTransitionTiming\_Anom+1) | 57.824 | -23.912 | -0.031 | 25.000 | 0.493 | -0.071 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(SpringTransitionTiming\_Anom+1) | 60.853 | -26.998 | 0.000 | 0.000 | 0.940 | 0.000 | 0.466 | NA | -0.008 |
| Linear | log(Tot\_B\_Survey+1) | log(SpringTransitionTiming\_Anom+1) | 60.286 | -26.893 | 0.008 | 25.000 | 0.662 | -0.032 | 0.501 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(SST+1) | 66.493 | -28.247 | -0.006 | 1.000 | 0.441 | -0.040 | NA | 0.028 | 0.000 |
| LMAC | log(Tot\_B\_Survey+1) | log(SST+1) | 66.493 | -28.247 | -0.006 | 30.000 | 0.448 | -0.040 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(SST+1) | 70.522 | -32.107 | 0.000 | 0.000 | 0.438 | 0.000 | 0.464 | NA | -0.001 |
| Linear | log(Tot\_B\_Survey+1) | log(SST+1) | 70.581 | -32.083 | 0.001 | 30.000 | 0.835 | -0.032 | 0.495 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(TL\_Landings+1) | 66.881 | -28.440 | 0.000 | 1.000 | 0.652 | -0.034 | NA | 0.028 | 0.000 |
| LMAC | log(Tot\_B\_Survey+1) | log(TL\_Landings+1) | 66.881 | -28.440 | 0.000 | 30.000 | 0.658 | -0.034 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(TL\_Landings+1) | 70.522 | -32.107 | 0.000 | 0.000 | 0.558 | 0.000 | 0.464 | NA | -0.002 |
| Linear | log(Tot\_B\_Survey+1) | log(TL\_Landings+1) | 70.553 | -32.070 | 0.002 | 30.000 | 0.793 | -0.031 | 0.494 | NA | NA |
| Linear | log(Tot\_B\_Survey+1) | log(Tot\_Landings+1) | 64.247 | -28.917 | 0.181 | 30.000 | 0.015 | 0.153 | 0.406 | NA | NA |
| GAMM | log(Tot\_B\_Survey+1) | log(Tot\_Landings+1) | 62.146 | -26.073 | 0.181 | 1.000 | 0.028 | 0.153 | NA | 0.056 | 0.000 |
| LMAC | log(Tot\_B\_Survey+1) | log(Tot\_Landings+1) | 62.146 | -26.073 | 0.181 | 30.000 | 0.030 | 0.153 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(Tot\_Landings+1) | 65.999 | -28.997 | 0.177 | 0.849 | 0.015 | 0.153 | 0.404 | NA | -0.004 |
| GAMM | log(Tot\_B\_Survey+1) | log(UpwellingMagnitude\_Anom+1) | 55.713 | -22.856 | -0.056 | 1.000 | 0.476 | -0.086 | NA | 0.128 | 0.000 |
| LMAC | log(Tot\_B\_Survey+1) | log(UpwellingMagnitude\_Anom+1) | 55.713 | -22.856 | -0.056 | 24.000 | 0.485 | -0.086 | NA | NA | NA |
| GAM | log(Tot\_B\_Survey+1) | log(UpwellingMagnitude\_Anom+1) | 59.195 | -24.729 | 0.123 | 1.369 | 0.190 | 0.073 | 0.475 | NA | 0.105 |
| Linear | log(Tot\_B\_Survey+1) | log(UpwellingMagnitude\_Anom+1) | 58.926 | -26.202 | 0.018 | 24.000 | 0.510 | -0.023 | 0.516 | NA | NA |
| GAMM | Prop\_PredFish | MEI\_Annual | -22.005 | 16.002 | 0.065 | 1.000 | 0.164 | 0.034 | NA | 0.056 | 0.000 |
