

**Supplementary material**





9 **Figure A2.** Relationship of wingbeat frequency (A), swimming speed (B) and Strouhal number  
10 (C) with current depth. Swimming speed and wingbeat frequency for each class of current depth  
11 was calculated based on individual mean values (n=11 for 5-10 m, 10-20 m, and 20-30m, n=9  
12 for 30-40 m, n=8 for 40-50 m, and n=2 for 50-60 m). Circle indicate mean value, and error bar  
13 shows s.d. Strouhal number was calculated based on mean wingbeat frequency and swimming  
14 speed for each class of current depth, and assuming the constant wingbeat amplitude (0.18 m).  
15 The gray zone indicates the range of Strouhal numbers for high propulsive efficiency.  
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