Tables

Table 1: Correlation matrix between environmental characteristics and dissolution. All values are Spearman rank correlations for all dates and stations. ,

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Chlorophyll-a (g/L) | Depth (m) | Dissolved Oxygen (mg/L) | Salinity (psu) | Temperature (C) | Dissolution I (%) | Dissolution II (%) | Dissolution III (%) |
| Aragonite saturation () | 0.1 | 0.53\*\* | 0.53\*\* | 0.48\*\* | -0.11 | 0.08 | 0.34\* | -0.39\* |
| Chlorophyll-a (g/L) |  | 0.08 | 0.23 | -0.25 | -0.16 | -0.07 | 0.03 | -0.01 |
| Depth (m) |  |  | 0.22 | 0.44\*\* | -0.06 | 0.16 | 0.01 | -0.14 |
| Dissolved Oxygen (mg/L) |  |  |  | -0.22 | -0.44\*\* | -0.03 | 0.16 | -0.03 |
| Salinity (psu) |  |  |  |  | 0.01 | 0.3\* | 0 | -0.37\* |
| Temperature (C) |  |  |  |  |  | -0.05 | 0.04 | -0.02 |
| Dissolution I (%) |  |  |  |  |  |  | -0.67\*\* | -0.53\*\* |
| Dissolution II (%) |  |  |  |  |  |  |  | -0.13 |

Table 2: Environmental characteristics of sample stations in Puget Sound. Stations are grouped by exposure categories defined by multivariate clustering (Figure 2). Depth is the maximum sampled depth for seasonal CTD casts. Average (min/max) aragonite saturation state, salinity, chlorophyll-a, temperature, and oxygen values are also shown based on approximately nine visits to each site and different samples by depth from 2014 to 2016.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Station | lon/lat | Depth (m) | Aragonite saturation () | Salinity (psu) | Chlorophyll-a (g/L) | Temperature (C) | Dissolved Oxygen (mg/L) |
| mild exposure | 22 | -123/48.3 | 120 | 1.1 (0.7, 1.7) | 31.5 (29.4, 35.5) | 1.5 (0.2, 7.3) | 10.4 (8.1, 12.8) | 191.4 (107.3, 270.4) |
| moderate exposure | 8 | -122.6/47.9 | 129 | 1.2 (0.6, 2.9) | 30.1 (27.2, 31.3) | 3.8 (0, 20.8) | 11.7 (9.6, 14.9) | 227.7 (161.6, 388.3) |
|  | 28 | -122.5/47.7 | 189 | 1.1 (0.6, 2) | 30.2 (27.1, 32.8) | 2.6 (0.1, 14) | 11.9 (9.3, 14.6) | 211.2 (155.8, 348.5) |
|  | 38 | -122.7/47.3 | 98 | 1.1 (0.7, 2.9) | 29.7 (27.3, 31.8) | 1.9 (0.1, 11.7) | 12.8 (9.5, 15.6) | 220.7 (136.2, 432.3) |
| severe exposure | 4 | -122.6/48.2 | 84 | 0.9 (0.5, 2.7) | 27.9 (20.4, 30.5) | 4.9 (0.1, 43.9) | 11.6 (9.1, 16.2) | 205.9 (88.6, 447.3) |
|  | 12 | -123.1/47.4 | 121 | 0.9 (0.3, 3) | 29.1 (23.9, 30.7) | 4.1 (0, 47.6) | 11.5 (8.5, 20.9) | 163.5 (21.4, 464.5) |
|  | 402 | -123/47.4 | 50 | 0.9 (0.2, 2.6) | 28.6 (21.8, 30.5) | 6 (0, 116.4) | 11.9 (8.9, 21.8) | 175.3 (19, 465.6) |

Table 3: Model comparison of pteropod dissolution (type III) against all combinations of environmental predictor variables. All combinations are compared with Akaike Information Criterion (AIC) and the model with the lowest AIC (in bold) is considered the most parsimonious. Models include data from all stations and sample dates. typ3: Type III dissolution, ara: minimum saturation state, oxy: dissolved oxygen, sal: salinity, temp: temperature.