| LMAC | Prop\_PredFish | MEI\_Annual | -22.005 | 16.002 | 0.065 | 30.000 | 0.171 | 0.034 | NA | NA | NA |
| GAM | Prop\_PredFish | MEI\_Annual | -18.522 | 12.944 | 0.051 | 0.529 | 0.155 | 0.035 | 0.029 | NA | -0.015 |
| Linear | Prop\_PredFish | MEI\_Annual | -19.972 | 13.193 | 0.066 | 30.000 | 0.155 | 0.035 | 0.029 | NA | NA |
| GAMM | Prop\_PredFish | NPGO | -20.414 | 15.207 | -0.002 | 1.000 | 0.511 | -0.035 | NA | 0.056 | 0.000 |
| LMAC | Prop\_PredFish | NPGO | -20.414 | 15.207 | -0.002 | 30.000 | 0.518 | -0.035 | NA | NA | NA |
| GAM | Prop\_PredFish | NPGO | -17.890 | 12.099 | 0.000 | 0.000 | 0.899 | 0.000 | 0.029 | NA | -0.004 |
| Linear | Prop\_PredFish | NPGO | -17.923 | 12.168 | 0.004 | 30.000 | 0.720 | -0.029 | 0.031 | NA | NA |
| **GAM** | **Prop\_PredFish** | **PDO\_Annual** | **-27.431** | **19.743** | **0.380** | **2.874** | **0.004** | **0.316** | **0.022** | **NA** | **0.293** |
| GAMM | Prop\_PredFish | PDO\_Annual | -23.812 | 16.906 | 0.081 | 1.000 | 0.054 | 0.051 | NA | 0.675 | 0.000 |
| LMAC | Prop\_PredFish | PDO\_Annual | -23.812 | 16.906 | 0.081 | 30.000 | 0.058 | 0.051 | NA | NA | NA |
| Linear | Prop\_PredFish | PDO\_Annual | -20.706 | 13.560 | 0.087 | 30.000 | 0.101 | 0.057 | 0.029 | NA | NA |
| GAMM | Prop\_PredFish | SpringTransitionTiming\_Anom | -21.231 | 15.616 | 0.066 | 1.000 | 0.265 | 0.035 | NA | 0.138 | 0.000 |
| LMAC | Prop\_PredFish | SpringTransitionTiming\_Anom | -21.231 | 15.616 | 0.066 | 30.000 | 0.273 | 0.035 | NA | NA | NA |
| GAM | Prop\_PredFish | SpringTransitionTiming\_Anom | -19.569 | 13.928 | 0.108 | 0.989 | 0.094 | 0.079 | 0.028 | NA | 0.023 |
| Linear | Prop\_PredFish | SpringTransitionTiming\_Anom | -20.631 | 13.522 | 0.085 | 30.000 | 0.105 | 0.055 | 0.029 | NA | NA |
| GAMM | Prop\_PredFish | SST | -21.332 | 15.666 | 0.078 | 1.000 | 0.242 | 0.047 | NA | 0.101 | 0.000 |
| LMAC | Prop\_PredFish | SST | -21.332 | 15.666 | 0.078 | 30.000 | 0.249 | 0.047 | NA | NA | NA |
| GAM | Prop\_PredFish | SST | -19.131 | 13.369 | 0.076 | 0.650 | 0.101 | 0.057 | 0.028 | NA | -0.011 |
| Linear | Prop\_PredFish | SST | -20.696 | 13.555 | 0.087 | 30.000 | 0.101 | 0.057 | 0.029 | NA | NA |
| GAMM | Prop\_PredFish | TL\_Landings | -20.460 | 15.230 | -0.026 | 1.000 | 0.477 | -0.060 | NA | 0.056 | 0.000 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | Prop\_PredFish | TL\_Landings | -20.460 | 15.230 | -0.026 | 30.000 | 0.484 | -0.060 | NA | NA | NA |
| GAM | Prop\_PredFish | TL\_Landings | -17.890 | 12.099 | 0.000 | 0.000 | 0.632 | 0.000 | 0.029 | NA | 0.000 |
