Supplemental Information

White and Amber Light at Night
Disrupt Sleep Physiology in Birds

Anne E. Aulsebrook, Farley Connelly, Robin D. Johnsson, Therése M. Jones, Raoul A. Mulder, Michelle L. Hall, Alexei L. Vyssotski, and John A. Lesku
Figure S1: Spectral Output of White Lighting (White) and Amber Lighting (Orange) for (A) Experiment 2 (pigeons) and (B) Experiment 3 (Australian magpies), related to STAR Methods. Light spectra were recorded using a MK350 LED Meter (UPRtek Zhunan, Taiwan) 2 m from the light and are therefore relative.
Table S1: Effects of White Light at Night on Night-Time and Daytime Sleep in Experiment 1, and White and Amber Light at Night an Night-Time Sleep in Experiment 2 in Pigeons, Related to Figures 1-4.

<table>
<thead>
<tr>
<th></th>
<th>NREM sleep</th>
<th>REM sleep</th>
<th>NREM SWA</th>
<th>% REM sleep</th>
<th>NREM bout duration</th>
<th>REM bout duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dfn(^a)</td>
<td>dfd(^b)</td>
<td>F</td>
<td>p</td>
<td>dfd</td>
<td>F</td>
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<td></td>
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<td></td>
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<tr>
<td>Night(^c)</td>
<td>2</td>
<td>64</td>
<td>204.02</td>
<td>&lt;0.001</td>
<td>64</td>
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</tr>
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<td>119.28</td>
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<tr>
<td>Third of night(^d)</td>
<td>2</td>
<td>64</td>
<td>7.16</td>
<td>0.002</td>
<td>64</td>
<td>21.34</td>
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<tr>
<td>Night x third</td>
<td>4</td>
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<tr>
<td>Third of day(^d)</td>
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<td>64</td>
<td>7.16</td>
<td>0.002</td>
<td>64</td>
<td>21.34</td>
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<td>35.14</td>
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<td>64</td>
<td>3.16</td>
<td>0.020</td>
<td>64</td>
<td>2.20</td>
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</tbody>
</table>

Night-time sleep (Experiment 2) | | | | | | | | | | | | |
| Night\(^c\)         | 1          | 77        | 287.58   | <0.001     | 77 | 114.36 | <0.001 | 77 | 80.11 | <0.001 | 77 | 19.14 | <0.001 | 77 | 62.54 | <0.001 |
|                      |            |           |          |            | 77 | 54.25  | <0.001 | |
| Third of night\(^d\) | 2          | 77        | 8.42     | <0.001     | 77 | 23.41  | <0.001 | 77 | 42.26 | <0.001 | 77 | 23.11 | <0.001 | 77 | 10.05 | <0.001 |
|                      |            |           |          |            | 77 | 35.14  | <0.001 | |
| Color of light\(^e\) | 1          | 77        | 3.86     | 0.053      | 77 | 2.80   | 0.098  | 77 | 0.10  | 5.09   | 77 | 0.27  | 1.35   | 77 | 0.25  | 2.88   |
|                      |            |           |          |            | 77 | 1.36   | 0.247  | |
| Night x third        | 2          | 77        | 4.98     | 0.009      | 77 | 1.24   | 0.296  | 77 | 11.28 | <0.001 | 77 | 1.72  | 0.185  | 77 | 6.05  | 0.004  |
|                      |            |           |          |            | 77 | 2.10   | 0.129  | |
| Night x color        | 1          | 77        | 2.41     | 0.125      | 77 | 3.80   | 0.055  | 77 | 5.31  | 0.024  | 77 | 2.41  | 0.124  | 77 | 0.82  | 0.368  |
|                      |            |           |          |            | 77 | 0.76   | 0.387  | |
| Third x color        | 2          | 77        | 0.34     | 0.716      | 77 | 0.12   | 0.886  | 77 | 0.24  | 0.790  | 77 | 0.18  | 0.835  | 77 | 1.40  | 0.252  |
|                      |            |           |          |            | 77 | 0.76   | 0.387  | |
| Night x third x color| 2          | 77        | 0.24     | 0.787      | 77 | 0.80   | 0.455  | 77 | 0.08  | 0.923  | 77 | 0.36  | 0.701  | 77 | 0.62  | 0.539  |
|                      |            |           |          |            | 77 | 0.27   | 0.766  | |

