**Web Appendix**

*Flow acceleration following larval trajectory*

The following section presents the derivation of , the flow acceleration following the path of a swimming larva. Suppose a larva swims with velocity in a flow field having velocity . We first calculate the total observed acceleration experienced by the larva, in terms of contributions from larval swimming and from the flow. In this scenario,

is the observed velocity of the larva at time and position . At the initial position and time , the larva has an observed velocity of

At time , the larva has an observed velocity of

where To obtain the total observed acceleration ,

Because we want to consider solely the component of acceleration that the larva feels due to the flow, we drop the swimming velocity derivative to obtain the flow acceleration at the larval position:

*Statistical analysis of non-acceleration turbulence fields as larval dive triggers*

The following tables document the results of the statistical analyses (modified *t* test and Wilcoxon rank sum test) comparing the means and medians (respectively) of the distributions and , for a set of mean hydromechanical parameters . The normally distributed mean and (horizontal and vertical normal strain rates) have the means of their distributions compared in Table A1, while the non-normally distributed fields, , and have their distribution medians compared in Table A2. Mean hydromechanical parameters are computed over the specified temporal interval in the first columns, and results are separated by flow regime.

Table A1: Modified t-test for mean hydromechanical parameters experienced by diving versus non-diving larvae: the comparison of distributions and for mean parameter , where mean is computed over stated temporal window prior to dive onset. The null hypothesis states that while the alternate hypothesis states that they differ. Degrees of freedom are df = 150 for no turbulence, and df = 104 for low turbulence. Significance level is , with significant results in bold.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time interval prior to dive onset (s) | Field | sd | *t* | 95% CI on | p-value |
| Unforced Regime | | | | | |
| 0.33 | Horizontal normal strain rate | 0.06 | 1.75 | [-0.002,0.03] | 0.08 |
| 0.66 | 0.05 | 1.46 | [-0.004,0.03] | 0.14 |
| 1.00 | 0.06 | 1.78 | [-0.001,0.03] | 0.07 |
| 1.33 | 0.05 | 1.68 | [-0.002,0.03] | 0.09 |
| 1.66 | 0.06 | 1.22 | [-0.007, 0.03] | 0.22 |
| 2.00 | 0.05 | 2.20 | [0.002,0.03] | **0.02** |
| 2.33 | 0.06 | 1.63 | [-0.003,0.03] | 0.10 |
| 2.66 | 0.05 | 0.56 | [-0.01,0.02] | 0.57 |
| 3.00 | 0.06 | 1.75 | [-0.002,0.03] | 0.08 |
|  |  |  |  |  |  |
| 0.33 | Vertical normal strain rate | 0.05 | 1.10 | [-0.007,0.02] | 0.27 |
| 0.66 | 0.05 | 0.84 | [-0.01,0.02] | 0.40 |
| 1.00 | 0.05 | 1.34 | [-0.005,0.02] | 0.18 |
| 1.33 | 0.04 | 1.17 | [-0.006,0.02] | 0.24 |
| 1.66 | 0.04 | 0.20 | [-0.01,0.01] | 0.83 |
| 2.00 | 0.04 | 1.65 | [-0.002,0.02] | 0.09 |
| 2.33 | 0.04 | 1.27 | [-0.005,0.02] | 0.20 |
| 2.66 | 0.04 | 0.88 | [-0.007,0.01] | 0.37 |
| 3.00 | 0.04 | 1.26 | [-0.005,0.02] | 0.20 |
| Forced Regime | | | | | |
| 0.33 | Horizontal normal strain rate | 0.09 | -1.33 | [-0.06,0.01] | 0.18 |
| 0.66 | 0.10 | -0.92 | [-0.05,0.2] | 0.35 |
| 1.00 | 0.10 | -0.99 | [-0.06,0.01] | 0.32 |
| 1.33 | 0.10 | -1.28 | [-0.06,0.01] | 0.20 |
| 1.66 | 0.10 | -1.32 | [-0.06,0.01] | 0.18 |
| 2.00 | 0.09 | -0.80 | [-0.05,0.02] | 0.42 |
| 2.33 | 0.09 | -1.92 | [-0.07,0.001] | 0.06 |
| 2.66 | 0.09 | -1.13 | [-0.05,0.01] | 0.25 |
| 3.00 | 0.10 | -0.68 | [-0.05,0.02] | 0.49 |
|  | | | | | |
| 0.33 | Vertical normal strain rate | 0.10 | -0.89 | [-0.05,0.02] | 0.37 |
| 0.66 | 0.12 | 0.32 | [-0.03,0.05] | 0.78 |
| 1.00 | 0.11 | -0.33 | [-0.05,0.03] | 0.73 |
| 1.33 | 0.11 | -1.31 | [-0.07,0.01] | 0.19 |
| 1.66 | 0.11 | -1.05 | [-0.06,0.02] | 0.29 |
| 2.00 | 0.10 | -0.40 | [-0.05,0.03] | 0.68 |
| 2.33 | 0.11 | -1.67 | [-0.07,0.006] | 0.09 |
| 2.66 | 0.10 | 0.39 | [-0.03,0.04] | 0.69 |
| 3.00 | 0.11 | -0.74 | [-0.05,0.02] | 0.45 |