|  |  |  |  |
| --- | --- | --- | --- |
| Model | Degrees of freedom | Adj. R-squared | AIC |
| typ3 ~ ara + oxy + sal + temp | 6 | 0.16 | 446.9 |
| typ3 ~ ara + oxy + sal | 5 | 0.18 | 444.96 |
| typ3 ~ ara + oxy + temp | 5 | 0.16 | 446.22 |
| typ3 ~ ara + sal + temp | 5 | 0.18 | 444.94 |
| typ3 ~ oxy + sal + temp | 5 | 0.14 | 447.57 |
| typ3 ~ ara + temp | 4 | 0.15 | 445.99 |
| **typ3 ~ ara + sal** | **4** | **0.2** | **443.13** |
| typ3 ~ ara + oxy | 4 | 0.18 | 444.28 |
| typ3 ~ oxy + sal | 4 | 0.14 | 446.53 |
| typ3 ~ oxy + temp | 4 | 0 | 455.77 |
| typ3 ~ sal + temp | 4 | 0.11 | 448.22 |
| typ3 ~ ara | 3 | 0.16 | 444.16 |
| typ3 ~ sal | 3 | 0.13 | 446.28 |
| typ3 ~ temp | 3 | 0 | 454.16 |
| typ3 ~ oxy | 3 | 0 | 453.9 |

Table 4: Model comparison of pteropod length against all combinations of environmental predictor variables. All combinations are compared with Akaike Information Criterion (AIC) and the model with the lowest AIC (in bold) is considered the most parsimonious. Models include data from all stations and sample dates. len: length, ara: minimum saturation state, oxy: dissolved oxygen, sal: salinity, temp: temperature, chla; chlorophyll-a.

|  |  |  |  |
| --- | --- | --- | --- |
| Model | Degrees of freedom | Adj. R-squared | AIC |
| len ~ ara + temp + oxy + sal + chla | 7 | 0 | 718.31 |
| len ~ ara + temp + oxy + sal | 6 | 0.01 | 716.65 |
| len ~ ara + temp + oxy + chla | 6 | 0.02 | 716.43 |
| len ~ ara + temp + sal + chla | 6 | 0.02 | 716.47 |
| len ~ ara + oxy + sal + chla | 6 | 0 | 719.51 |
| len ~ temp + oxy + sal + chla | 6 | 0.02 | 716.4 |
| len ~ ara + temp + oxy | 5 | 0.03 | 714.92 |
| len ~ ara + temp + sal | 5 | 0.03 | 714.75 |
| len ~ ara + temp + chla | 5 | 0.02 | 715.28 |
| len ~ ara + oxy + sal | 5 | 0 | 717.57 |
| len ~ ara + oxy + chla | 5 | 0 | 719.08 |
| len ~ ara + sal + chla | 5 | 0 | 718.19 |
| len ~ temp + oxy + sal | 5 | 0.03 | 714.68 |
| len ~ temp + oxy + chla | 5 | 0.02 | 715.16 |
| len ~ temp + sal + chla | 5 | 0.04 | 714.47 |
| len ~ oxy + sal + chla | 5 | 0 | 717.82 |
| len ~ ara + temp | 4 | 0.03 | 713.77 |
| len ~ ara + oxy | 4 | 0 | 717.3 |
| len ~ ara + sal | 4 | 0 | 716.28 |
| len ~ ara + chla | 4 | 0 | 717.08 |
| len ~ temp + oxy | 4 | 0.04 | 713.57 |
| len ~ temp + sal | 4 | 0.05 | 712.76 |
| len ~ temp + chla | 4 | 0.04 | 713.48 |
| len ~ oxy + sal | 4 | 0 | 715.93 |
| len ~ oxy + chla | 4 | 0 | 717.26 |
| len ~ sal + chla | 4 | 0 | 716.19 |
| len ~ ara | 3 | 0 | 715.3 |
| **len ~ temp** | **3** | **0.05** | **711.92** |
| len ~ oxy | 3 | 0 | 715.47 |
| len ~ sal | 3 | 0 | 714.28 |
| len ~ chla | 3 | 0 | 715.36 |

*Table 5: (#tab:cumstrmod) Linear multiple regression models testing the additive effects of minimum observed cumulative stress exposure (St, eqn. 2) and cohort year (factor) on extent of type III dissolution in pteropods. Results for two models are shown where the first includes 2016 data and the second does not because of missing April observations (Figure 7, bottom). Values shown are parameter estimates and standard error for the predictors (left column) in each linear model. Sample size and R-squared values for each model are shown at the bottom.*

Table 6:

|  |  |  |
| --- | --- | --- |
|  | By year | By year (no 2016) |
| Constant | 6.78 | 5.68 |
|  | (5.43) | (5.19) |
| St | 48.64 \*\*\* | 53.11 \*\*\* |
|  | (12.38) | (12.13) |
| 2015 | 10.69 | 10.44 |
|  | (6.22) | (5.88) |
| 2016 | 7.54 |  |
|  | (6.79) |  |
| N | 50 | 36 |
| R2 | 0.31 | 0.42 |
| \*\*\* p < 0.001; \*\* p < 0.01; \* p < 0.05. | | |