Fitted models are linear mixed effects models with bird identity as a random intercept. Night-time (12 h) and daytime (12 h) sleep were modelled separately. For Experiment 1, night/day (baseline, treatment/post-treatment, or recovery), third of the night/day, and the interaction between night/day and third were included as categorical fixed effects. For Experiment 2, night (baseline or light at night), third of the day/night, light color, and the interactions between these factors were included as categorical fixed effects. Results presented are omnibus tests performed using a type three analysis of variance. Statistically significant results are highlighted in bold.

a dfn is degrees of freedom numerator
b dfd is degrees of freedom denominator. Degrees of freedom were calculated using the Satterthwaite method and can vary depending on the response variable.
c Night is baseline (no artificial light at night), treatment (white light throughout the night) and recovery (night after treatment night; no artificial light at night). Day is the 12 h day after each of these nights (baseline, post-treatment, recovery).
d Third of night/day represents a 4 h period of the night/day
After determining that there were significant effects of light at night on pigeon sleep, as well as time of day/night (Experiment 1; Table S1), we conducted post-hoc comparisons between each third (4 h) of each night/day and the equivalent baseline period. Df is degrees of freedom; estimate is unstandardized regression coefficient (± standard error). To control for the false discovery rate, we adjusted p-values across each experiment using a Benjamini-Hochberg correction [S2, S3]. Significant differences are shown in bold font.

