


生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	空中衝浪的鳥兒 (Birds That Surf the Air)
生物系統 LIVING SYSTEM	鵜鶘 (<i>Pelicanidae</i>)
功能類別 FUNCTIONS	#藉由氣體移動 #Move in/Through Gases
作用機制標題	當鵜鶘的翅膀靠緊水面，他會利用「翼地效應」將升力最大化，並最小化阻力，以節省能量 (When pelicans wings glide close to water, the use “ground effect” to maximize lift, minimize drag, and conserve energy.)
生物系統/作用機制示意圖 (確認版權、註明出處； 畫質)	 <p>https://upload.wikimedia.org/wikipedia/commons/7/7d/Brown_pelican_skimming_(22302896274).jpg</p>
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>鵜鶘、黑剪嘴鷗和其他鳥類在滑行於水面上時會藉由「翼地效應 (“ground effect”)」提高升力，減少阻力，以儲存能量。</p> <p>當鳥在滑行時，牠會將他的雙翅向外伸展乘風飛翔，把拍打翅膀的能量節省起來。在這種「固定翅」的飛行模式下，有一部分的空氣將會像翅膀的下方流過，導致鳥向上浮。除此之外，翅膀的弧度也會造成在上方的空氣形成更快的氣流，此股更快的氣流會形成較小的壓力，進而產生升力。在靠近翅膀外緣處，在下方的高氣壓會向上推動在上方的低氣壓，產生漩渦。下洗氣流和漩渦都會增加阻力，增加保持在空氣中所需要的能量。當鳥類在水面上飛時，這些相關的力將會有所改變。因為現在能提供給下洗氣流擴散的空間變少了，壓縮到了翅膀跟表面形成緩衝，讓他有更大的壓力去增加升力。同時能給漩渦的空間也變少，阻力也跟著減少。</p>	

<p>Pelicans, skimmers, and other birds save energy when gliding across water because of something called the “ground effect,” which increases lift and reduces drag.</p> <p>When a bird glides, it stretches its wings outward and rides the wind, saving the energy it would otherwise use to flap. In this “fixed-wing” mode of flight, some of the air that flows under the wing impacts it and washes downward, pushing the wing (and bird) upward. In addition, the curvature of the wing causes the air above it to move faster and drop in pressure, also contributing to the lift. Near the tips of the wings, the higher-pressure air below is able to push up into the region of lower pressure above and create swirling vortices. Both downwash and the vortices increase drag, adding to the amount of energy required to stay airborne.</p> <p>When birds fly just above the water, the relative effects of these forces change. Because there is less room for downwash to disperse, it compresses the air between the wing and the surface, creating a cushion of even higher pressure that increases lift. There is also less space for vortices to form, decreasing drag.</p>
文獻引用 (REFERENCES)
<p>“Some behavioural adaptations proposed for locomotion involve interference effects among individuals in a group or between individuals and a surface...In black skimmers (<i>Rynchops nigra</i>) ground effect was estimated to reduce induced drag by 50-90%.”</p>
參考文獻清單與連結 (REFERENCE LIST) Harvard 或 APA 格式
<p>Hainsworth, F. Reed. (1988). Induced drag savings from ground effect and formation flight in brown pelicans. <i>Journal of Experimental Biology</i>.</p>
延伸閱讀: Harvard 或 APA 格式 (取自 AskNature 原文；若為翻譯者補充，請註明)
生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)
撰寫/翻譯/編修者與日期
周毓珉翻譯 (2024/03/27)；許秋容編修 (2024/05/17)；陳柏宇編修 (2024/11/30)
AskNature 原文連結
https://asknature.org/strategy/birds-surf-air/

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