| Linear | Prop\_PredFish | TL\_Landings | -17.784 | 12.099 | 0.000 | 30.000 | 0.982 | -0.033 | 0.031 | NA | NA |
| GAMM | Prop\_PredFish | Tot\_Landings | -22.212 | 16.106 | 0.033 | 1.000 | 0.142 | 0.001 | NA | 0.053 | 0.000 |
| LMAC | Prop\_PredFish | Tot\_Landings | -22.212 | 16.106 | 0.033 | 30.000 | 0.149 | 0.001 | NA | NA | NA |
| GAM | Prop\_PredFish | Tot\_Landings | -17.945 | 12.312 | 0.013 | 0.186 | 0.276 | 0.007 | 0.029 | NA | -0.026 |
| Linear | Prop\_PredFish | Tot\_Landings | -19.067 | 12.740 | 0.039 | 30.000 | 0.277 | 0.007 | 0.030 | NA | NA |
| GAMM | Prop\_PredFish | UpwellingMagnitude\_Anom | -20.000 | 15.000 | -0.007 | 1.000 | 0.864 | -0.040 | NA | 0.056 | 0.000 |
| LMAC | Prop\_PredFish | UpwellingMagnitude\_Anom | -20.000 | 15.000 | -0.007 | 30.000 | 0.866 | -0.040 | NA | NA | NA |
| GAM | Prop\_PredFish | UpwellingMagnitude\_Anom | -17.890 | 12.099 | 0.000 | 0.000 | 0.856 | 0.000 | 0.029 | NA | -0.012 |
| Linear | Prop\_PredFish | UpwellingMagnitude\_Anom | -18.179 | 12.296 | 0.012 | 30.000 | 0.546 | -0.021 | 0.031 | NA | NA |
| GAMM | StellerSeaLion\_Abund | NPGO | 12.358 | -1.179 | -0.083 | 1.000 | 0.676 | -0.207 | NA | 0.122 | 0.000 |
| LMAC | StellerSeaLion\_Abund | NPGO | 12.358 | -1.179 | -0.083 | 5.000 | 0.702 | -0.207 | NA | NA | NA |
| GAM | StellerSeaLion\_Abund | NPGO | 70.796 | -3.398 | 0.000 | 0.000 | 0.707 | 0.000 | 0.210 | NA | 0.000 |
| Linear | StellerSeaLion\_Abund | NPGO | 15.796 | -3.398 | 0.000 | 5.000 | 0.999 | -0.200 | 0.303 | NA | NA |
| **Linear** | **StellerSeaLion\_Abund** | **PDO\_Annual** | **167.765** | **-79.882** | **0.488** | **7.000** | **0.036** | **0.414** | **4957391.208** | **NA** | **NA** |
| GAMM | StellerSeaLion\_Abund | PDO\_Annual | 169.765 | -79.882 | 0.488 | 1.000 | 0.028 | 0.414 | NA | 1.000 | 0.000 |
| LMAC | StellerSeaLion\_Abund | PDO\_Annual | 169.765 | -79.882 | 0.488 | 7.000 | 0.036 | 0.414 | NA | NA | NA |
| GAM | StellerSeaLion\_Abund | PDO\_Annual | 185.680 | -79.441 | 0.535 | 1.399 | 0.063 | 0.437 | 5054036.880 | NA | 0.048 |
| GAMM | StellerSeaLion\_Abund | TL\_Landings | 175.284 | -82.642 | 0.018 | 1.000 | 0.711 | -0.121 | NA | 1.000 | -0.001 |
| LMAC | StellerSeaLion\_Abund | TL\_Landings | 175.608 | -82.804 | 0.019 | 7.000 | 0.723 | -0.121 | NA | NA | NA |
| GAM | StellerSeaLion\_Abund | TL\_Landings | 189.782 | -82.891 | 0.000 | 0.000 | 0.983 | 0.000 | 7406779.500 | NA | -0.019 |
| Linear | StellerSeaLion\_Abund | TL\_Landings | 173.608 | -82.804 | 0.019 | 7.000 | 0.723 | -0.121 | 9489471.543 | NA | NA |