### Table S2: Effect of White Artificial Light at Night on Night-time and Daytime Sleep in Pigeons (Post-Hoc Comparisons), Related to Figures 1 and 2.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Night – Baseline Night</th>
<th>Recovery Night – Baseline Night</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>df Estimate ± SE t-ratio p-value</td>
<td>df Estimate ± SE t-ratio p-value</td>
</tr>
<tr>
<td><strong>Night-time sleep</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NREM sleep</td>
<td>T1 64 -0.97 ± 0.07 -13.52 &lt;0.001</td>
<td>T1 64 -0.20 ± 0.07 -2.75 0.012</td>
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<tr>
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<td>T2 64 -0.75 ± 0.07 -10.54 &lt;0.001</td>
<td>T2 64 -0.20 ± 0.07 -2.79 0.011</td>
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<tr>
<td></td>
<td>T3 64 -0.63 ± 0.07 -8.82 &lt;0.001</td>
<td>T3 64 -0.04 ± 0.07 -0.53 0.631</td>
</tr>
<tr>
<td>REM sleep</td>
<td>T1 64 0.83 ± 0.12 -4.90 &lt;0.001</td>
<td>T1 64 -0.04 ± 0.12 4.80 &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T2 64 1.00 ± 0.12 -6.40 &lt;0.001</td>
<td>T2 64 0.10 ± 0.12 2.85 0.01</td>
</tr>
<tr>
<td></td>
<td>T3 64 0.59 ± 0.12 -5.94 &lt;0.001</td>
<td>T3 64 0.10 ± 0.12 1.22 0.286</td>
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<tr>
<td>NREM SWA</td>
<td>T1 64 -0.08 ± 0.02 -3.54 0.001</td>
<td>T1 64 -0.16 ± 0.02 -6.46 &lt;0.001</td>
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<td>T2 64 -0.20 ± 0.02 -8.48 &lt;0.001</td>
<td>T2 64 -0.14 ± 0.02 -5.91 &lt;0.001</td>
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<tr>
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<td>T3 64 -0.28 ± 0.02 -11.67 &lt;0.001</td>
<td>T3 64 -0.06 ± 0.02 -2.67 0.014</td>
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<tr>
<td>NREM Bout Length</td>
<td>T1 64 -0.61 ± 0.07 -9.20 &lt;0.001</td>
<td>T1 64 -0.49 ± 0.07 -7.36 &lt;0.001</td>
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<tr>
<td></td>
<td>T2 64 -0.31 ± 0.07 -4.66 &lt;0.001</td>
<td>T2 64 -0.31 ± 0.07 -4.65 &lt;0.001</td>
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<tr>
<td></td>
<td>T3 64 -0.43 ± 0.07 -6.52 &lt;0.001</td>
<td>T3 64 -0.14 ± 0.07 -2.06 0.062</td>
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<tr>
<td>REM Bout Length</td>
<td>T1 64 -0.05 ± 0.03 -1.78 0.108</td>
<td>T1 64 0.15 ± 0.03 5.76 &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T2 64 -0.19 ± 0.03 -7.46 &lt;0.001</td>
<td>T2 64 0.11 ± 0.03 4.33 &lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T3 64 -0.16 ± 0.03 -6.19 &lt;0.001</td>
<td>T3 64 0.03 ± 0.03 1.12 0.319</td>
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<td>Percent Sleep REM</td>
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<td>T1 72 0.61 ± 0.11 5.69 &lt;0.001</td>
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<tr>
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<td>T2 72 -0.47 ± 0.11 -4.40 &lt;0.001</td>
<td>T2 72 0.36 ± 0.11 3.32 0.002</td>
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<tr>
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<td>T3 72 -0.39 ± 0.11 -3.63 0.001</td>
<td>T3 72 0.15 ± 0.11 1.38 0.22</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Daytime sleep</th>
<th>Post-treatment Day – Baseline Day</th>
<th>Recovery Day – Baseline Day</th>
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</thead>
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<tr>
<td></td>
<td>df Estimate ± SE t-ratio p-value</td>
<td>df Estimate ± SE t-ratio p-value</td>
</tr>
<tr>
<td>NREM</td>
<td>T1 64 0.38 ± 0.10 3.99 &lt;0.001</td>
<td>T1 64 -0.19 ± 0.10 -1.95 0.076</td>
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<tr>
<td></td>
<td>T2 64 0.36 ± 0.10 3.77 0.001</td>
<td>T2 64 -0.10 ± 0.10 -1.07 0.337</td>
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<tr>
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<td>T3 64 0.11 ± 0.10 1.17 0.303</td>
<td>T3 64 0.00 ± 0.10 -0.05 0.959</td>
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<tr>
<td>REM</td>
<td>T1 64 0.83 ± 0.12 6.83 &lt;0.001</td>
<td>T1 64 -0.04 ± 0.12 -0.29 0.787</td>
</tr>
<tr>
<td></td>
<td>T2 64 1.00 ± 0.12 8.20 &lt;0.001</td>
<td>T2 64 0.10 ± 0.12 0.83 0.472</td>
</tr>
<tr>
<td></td>
<td>T3 64 0.59 ± 0.12 4.88 &lt;0.001</td>
<td>T3 64 0.10 ± 0.12 0.81 0.472</td>
</tr>
<tr>
<td>NREM SWA</td>
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<td>T1 64 0.01 ± 0.03 0.32 0.779</td>
</tr>
<tr>
<td></td>
<td>T2 64 -0.13 ± 0.03 -3.85 0.001</td>
<td>T2 64 0.02 ± 0.03 0.62 0.591</td>
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<tr>
<td></td>
<td>T3 64 -0.08 ± 0.03 -2.44 0.025</td>
<td>T3 64 0.02 ± 0.03 0.57 0.616</td>
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</tbody>
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Table S3: Effects of White and Amber Artificial Light at Night on Night-time Sleep in Pigeons (Post-Hoc Comparisons), Related to Figures 3 and 4.

