**The utility of different acoustic indicators to describe biological sounds of a coral reef soundscape**

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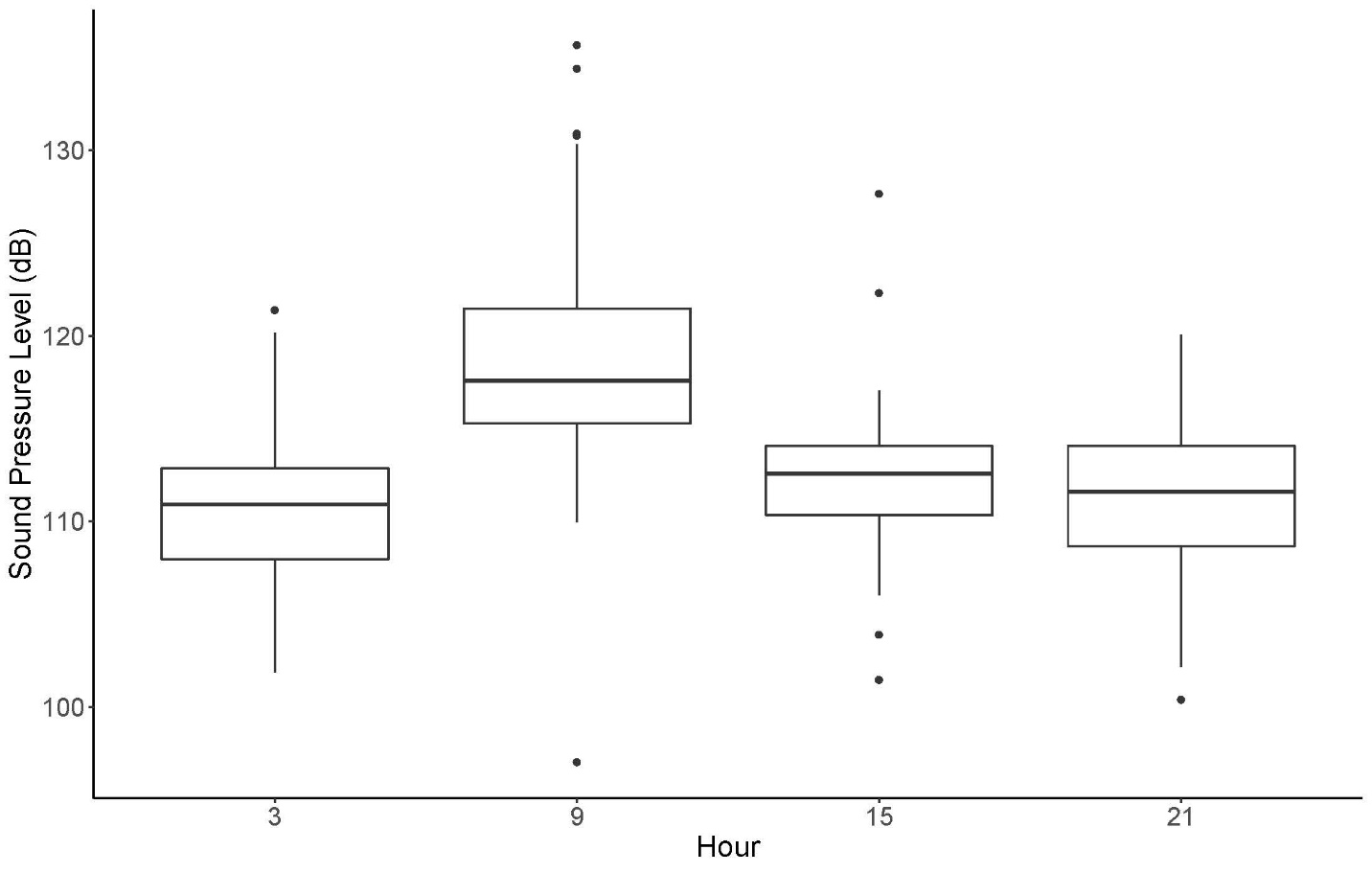
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**Supplementary Materials**



**Supplementary Figure 1.** Differences in Sound Pressure Level (dB) between the four sampled times of day using subsampled individually selected knocks.