| GAMM | StellerSeaLion\_Abund | Tot\_Landings | 172.541 | -81.270 | 0.302 | 1.000 | 0.104 | 0.203 | NA | 1.000 | 0.000 |
| LMAC | StellerSeaLion\_Abund | Tot\_Landings | 172.541 | -81.270 | 0.302 | 7.000 | 0.125 | 0.203 | NA | NA | NA |
| GAM | StellerSeaLion\_Abund | Tot\_Landings | 188.296 | -81.477 | 0.270 | 0.670 | 0.123 | 0.203 | 6445061.654 | NA | -0.033 |
| Linear | StellerSeaLion\_Abund | Tot\_Landings | 170.541 | -81.270 | 0.302 | 7.000 | 0.125 | 0.203 | 6748453.869 | NA | NA |
| **Linear** | **log(StellerSeaLion\_Abund+1)** | **log(MEI\_Annual+1)** | **9.441** | **-0.721** | **0.594** | **7.000** | **0.015** | **0.536** | **0.114** | **NA** | **NA** |
| GAMM | log(StellerSeaLion\_Abund+1) | log(MEI\_Annual+1) | 5.213 | 2.393 | 0.926 | 2.887 | 0.001 | 0.885 | NA | 1.000 | 0.332 |
| LMAC | log(StellerSeaLion\_Abund+1) | log(MEI\_Annual+1) | 11.441 | -0.721 | 0.594 | 7.000 | 0.015 | 0.536 | NA | NA | NA |
| GAM | log(StellerSeaLion\_Abund+1) | log(MEI\_Annual+1) | 15.366 | 6.554 | 0.919 | 2.237 | 0.000 | 0.888 | 0.033 | NA | 0.325 |
| GAMM | log(StellerSeaLion\_Abund+1) | log(SST+1) | 18.937 | -4.469 | 0.031 | 1.000 | 0.776 | -0.107 | NA | 1.000 | -0.008 |
| LMAC | log(StellerSeaLion\_Abund+1) | log(SST+1) | 19.198 | -4.599 | 0.040 | 7.000 | 0.608 | -0.098 | NA | NA | NA |
| GAM | log(StellerSeaLion\_Abund+1) | log(SST+1) | 33.561 | -4.780 | 0.000 | 0.000 | 0.596 | 0.000 | 0.214 | NA | -0.040 |
| Linear | log(StellerSeaLion\_Abund+1) | log(SST+1) | 17.198 | -4.599 | 0.040 | 7.000 | 0.608 | -0.098 | 0.269 | NA | NA |
| **Linear** | **log(StellerSeaLion\_Abund+1)** | **log(UpwellingMagnitude\_Anom+1)** | **8.163** | **-0.082** | **0.648** | **7.000** | **0.009** | **0.598** | **0.099** | **NA** | **NA** |
| GAMM | log(StellerSeaLion\_Abund+1) | log(UpwellingMagnitude\_Anom+1) | 10.163 | -0.082 | 0.648 | 1.000 | 0.006 | 0.598 | NA | 1.000 | 0.000 |
| LMAC | log(StellerSeaLion\_Abund+1) | log(UpwellingMagnitude\_Anom+1) | 10.163 | -0.082 | 0.648 | 7.000 | 0.009 | 0.598 | NA | NA | NA |
| GAM | log(StellerSeaLion\_Abund+1) | log(UpwellingMagnitude\_Anom+1) | 26.107 | -0.131 | 0.644 | 0.922 | 0.008 | 0.598 | 0.097 | NA | -0.004 |
| GAMM | log(StellerSeaLion\_Abund+1) | SpringTransitionTiming\_Anom | 6.271 | 1.865 | -0.011 | 1.000 | 0.989 | -0.141 | NA | 1.000 | -0.288 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | log(StellerSeaLion\_Abund+1) | SpringTransitionTiming\_Anom | 16.492 | -3.246 | 0.278 | 7.000 | 0.164 | 0.175 | NA | NA | NA |
| GAM | log(StellerSeaLion\_Abund+1) | SpringTransitionTiming\_Anom | 32.320 | -3.363 | 0.270 | 0.797 | 0.175 | 0.189 | 0.193 | NA | -0.010 |