<table>
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<tr>
<th>Third</th>
<th>df</th>
<th>White: Treatment – Baseline</th>
<th>Amber: Treatment – Baseline</th>
<th>p-value</th>
<th>p-value</th>
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<tr>
<td></td>
<td></td>
<td>Estimate ± SE</td>
<td>t-ratio</td>
<td></td>
<td>Estimate ± SE</td>
</tr>
<tr>
<td>NREM</td>
<td>T1</td>
<td>77</td>
<td>-1.00 ± 0.10</td>
<td>-9.61</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>77</td>
<td>-0.71 ± 0.10</td>
<td>-6.85</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>77</td>
<td>-0.65 ± 0.10</td>
<td>-6.21</td>
<td>&lt;0.001</td>
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<tr>
<td></td>
<td>T1</td>
<td>77</td>
<td>-0.65 ± 0.13</td>
<td>-4.81</td>
<td>&lt;0.001</td>
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<td></td>
<td>T2</td>
<td>77</td>
<td>-0.72 ± 0.13</td>
<td>-5.32</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>77</td>
<td>-0.72 ± 0.13</td>
<td>-5.35</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>NREM SWA</td>
<td>T1</td>
<td>77</td>
<td>-0.11 ± 0.04</td>
<td>-2.64</td>
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<td>T2</td>
<td>77</td>
<td>-0.17 ± 0.04</td>
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<td>NREM Bout Length</td>
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<td>T2</td>
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<td>-1.69</td>
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<td>T3</td>
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<td>0.008</td>
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<tr>
<td>REM Bout Length</td>
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<td>77</td>
<td>-0.08 ± 0.04</td>
<td>-2.17</td>
<td>0.049</td>
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<tr>
<td></td>
<td>T2</td>
<td>77</td>
<td>-0.17 ± 0.04</td>
<td>-4.62</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>77</td>
<td>-0.12 ± 0.04</td>
<td>-3.29</td>
<td>0.004</td>
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<tr>
<td>Percent Sleep REM</td>
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<td></td>
<td>T2</td>
<td>77</td>
<td>-0.36 ± 0.12</td>
<td>-2.96</td>
<td>0.008</td>
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<tr>
<td></td>
<td>T3</td>
<td>77</td>
<td>-0.34 ± 0.12</td>
<td>-2.73</td>
<td>0.014</td>
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</table>

After determining that there were significant effects of light at night on pigeon sleep, as well as time of night (Experiment 2; Table S1), we conducted post-hoc comparisons between each third (4 h) of each night for each light type and the equivalent baseline period. Df is degrees of freedom; estimate is unstandardized regression co-efficient (± standard error). To control for the false discovery rate, we adjusted p-values across each experiment using a Benjamini-Hochberg correction [S1, S2]. Significant differences are shown in bold font.
Table S4: Effects of White and Amber Artificial Light on Night-time and Daytime Sleep in Magpies (Experiment 3), Related to Figures 3 and 4.

<table>
<thead>
<tr>
<th></th>
<th>NREM sleep</th>
<th>REM sleep</th>
<th>NREM SWA</th>
<th>% REM sleep</th>
<th>NREM bout duration</th>
<th>REM bout duration</th>
</tr>
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<tr>
<td></td>
<td>dfn</td>
<td>dfd</td>
<td>F</td>
<td>p</td>
<td>dfd</td>
<td>F</td>
</tr>
<tr>
<td>Night</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>2.36</td>
<td>0.100</td>
<td>99</td>
<td>49.74</td>
</tr>
<tr>
<td>Third of night</td>
<td>2</td>
<td>100</td>
<td>2.36</td>
<td>0.100</td>
<td>99</td>
<td>49.74</td>
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<td>6.10</td>
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<td>106</td>
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<tr>
<td>Night x third</td>
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<td>100</td>
<td>79.41</td>
<td></td>
<td>99</td>
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<td>0.572</td>
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<td>1.57</td>
<td>0.213</td>
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<td>1.65</td>
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<td>Night x third x color</td>
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<td>0.91</td>
<td>0.461</td>
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</tr>
<tr>
<td>Day</td>
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<td>65</td>
<td>4.33</td>
<td></td>
<td>64</td>
<td>3.21</td>
</tr>
<tr>
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<td>33.50</td>
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<td>64</td>
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</tr>
<tr>
<td>Color of light</td>
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<td>2.60</td>
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<td>69</td>
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<td>1</td>
<td>65</td>
<td>1.98</td>
<td></td>
<td>64</td>
<td>0.14</td>
</tr>
<tr>
<td>Third x color</td>
<td>2</td>
<td>65</td>
<td>0.25</td>
<td></td>
<td>64</td>
<td>0.85</td>
</tr>
<tr>
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<td>65</td>
<td>0.72</td>
<td></td>
<td>64</td>
<td>2.12</td>
</tr>
</tbody>
</table>

