*Temperature*

The temperature in the buckets ramped up slowly over 24h on day 1 and ramped down over 8h on day 4. The treatments lasted from 09:00 on November 09 to 01:00 on November 13 for a total of X hours of heat exposure. Temperature treatments varied slightly from the target temperatures (Figure 1). The mean temperature of the 12°C was 12.5°C but varied from 11.2-14.0°C, the mean of the 17°C treatment was 16.8°C but ranged from 16°C to 17.9°C, and the 22°C treatment had a mean temperature of 21.9°C but varied from 20.0°C to 23.3°C.

*Lethal Effects*

All five of the mortalities occurred in the hottest (22ºC) treatment. The mortalities occurred on day 3 (*N*=2), day 4 (*N*=1), day 6 (*N*=1) and day 7 (*N*=1) of the experiment (Figure 1). The results of a Kruskal-Wallis rank sum test indicated that the treatment-based difference was significant (χ2 = , df = , p = 0.00337). A Dunn’s Test indicated that cucumbers experienced significantly higher mortality in the 22ºC treatment than in the cooler treatments (Z = NUMBER HERE, df =, p = 0.00334) (Supplementary Table 1).

|  |  |  |
| --- | --- | --- |
| Comparison | Z-score | Adjusted p-value |
| Control – heat | -2.935 | 0.00334 \* |
| Control – room | 0.0000 | 1.000 |
| Heat – room | 2.935 | 0.00334 \* |

*Sublethal Data*

Sea cucumber stiffness, as measured by antipredator response and structure maintenance, varied across the duration of the experiment (Figure 1, 2). Stiffness metrics were significantly positively correlated (r = 0.53, p < 0.001; Figure S1). For both stiffness metrics, the backward-selected models with the lowest AIC values indicated that treatment and treatment day both had significant effects on stiffness metrics (INSERT P VALUES? Table S1, S2).

In both 17 and 22 treatments, there was a significantly lower likelihood of being fully stiff with increasing time.

There was a significantly lower log odds of being fully stiff for all days compared to the day preceding the experiment and for both 17°C and 22°C treatments relative to the control (Figure S2). However, there were no significant differences in the log-odds likelihood of stiffness between 17°C and 22°C treatments as indicated by the high degree of overlap in 95% confidence intervals (Figure S2).

Activity scores varied across treatments over the duration of the experiment (Figure 3). Kruskal-Wallis tests investigating differences between treatments on days 1, 2, 5 and 12 only found a significant difference on day 2 (the first day of the heat treatment; Table S3). The Dunn test conducted on day 2 did not discern any significant differences between temperature treatments (Table S4), although the difference in activity scores between the 12°C and 22°C treatment was almost significant (*Z* = 2.39, P-adjusted = 0.0506). The absence of a treatment-related effect on activity scores was further compounded by the exclusion of treatment as a predictor variable in our forward selected generalized additive model output as treatment day was the only variable retained in the top model (Table S5).

Evidence of stress spawning (eggs or sperm) occurred in 11 buckets over the course of the experiment. Nine of these buckets were in the 17ºC and 22ºC treatments. However, a Kruskal-Wallis rank sum test indicated that there was no significant difference between any of the temperatures (chi squared and T values, p = 0.4865).

Our logistic regression model suggested temperature treatment does not explain a significant amount of the variance in evisceration data because it was excluded from our forward selected model. However, weight (p = 0.0383) and defecation status (p = 0.0163) were included in the top model as significant predictors of evisceration (Supplementary Table 1). Two cucumbers in the heat treatment eviscerated their respiratory trees in addition to their internal organs (Figure {X}). One cucumber died within 12h, the other survived for more than 60 hours. The latter cucumber was severely impacted by eviscerating its respiratory tree; its stiffness rates and activity scores all dropped to zero, however it continued to move extremely slowly and wave its mouth parts.

*Wasting*

ADD SENTENCE HERE DESCRIBING LESIONS Major lesions were observed in two individuals in the heat treatment that had 4 and 1 lesions, respectively, on the final day of heating (day 4). Neither of these individuals died and their lesions appeared to heal and were re-classified as minor lesions on day 12 of the experiment. Varying numbers of minor lesions were observed in 17, 15, and 10 individuals in the 12°C, 17°C and 22°C treatments and the maximum number of lesions per individual was not statistically significant across treatments (Figure S3). Based on gene ralized additive model results, the maximum number of lesions per individual was not significantly affected by weight or treatment (Table SX).