Table A2: Wilcoxon rank sum test comparing medians of mean hydromechanical parameters experienced by diving versus non-diving larvae: the comparison of distributions and for mean parameter , where mean is computed over stated temporal window prior to dive onset. . The null hypothesis states that medians while the alternate hypothesis states that they differ.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time interval prior to dive onset (s) | Field | Rank sum | *z* | p-value |
| Unforced Regime | | | | |
| 0.33 | Vorticity magnitude | 5968 | 0.56 | 0.57 |
| 0.66 | 5716 | -0.35 | 0.71 |
| 1.00 | 6126 | 1.14 | 0.25 |
| 1.33 | 6024 | 0.77 | 0.44 |
| 1.66 | 5951 | 0.50 | 0.61 |
| 2.00 | 5983 | 0.62 | 0.53 |
| 2.33 | 5867 | 0.19 | 0.84 |
| 2.66 | 5799 | -0.05 | 0.95 |
| 3.00 | 5982 | 0.61 | 0.53 |
|  |  |  |  |  |
| 0.33 | Shear strain rate magnitude | 5647 | -0.61 | 0.53 |
| 0.66 | 5745 | -0.25 | 0.80 |
| 1.00 | 6050 | 0.86 | 0.38 |
| 1.33 | 5764 | -0.18 | 0.85 |
| 1.66 | 5825 | 0.03 | 0.96 |
| 2.00 | 5508 | -1.12 | 0.26 |
| 2.33 | 5827 | 0.04 | 0.96 |
| 2.66 | 5750 | -0.23 | 0.81 |
| 3.00 | 6025 | 0.77 | 0.43 |
|  | Angular acceleration magnitude |  |  |  |
| 0.33 | 5415 | 1.20 | 0.23 |
| 0.66 | 5455 | 1.36 | 0.17 |
| 1.00 | 5431 | 1.27 | 0.20 |
| 1.33 | 5438 | 1.29 | 0.19 |
| 1.66 | 5328 | 0.86 | 0.38 |
| 2.00 | 5340 | 0.90 | 0.36 |
| 2.33 | 5299 | 0.74 | 0.46 |
| 2.66 | 5188 | 0.30 | 0.76 |
| 3.00 | 5083 | -0.10 | 0.91 |
| Forced Regime | | | | |
| 0.33 | Vorticity magnitude | 2940 | 0.65 | 0.51 |
| 0.66 | 3004 | 1.06 | 0.28 |
| 1.00 | 2940 | 0.65 | 0.51 |
| 1.33 | 2838 | 0.01 | 0.98 |
| 1.66 | 2954 | 0.74 | 0.45 |
| 2.00 | 2954 | 0.74 | 0.45 |
| 2.33 | 2930 | 0.59 | 0.55 |
| 2.66 | 2805 | -0.18 | 0.84 |
| 3.00 | 2917 | 0.51 | 0.60 |
|  |  |  |  |  |
| 0.33 | Shear strain rate magnitude | 2983 | 0.92 | 0.35 |
| 0.66 | 3080 | 1.54 | 0.12 |
| 1.00 | 2978 | 0.89 | 0.36 |
| 1.33 | 2988 | 0.96 | 0.33 |
| 1.66 | 3082 | 1.55 | 0.12 |
| 2.00 | 3189 | 2.23 | **0.02** |
| 2.33 | 2961 | 0.78 | 0.42 |
| 2.66 | 3105 | 1.69 | 0.08 |
| 3.00 | 2876 | 0.25 | 0.80 |
|  |  |  |  |  |
| 0.33 | Angular acceleration magnitude | 2401 | 1.41 | 0.15 |
| 0.66 | 2299 | 0.67 | 0.49 |
| 1.00 | 2337 | 0.95 | 0.34 |
| 1.33 | 2309 | 0.75 | 0.45 |
| 1.66 | 2352 | 1.05 | 0.28 |
| 2.00 | 2333 | 0.92 | 0.36 |
| 2.33 | 2365 | 1.15 | 0.24 |
| 2.66 | 2353 | 1.06 | 0.28 |
| 3.00 | 2305 | 0.71 | 0.47 |