Fitted models are Linear mixed effects models with bird identity as a random intercept. Night-time (12 h) and daytime (12 h) sleep were modelled separately, with night (baseline, treatment, recovery), third of the day/night, light color, and the interactions between these factors as categorical fixed effects. Results presented are omnibus tests performed using a type three analysis of variance. Statistically significant results are highlighted in bold.

a dfn is degrees of freedom numerator
b dfd is degrees of freedom denominator. Degrees of freedom were calculated using the Satterthwaite method and can vary depending on the response variable.

Night is baseline (no artificial light at night), treatment (light during the first 4 h of the night), and recovery (night after treatment night; no artificial light at night). Day is the 12 h day after each of these nights (baseline, post-treatment, recovery).

d Third of night/day represents a 4 h period of the night/day
e Color of light was white (blue-rich) or amber (blue-reduced)
### Table S5: Effects of White Artificial Light in the Early Night on Sleep in Night-time and Daytime sleep in Magpies (Post-Hoc Comparisons), Related to Figures 3 and 4.

<table>
<thead>
<tr>
<th>Third</th>
<th>df</th>
<th>Treatment night – Baseline night</th>
<th>Night-time sleep</th>
<th>Recovery night – Baseline night</th>
<th>Daytime sleep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Estimate ± SE</td>
<td>t-ratio</td>
<td>p-value</td>
<td>Estimate ± SE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>100</td>
<td>-1.69 ± 0.16</td>
<td>-10.56</td>
<td><strong>&lt;0.001</strong></td>
<td>-0.39 ± 0.16</td>
</tr>
<tr>
<td>NREM</td>
<td>T2</td>
<td>0.90 ± 0.16</td>
<td>5.63</td>
<td><strong>&lt;0.001</strong></td>
<td>-0.17 ± 0.16</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.55 ± 0.16</td>
<td>3.43</td>
<td><strong>0.006</strong></td>
<td>-0.06 ± 0.16</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-1.16 ± 0.19</td>
<td>-6.02</td>
<td><strong>&lt;0.001</strong></td>
<td>0.26 ± 0.19</td>
</tr>
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<td>REM</td>
<td>T2</td>
<td>-1.18 ± 0.19</td>
<td>-6.11</td>
<td><strong>&lt;0.001</strong></td>
<td>0.12 ± 0.19</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>-0.13 ± 0.19</td>
<td>-0.68</td>
<td>0.812</td>
<td>-0.12 ± 0.19</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-0.29 ± 0.08</td>
<td>-3.68</td>
<td><strong>0.003</strong></td>
<td>-0.13 ± 0.08</td>
</tr>
<tr>
<td>NREM SWA</td>
<td>T2</td>
<td>0.27 ± 0.08</td>
<td>3.52</td>
<td><strong>0.005</strong></td>
<td>-0.13 ± 0.08</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.05 ± 0.08</td>
<td>0.66</td>
<td>0.812</td>
<td>-0.03 ± 0.08</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-1.69 ± 0.20</td>
<td>-8.28</td>
<td><strong>&lt;0.001</strong></td>
<td>-0.41 ± 0.20</td>
</tr>
<tr>
<td>NREM Bout Length</td>
<td>T2</td>
<td>1.32 ± 0.20</td>
<td>6.76</td>
<td><strong>&lt;0.001</strong></td>
<td>-0.11 ± 0.20</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.33 ± 0.20</td>
<td>1.67</td>
<td>0.275</td>
<td>-0.09 ± 0.20</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-0.21 ± 0.07</td>
<td>-2.52</td>
<td>0.061</td>
<td>0.04 ± 0.07</td>
</tr>
<tr>
<td>REM Bout Length</td>
<td>T2</td>
<td>-0.20 ± 0.07</td>
<td>-2.76</td>
<td><strong>0.038</strong></td>
<td>0.04 ± 0.07</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>-0.11 ± 0.07</td>
<td>-1.49</td>
<td>0.346</td>
<td>-0.04 ± 0.07</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-0.61 ± 0.21</td>
<td>-2.92</td>
<td><strong>0.026</strong></td>
<td>0.08 ± 0.21</td>
</tr>
<tr>
<td>Percent Sleep REM</td>
<td>T2</td>
<td>-0.90 ± 0.21</td>
<td>-4.29</td>
<td><strong>&lt;0.001</strong></td>
<td>-0.11 ± 0.21</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>-0.04 ± 0.21</td>
<td>-0.21</td>
<td>0.923</td>
<td>-0.07 ± 0.21</td>
</tr>
</tbody>
</table>

