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Aerodynamic effect of alula in avian flight¹ SANG-IM LEE, JAE-MYOUNG LEE, HYUNGMIN PARK, PIOTR JABLONSKI, HAECHEON CHOI, Seoul National University — Alula is a small structure located at the joint between handwing and armwing of birds and has been suggested to function as a leading-edge slot. In this study, we investigated the functional aspect of alula in bird flight with experimental conditions that reflect the flow characteristics used by birds in their actual flight using magpies as the model species. The presence of alula enabled the bird to perform steeper descending flights with greater lateral angle changes. Force measurements showed that alula presence increased the lift when the angle of attack was high (higher than 20-45 deg), which resulted in the stall delay by 5 deg. The wake width was significantly thinner when alula was present, suggesting that boundary layer separation is delayed when alula is used. This result was corroborated by PIV; accelerated streamwise velocity over the wing surface was recovered faster and separation point was pushed downstream when alula was present. To conclude, the lift enhancement and stall delay by alula are closely related to the downstream movement of separation point and faster recovery of accelerated flow over the wing surface, which endows greater flight maneuverability to the birds.

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