Supplement 1

For wing area, at least two photographs were taken of each fully-extended wing (*i.e.* wings stretched until leading edge was ~180°). In rare situations where feathers on one wing were not in good condition, we calculated wing area by using only one wing and assumed the wings were symmetrical (Pennycuick 2008). Pictures of the wings were taken over-top with the outstretched wing set over a sheet of graph paper (with 6 mm x 6 mm cells) or a ruler as a scale. We calculated wing area following the methods outlined in Pennycuick (2008). We first measured the distance from the leading edge of the wing to the tip of the longest secondary feather (root width) and the distance from the midline of the body to the insertion of the wing onto the body (root length). We then multiplied the root width and root length to obtain the "body box" (*i.e.* the area between the insertion point of a wing and the midline of the body; Pennycuick 2008). In most pictures, the actual root length could not be calculated due to the midline of the body being out of focus/view, so we instead measured the full length of one wing (from the tip of the longest feather to the point where it inserts onto the body) in ImageJ® and subtracted this value from half of the wing span (equivalent to the full length of one wing plus the root length) to estimate the root length. We then multiplied the root width by the root length to obtain the body box (cm^2). We made an outline around the wing outside the body box (termed partial-wing) in ImageJ® to obtain the shape of the partial-wing and calculated the area of this shape to obtain the partial-wing area. The partial-wing area included the spaces between feathers, as we were interested in the total area of the shape when the wing was fully extended. In instances where the wing was not fully extended, we would estimate the leading edge of the wing by projecting a line originating from the bend of the wing (perpendicular to the width of the wing) with the same length as the distance from the same origin as the projected line to the tip of

the outermost primary feather, create an outline of the partial-wing using the newly projected leading edge, then calculate the area of this outline (Fig. S1). We took the sum of the body box and the partial-wing area to obtain the wing area for each wing. This was done for all images taken for the left and right wings.

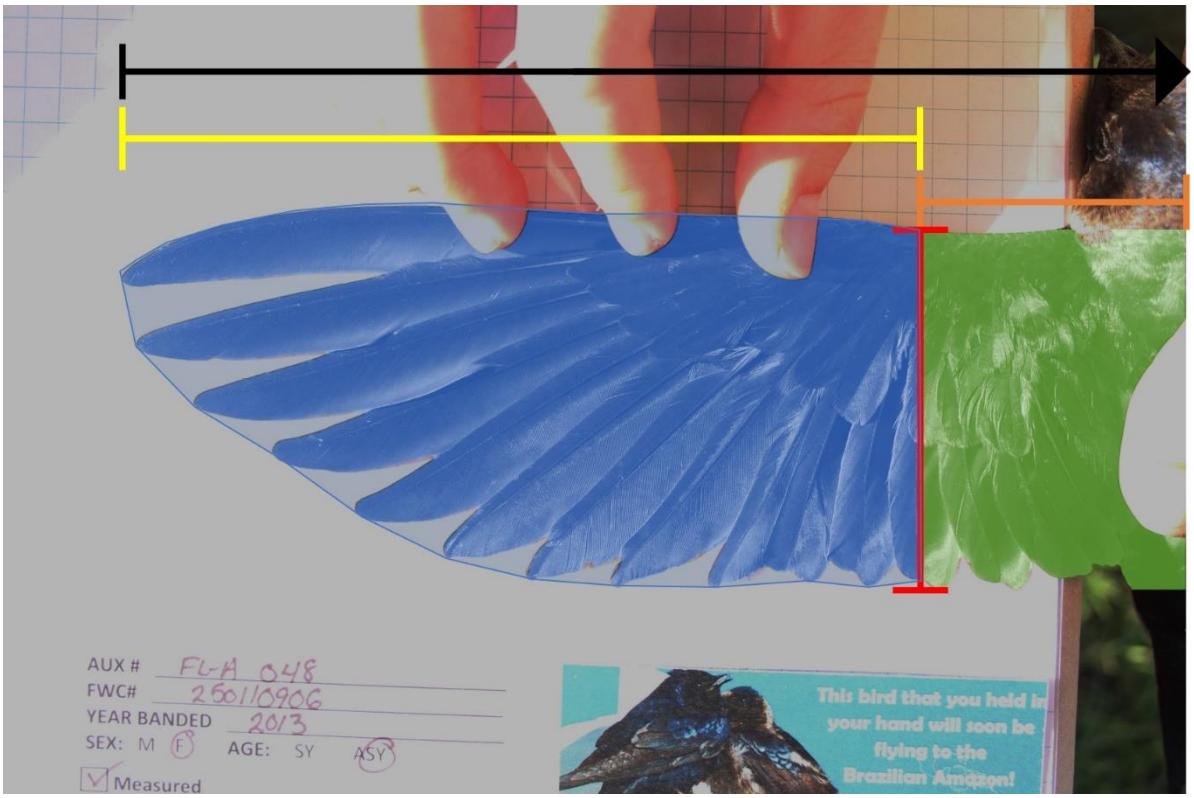

Figure S1. Photograph of the wing area taken for an after-second year, female purple martin from Florida, USA. The total wing area for each wing was calculated by taking the sum area of the partial-wing (blue) and the body box (green). The partial-wing area was determined by calculating the area of the partial-wing outline. The spaces between feathers within the outline were included in the calculation of the area. The body box (green) was calculated by multiplying the root width (red line) and the root length (orange line). We modified the calculation of the root length from Pennycuick (2008), by subtracting the length of the partial-wing (yellow line) from the length of half the wingspan (black line); this was done due to the midline of the body being out of focus/view for most pictures. The identity (FWC#) and the year the bird was banded can be seen in the lower half of the picture. A sheet of graph paper can be seen in the background; used as a scale to calculate wing area (each cell on the graph paper is 6mm x 6mm).