After determining that there were significant effects of light at night on magpie sleep, as well as time of night/day (Experiment 2; Table S4), we conducted post-hoc comparisons between each third (4 h) of each night/day and the equivalent baseline period. To control for the false discovery rate, we adjusted p-values across each experiment using a Benjamini-Hochberg correction [S1, S2]. Df is degrees of freedom; estimate is unstandardized regression co-efficient (± standard error). Significant differences are shown in bold font. *Degrees of freedom differ because one magpie did not sleep during the first third of the treatment night (therefore we had no SWA data for this bird).
After determining that there were significant effects of light at night on magpie sleep, as well as time of night/day (Experiment 2; Table S4), we conducted post-hoc comparisons between each third (4 h) of each night/day and the equivalent baseline period. Df is degrees of freedom; estimate is unstandardized regression co-efficient (± standard error). To control for the false discovery rate, we adjusted p-values across each experiment using a Benjamini-Hochberg correction [S1, S2]. Significant differences are shown in bold font.
Table S7: Comparing Amber and White Artificial Light Treatments on Night-time Sleep in Magpies (Post-Hoc Comparisons), Related to Figures 3 and 4.

<table>
<thead>
<tr>
<th>Third</th>
<th>df</th>
<th>Estimate ± SE</th>
<th>t-ratio</th>
<th>p-value</th>
<th>Estimate ± SE</th>
<th>t-ratio</th>
<th>p-value</th>
<th>Estimate ± SE</th>
<th>t-ratio</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NREM</td>
<td>T1</td>
<td>0.01 ± 0.16</td>
<td>0.05</td>
<td>0.983</td>
<td>0.43 ± 0.16</td>
<td>2.65</td>
<td>0.044</td>
<td>0.37 ± 0.16</td>
<td>2.31</td>
<td>0.089</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>0.04 ± 0.16</td>
<td>0.25</td>
<td>0.191</td>
<td>-0.02 ± 0.16</td>
<td>-0.14</td>
<td>0.952</td>
<td>0.12 ± 0.16</td>
<td>0.76</td>
<td>0.786</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>0.15 ± 0.16</td>
<td>0.94</td>
<td>0.674</td>
<td>0.03 ± 0.16</td>
<td>0.21</td>
<td>0.923</td>
<td>0.12 ± 0.16</td>
<td>0.74</td>
<td>0.790</td>
</tr>
<tr>
<td></td>
<td>T1</td>
<td>-0.19 ± 0.19</td>
<td>-0.96</td>
<td>0.670</td>
<td>0.16 ± 0.19</td>
<td>0.84</td>
<td>0.748</td>
<td>-0.36 ± 0.19</td>
<td>-1.84</td>
<td>0.232</td>
</tr>
<tr>
<td></td>
<td>T2</td>
<td>0.01 ± 0.19</td>
<td>0.06</td>
<td>0.983</td>
<td>0.31 ± 0.19</td>
<td>1.61</td>
<td>0.292</td>
<td>-0.25 ± 0.19</td>
<td>-1.27</td>
<td>0.455</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>-0.36 ± 0.19</td>
<td>-1.82</td>
<td>0.233</td>
<td>-0.09 ± 0.19</td>