| Linear | log(StellerSeaLion\_Abund+1) | SpringTransitionTiming\_Anom | 14.604 | -3.302 | 0.280 | 7.000 | 0.143 | 0.177 | 0.202 | NA | NA |
| GAMM | TL\_SurveyedComm | MEI\_Annual | -10.123 | 10.062 | 0.027 | 1.000 | 0.155 | -0.005 | NA | 0.051 | 0.000 |
| LMAC | TL\_SurveyedComm | MEI\_Annual | -10.123 | 10.062 | 0.027 | 30.000 | 0.162 | -0.005 | NA | NA | NA |
| GAM | TL\_SurveyedComm | MEI\_Annual | -5.772 | 6.040 | 0.000 | 0.000 | 0.562 | 0.000 | 0.043 | NA | -0.031 |
| Linear | TL\_SurveyedComm | MEI\_Annual | -6.679 | 6.546 | 0.031 | 30.000 | 0.334 | -0.001 | 0.044 | NA | NA |
| GAMM | TL\_SurveyedComm | NPGO | -8.393 | 9.196 | 0.033 | 1.000 | 0.556 | 0.001 | NA | 0.056 | 0.000 |
| LMAC | TL\_SurveyedComm | NPGO | -8.393 | 9.196 | 0.033 | 30.000 | 0.562 | 0.001 | NA | NA | NA |
| GAM | TL\_SurveyedComm | NPGO | -5.812 | 6.218 | 0.011 | 0.158 | 0.284 | 0.006 | 0.043 | NA | -0.027 |
| Linear | TL\_SurveyedComm | NPGO | -6.908 | 6.661 | 0.038 | 30.000 | 0.284 | 0.006 | 0.044 | NA | NA |
| **GAM** | **TL\_SurveyedComm** | **PDO\_Annual** | **-15.462** | **13.726** | **0.381** | **2.841** | **0.003** | **0.319** | **0.032** | **NA** | **0.358** |
| GAMM | TL\_SurveyedComm | PDO\_Annual | -10.138 | 10.069 | 0.169 | 1.829 | 0.166 | 0.117 | NA | 0.777 | 0.151 |
| LMAC | TL\_SurveyedComm | PDO\_Annual | -9.460 | 9.730 | 0.018 | 30.000 | 0.251 | -0.015 | NA | NA | NA |
| Linear | TL\_SurveyedComm | PDO\_Annual | -6.433 | 6.423 | 0.024 | 30.000 | 0.400 | -0.009 | 0.045 | NA | NA |
| Linear | TL\_SurveyedComm | SpringTransitionTiming\_Anom | -10.228 | 8.321 | 0.133 | 30.000 | 0.040 | 0.104 | 0.040 | NA | NA |
| GAMM | TL\_SurveyedComm | SpringTransitionTiming\_Anom | -10.416 | 10.208 | 0.109 | 1.000 | 0.127 | 0.079 | NA | 0.386 | 0.000 |
| LMAC | TL\_SurveyedComm | SpringTransitionTiming\_Anom | -10.416 | 10.208 | 0.109 | 30.000 | 0.133 | 0.079 | NA | NA | NA |
| GAM | TL\_SurveyedComm | SpringTransitionTiming\_Anom | -11.579 | 11.714 | 0.299 | 2.770 | 0.017 | 0.230 | 0.036 | NA | 0.166 |
| GAMM | TL\_SurveyedComm | SST | -8.593 | 9.296 | 0.039 | 1.000 | 0.461 | 0.008 | NA | 0.063 | 0.000 |
| LMAC | TL\_SurveyedComm | SST | -8.593 | 9.296 | 0.039 | 30.000 | 0.468 | 0.008 | NA | NA | NA |
| GAM | TL\_SurveyedComm | SST | -5.982 | 6.492 | 0.028 | 0.347 | 0.225 | 0.017 | 0.043 | NA | -0.021 |
| Linear | TL\_SurveyedComm | SST | -7.259 | 6.837 | 0.049 | 30.000 | 0.225 | 0.017 | 0.043 | NA | NA |
| GAMM | TL\_SurveyedComm | TL\_Landings | -8.583 | 9.291 | 0.015 | 1.000 | 0.476 | -0.018 | NA | 0.243 | 0.000 |