**Supplementary Table 1.** Top models from AICc stepwise comparisons and results (parameter estimates) for final model fixed effects from linear mixed-effects model examining changes in high frequency SPL associated with changes in snapping shrimp snaps.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | | | **K** | **AICc** | | **ΔAIC** | | **Adjusted R2** | **P value** |
| HF SPL ~ Snaps \* Day/Night + Year + Lunar Phase + Fishing Pressure | | | 8 | 77923.39 | | 0 | | 0.371 | < 0.0001 |
| HF SPL ~ Snaps + Day/Night + Year + Lunar Phase + Fishing Pressure | | | 7 | 78034.51 | | 111.11 | | 0.367 | < 0.0001 |
| HF SPL ~ Snaps + Year + Lunar Phase + Fishing Pressure | | | 6 | 79819.11 | | 1895.72 | | 0.292 | < 0.0001 |
| **Parameter estimates for final model** | | | | | | | | | |
| **Parameter** | **Estimate** | **Std. Error** | | | **t value** | | **P value** | | |
| (Intercept) | 114.94 | 0.034 | | | 3354.404 | | < 0.0001 | | |
| Snaps | 0.87 | 0.059 | | | 14.696 | | < 0.0001 | | |
| Day/Night (Night) | 1.92 | 0.044 | | | -8.868 | | < 0.0001 | | |
| Snaps \* Day/Night | 0.21 | 0.045 | | | 10.652 | | < 0.0001 | | |
| Lunar Phase | 3.40 | 0.046 | | | 4.767 | | < 0.0001 | | |
| Year (2018) | 1.00 | 0.045 | | | 74.472 | | < 0.0001 | | |
| Fishing Pressure | 0.97 | 0.092 | | | 22.314 | | < 0.0001 | | |

**Supplementary Table 2.** Parameter estimates for the selected low frequency ACI model calculated using a frequency resolution of 15.6 Hz. Fixed effects from linear mixed-effects model examining changes in ACI associated with changes in snapping shrimp snaps. The intercept and all main effects represent our 15:00 sampling time.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **15.6 Hz Frequency Resolution Model** | | | | |
| LF ACI ~ Knocks \* Hour + Herbivory + Year + Lunar Phase + Fishing Pressure | | | | |
| **Parameter estimates for final model** | | | | |
| **Parameter** | **Estimate** | **Std. Error** | **t value** | **P value** |
| (Intercept) | 35.962 | 0.234 | 153.386 | < 0.0001 |
| Knocks | 0.756 | 0.505 | 1.497 | 0.136 |
| 21:00 | -0.161 | 0.268 | -0.603 | 0.547 |
| 03:00 | 1.178 | 0.276 | 4.263 | < 0.0001 |
| 09:00 | 0.038 | 0.278 | 0.136 | 0.892 |
| Herbivory | 0.740 | 0.186 | 3.970 | 0.0001 |
| Lunar Phase | -0.058 | 0.182 | -0.318 | 0.751 |
| Year (2018) | 0.216 | 0.164 | 1.315 | 0.190 |
| Fishing Pressure | 1.308 | 0.184 | 7.107 | < 0.0001 |
| Knocks \* 21:00 | 1.075 | 0.587 | 1.831 | 0.0687 |
| Knocks \* 03:00 | 0.109 | 0.574 | 0.190 | 0.850 |
| Knocks \* 09:00 | 1.493 | 0.581 | 2.570 | 0.011 |

**Supplementary Table 3.** Parameter estimates for the selected low frequency ACI model calculated using a frequency resolution of 4 Hz. Fixed effects from linear mixed-effects model examining changes in ACI associated with changes in snapping shrimp snaps. The intercept and all main effects represent our 15:00 sampling time.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **4 Hz Frequency Resolution Model** | | | | |
| LF ACI ~ Knocks \* Hour + Herbivory + Year + Lunar Phase + Fishing Pressure | | | | |
| **Parameter estimates for final model** | | | | |
| **Parameter** | **Estimate** | **Std. Error** | **t value** | **P value** |
| (Intercept) | 77.004 | 0.346 | 222.837 | <0.0001 |
| Knocks | 0.947 | 0.744 | 1.272 | 0.205 |
| 21:00 | -0.483 | 0.395 | -1.223 | 0.223 |
| 03:00 | -0.189 | 0.407 | -0.463 | 0.643 |
| 09:00 | -1.342 | 0.410 | -3.276 | 0.001 |
| Herbivory | 1.794 | 0.275 | 6.535 | < 0.0001 |
| Lunar Phase | -0.099 | 0.268 | -0.368 | 0.713 |
| Year (2018) | 0.223 | 0.242 | 0.920 | 0.359 |
| Fishing Pressure | 1.879 | 0.271 | 6.925 | < 0.0001 |
| Knocks \* 21:00 | 0.319 | 0.865 | 0.369 | 0.713 |
| Knocks \* 03:00 | -1.327 | 0.846 | -1.569 | 0.119 |
| Knocks \* 09:00 | 1.542 | 0.856 | 1.801 | 0.073 |