<td>-0.48</td>
<td>0.841</td>
<td>-0.33 ± 0.19</td>
<td>-1.70</td>
<td>0.274</td>
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<tr>
<td>NREM SWA</td>
<td>T1</td>
<td>0.00 ± 0.08</td>
<td>0.02</td>
<td>0.988</td>
<td>0.37 ± 0.08</td>
<td>4.69</td>
<td>&lt;0.001</td>
<td>0.08 ± 0.08</td>
<td>1.02</td>
<td>0.621</td>
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<tr>
<td></td>
<td>T2</td>
<td>-0.02 ± 0.08</td>
<td>-0.24</td>
<td>0.920</td>
<td>-0.03 ± 0.08</td>
<td>-0.37</td>
<td>0.880</td>
<td>0.00 ± 0.08</td>
<td>0.90</td>
<td>0.699</td>
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<tr>
<td></td>
<td>T3</td>
<td>0.02 ± 0.08</td>
<td>0.28</td>
<td>0.897</td>
<td>0.10 ± 0.08</td>
<td>1.27</td>
<td>0.455</td>
<td>0.00 ± 0.08</td>
<td>0.04</td>
<td>0.983</td>
</tr>
<tr>
<td>NREM Bout Length</td>
<td>T1</td>
<td>0.09 ± 0.20</td>
<td>0.48</td>
<td>0.841</td>
<td>1.23 ± 0.20</td>
<td>6.01</td>
<td>&lt;0.001</td>
<td>0.27 ± 0.20</td>
<td>1.39</td>
<td>0.402</td>
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<tr>
<td></td>
<td>T2</td>
<td>0.08 ± 0.20</td>
<td>0.40</td>
<td>0.862</td>
<td>-0.36 ± 0.20</td>
<td>-1.85</td>
<td>0.232</td>
<td>0.09 ± 0.20</td>
<td>0.45</td>
<td>0.843</td>
</tr>
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<td>0.09 ± 0.20</td>
<td>0.44</td>
<td>0.843</td>
<td>0.01 ± 0.20</td>
<td>0.04</td>
<td>0.983</td>
<td>0.02 ± 0.20</td>
<td>0.12</td>
<td>0.967</td>
</tr>
<tr>
<td>REM Bout Length</td>
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<td>-0.11 ± 0.07</td>
<td>-1.55</td>
<td>0.317</td>
<td>-0.02 ± 0.07</td>
<td>-0.28</td>
<td>0.897</td>
<td>-0.14 ± 0.07</td>
<td>-1.91</td>
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<tr>
<td></td>
<td>T2</td>
<td>-0.06 ± 0.07</td>
<td>-0.77</td>
<td>0.786</td>
<td>0.02 ± 0.07</td>
<td>0.29</td>
<td>0.897</td>
<td>-0.09 ± 0.07</td>
<td>-1.32</td>
<td>0.438</td>
</tr>
<tr>
<td></td>
<td>T3</td>
<td>-0.17 ± 0.07</td>
<td>-2.37</td>
<td>0.080</td>
<td>-0.07 ± 0.07</td>
<td>-0.93</td>
<td>0.674</td>
<td>-0.18 ± 0.07</td>
<td>-2.51</td>
<td>0.061</td>
</tr>
</tbody>
</table>

After determining that there were significant effects of light at night on magpie sleep, as well as time of night/day (Experiment 2; Table S4), we conducted post-hoc comparisons between each third (4 h) of each night/day and the equivalent baseline period. Df is degrees of freedom; estimate is unstandardized regression co-efficient (± standard error). To control for the false discovery rate, we adjusted p-values across each experiment using a Benjamini-Hochberg correction [S1, S2]. Significant differences are shown in bold font.
SUPPLEMENTAL REFERENCES