| LMAC | TL\_SurveyedComm | TL\_Landings | -8.583 | 9.291 | 0.015 | 30.000 | 0.483 | -0.018 | NA | NA | NA |
| GAM | TL\_SurveyedComm | TL\_Landings | -7.357 | 9.721 | 0.206 | 2.889 | 0.117 | 0.124 | 0.041 | NA | 0.190 |
| Linear | TL\_SurveyedComm | TL\_Landings | -6.164 | 6.289 | 0.015 | 30.000 | 0.498 | -0.017 | 0.045 | NA | NA |
| GAMM | TL\_SurveyedComm | Tot\_Landings | -9.597 | 9.799 | 0.017 | 1.000 | 0.221 | -0.015 | NA | 0.051 | 0.000 |
| LMAC | TL\_SurveyedComm | Tot\_Landings | -9.597 | 9.799 | 0.017 | 30.000 | 0.228 | -0.015 | NA | NA | NA |
| GAM | TL\_SurveyedComm | Tot\_Landings | -5.772 | 6.040 | 0.000 | 0.000 | 0.714 | 0.000 | 0.043 | NA | -0.023 |
| Linear | TL\_SurveyedComm | Tot\_Landings | -6.423 | 6.419 | 0.023 | 30.000 | 0.403 | -0.009 | 0.045 | NA | NA |
| GAMM | TL\_SurveyedComm | UpwellingMagnitude\_Anom | -8.057 | 9.028 | 0.001 | 1.000 | 0.930 | -0.032 | NA | 0.051 | 0.000 |
| LMAC | TL\_SurveyedComm | UpwellingMagnitude\_Anom | -8.057 | 9.028 | 0.001 | 30.000 | 0.931 | -0.032 | NA | NA | NA |
| GAM | TL\_SurveyedComm | UpwellingMagnitude\_Anom | -5.772 | 6.040 | 0.000 | 0.000 | 0.641 | 0.000 | 0.043 | NA | -0.003 |
| Linear | TL\_SurveyedComm | UpwellingMagnitude\_Anom | -5.747 | 6.080 | 0.003 | 30.000 | 0.784 | -0.031 | 0.046 | NA | NA |
| GAMM | Ecosystem response DFA trend | Environment pressure DFA trend | 92.740 | -41.370 | -0.744 | 1.000 | 0.458 | -0.045 | NA | 0.000 | 0.000 |
| LMAC | Ecosystem response DFA trend | Environment pressure DFA trend | 92.740 | -41.370 | -0.744 | 30.000 | 0.465 | -0.045 | NA | NA | NA |
| GAM | Ecosystem response DFA trend | Environment pressure DFA trend | 134.897 | -64.295 | 0.000 | 0.000 | 0.923 | 0.000 | 3.470 | NA | 0.000 |
| Linear | Ecosystem response DFA trend | Environment pressure DFA trend | 134.996 | -64.291 | 0.000 | 30.000 | 0.936 | -0.033 | 3.704 | NA | NA |
| GAMM | Ecosystem response DFA trend | Human pressure DFA trend | 92.592 | -41.296 | -0.722 | 1.000 | 0.398 | -0.017 | NA | 0.003 | 0.000 |
| Model | Response | Pressure | AICc | logLik | dev.expl | edf | Pvalue | R2 | GCV | p.ac | diff.dev.expl |
| LMAC | Ecosystem response DFA trend | Human pressure DFA trend | 92.592 | -41.296 | -0.722 | 30.000 | 0.406 | -0.017 | NA | NA | NA |
| GAM | Ecosystem response DFA trend | Human pressure DFA trend | 124.854 | -55.523 | 0.422 | 3.750 | 0.004 | 0.342 | 2.595 | NA | 0.404 |
| Linear | Ecosystem response DFA trend | Human pressure DFA trend | 134.436 | -64.011 | 0.018 | 30.000 | 0.470 | -0.015 | 3.640 | NA | NA |