**Supplementary Table 4.** Top models from AICc stepwise comparisons and results (parameter estimates) for final model fixed effects from linear mixed-effects model examining changes in high frequency ACI associated with changes in snapping shrimp snaps. The intercept and all main effects represent our 15:00 sampling time.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | | | | **K** | **AICc** | **ΔAIC** | | **Adjusted R2** | **P value** |
| **31.2 Hz** | **HF SPL ~ Snaps \* Day/Night + Year + Lunar Phase + Fishing Pressure** | | | 8 | 122047.6 | 0 | | 0.3701 | < 0.0001 |
| 15.6 Hz | HF SPL ~ Snaps \* Day/Night + Year + Lunar Phase + Fishing Pressure | | | 8 | 140954.0 | 18906.4 | | 0.335 | < 0.0001 |
| 4 Hz | HF SPL ~ Snaps \* Day/Night + Year + Lunar Phase + Fishing Pressure | | | 8 | 160751.3 | 38703.7 | | 0.285 | < 0.0001 |
| **Parameter estimates for final model** | | | | | | | | | |
| **Parameter** | | **Estimate** | **Std. Error** | **t value** | | | **P value** | | |
| (Intercept) | | -23510 | 376.3 | -67.263 | | | < 0.0001 | | |
| Snaps | | -6.829 | 0.242 | -28.187 | | | < 0.0001 | | |
| Day/Night (Night) | | -1.669 | 0.181 | -9.212 | | | < 0.0001 | | |
| Snaps \* Day/Night | | 0.925 | 0.374 | 2.477 | | | < 0.0132 | | |
| Lunar Phase | | 0.315 | 0.182 | 1.733 | | | 0.0832 | | |
| Year (2018) | | 12.780 | 0.187 | 68.495 | | | < 0.0001 | | |
| Fishing Pressure | | -8.700 | 0.185 | -47.073 | | | < 0.0001 | | |

**Supplementary Table 5.** Parameter estimates for the selected high frequency ACI model calculated using a frequency resolution of 15.6 Hz. Fixed effects from linear mixed-effects model examining changes in ACI associated with changes in snapping shrimp snaps. The intercept and all main effects represent our 15:00 sampling time.

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| --- | --- | --- | --- | --- |
| **15.6 Hz Model** | | | | |
| HF SPL ~ Snaps \* Day/Night + Year + Lunar Phase + Fishing Pressure | | | | |
| **Parameter estimates** | | | | |
| **Parameter** | **Estimate** | **Std. Error** | **t value** | **P value** |
| (Intercept) | -48400 | 682.2 | -70.941 | < 0.0001 |
| Snaps | -10.49 | 0.4392 | -23.886 | < 0.0001 |
| Day/Night (Night) | -3.753 | 0.328 | -11.429 | < 0.0001 |
| Snaps \* Day/Night | 1.466 | 0.677 | 2.165 | 0.030 |
| Lunar Phase | 0.534 | 0.329 | 1.624 | 0.105 |
| Year (2018) | 24.40 | 0.338 | 72.150 | < 0.0001 |
| Fishing Pressure | -10.69 | 0.335 | 2.165 | < 0.0001 |

**Supplementary Table 6.** Parameter estimates for the selected high frequency ACI model calculated using a frequency resolution of 4 Hz. Fixed effects from linear mixed-effects model examining changes in ACI associated with changes in snapping shrimp snaps. The intercept and all main effects represent our 15:00 sampling time.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **4 Hz Model** | | | | |
| HF SPL ~ Snaps \* Day/Night + Year + Lunar Phase + Fishing Pressure | | | | |
| **Parameter estimates** | | | | |
| **Parameter** | **Estimate** | **Std. Error** | **t value** | **P value** |
| (Intercept) | -80600 | 1272 | -63.369 | < 0.0001 |
| Snaps | -17.50 | 0.819 | -21.370 | < 0.0001 |
| Day/Night (Night) | -7.957 | 0.612 | -12.997 | < 0.0001 |
| Snaps \* Day/Night | 4.833 | 1.262 | 3.828 | < 0.001 |
| Lunar Phase | 0.842 | 0.614 | 1.373 | 0.170 |
| Year (2018) | 40.84 | 0.631 | 64.775 | < 0.0001 |
| Fishing Pressure | -16.669 | 0.625 | 3.828 | < 0.0001 |

**Supplementary Table 7**. Model parameter estimates and statistics for a model examining the influence of time of day on the received level (dB) of individual knocks selected from the acoustic data.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Estimate** | **SE** | **t value** | **P value** |
| Intercept (03:00) | 111. | 0.7 | 149.7 | < 0.0001 |
| 09:00 | 7.7 | 0.9 | 8.1 | < 0.0001 |
| 15:00 | 1.0 | 1.2 | 0.8 | 0.41 |
| 21:00 | -0.2 | 1.1 | 0.1 | 0.89 |