

SOARING BIRDS OF MT. EVEREST

by Edward E. Hindman, New York City, USA

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1. Introduction

Mountaineering literature on the Mt. Everest region of the Himalaya mountains of Nepal and Tibet occasionally contains observations of soaring birds. Ullman (1964) reported sightings of the awkward, black "gorak" bird scavenging at Base Camp (17,800 feet elevation, 5400m) on the Khumbu glacier and at advanced based camp (21,300 feet, 6450m) in the nearby West Cwm. Further, Venables (1989) reported sighting brilliant black choughs high-altitude scavengers "dancing in the wind" just below the South Col on the Kangshung (east) face Everest at an elevation of 26,000 feet (7900m). Also, Welty (1975) reported choughs have been seen at 27,155 feet (8230m) on the summit pyramid of Everest.

How did the birds achieve these altitudes? To help answer this question, the author climbed from the Lukla airstrip (9,100 feet, 2760m) to Kala Pattar (18,320 feet, 5550m) near the base of Mt. Everest in November-December, 1992 to observe

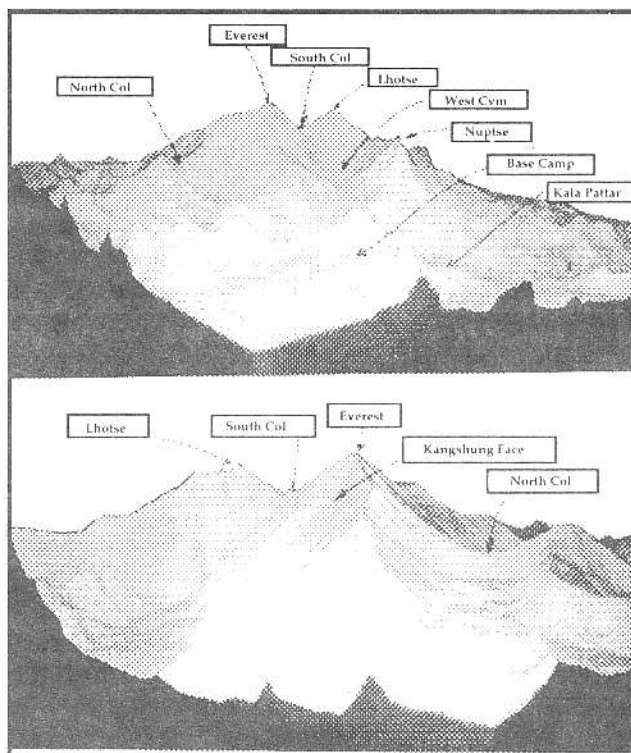


Figure 1. a. The Everest-Lhotse-Nuptse trinity viewed from the west. The locations of bird sightings at Base Camp, West Cwm, Lhotse face and South Col are indicated.

b. Mt. Everest and the Kangshung face viewed from the northeast. The pictures show the model of Mt. Everest which was located in the Boston Museum of Science, Summer 1990. The model was produced from the map of Mt. Everest by Washburn (1988).

the birds first hand.

This paper contains descriptions of soaring birds observed in the Everest region and estimates of the choughs gliding characteristics. It is shown that the birds most likely soared to the extreme altitudes in the airflows caused by Everest. The choughs appear to be the surrogate soaring "pilots" of Everest.

2. Sightings of soaring birds on Everest

Raven (Corvus corax)

The most recorded sightings have occurred at Base Camp (17,600 feet, 5330m) on the Khumbu glacier (Figure 1). Ullman (1964) refers to the awkward, poor flying, black gorak ("crow" in Nepali). Porzak (1991, personal communication) reports seeing the goraks soar and "jump" from thermal to thermal in the vicinity of Base Camp during his successful climb of Everest in the spring of 1990. Uchida (1991) reports Gorakshep (17,500 feet, 5300m) the Sherpa summer village near Base Camp, means "graveyard of crows." Ap-

parently, the gorak cannot live too long at Base Camp and must descend to lower elevations to survive just like the climbers.

Sightings of goraks also have occurred in the West Cwm (see Figure 1). Porzak remembers seeing the goraks at Camp II in the West Cwm (21,350 feet, 6470m) and possibly on the Lhotse face (25,800 feet, 7820m). This observation is consistent with the report by Ullman of sightings of goraks at advance base camp in the Cwm (21,350 feet).

The author observed goraks at all locations along the trek route. The birds were observed to be excellent scavengers but poor at soaring. They could not perform symmetric turns in soaring flight, but frequently flapped and adjusted their wings while circling, unlike the Lammergeier (see below) which appeared to lock its wings and circle like a sailplane.

Chough (Pyrrhocorax)

These birds have been sighted on the Kangshung (east face) (see Figure 1); the most recent face of Everest to be climbed. Venables (1989) reports seeing the chough "dancing in the wind" just below the South Col on the Kangshung face at about 26,000 feet, 7900m (see Figure 2). This report caught the author's attention because the birds were flying in the turbulent wake of the Everest pyramid; an unexpected location for soaring flight or any type of flight.

The chough has been characterized in the literature. Fleming, et al. (1979) have described the flight characteristics of the red-billed chough as very playful and cavorting in the air. A favorite game they observed near Dhaulagiri was for a chough to descend a narrow gully slowly, supported by a strong updraft. Once at the bottom, the bird extended its wings and ascended quickly and waited in turn for the next bird to complete the cycle (it was not mentioned whether the waiting bird perched or hovered).

Likewise, the author observed on the clear morning of November 28, 1992 at 0950 LST a gaggle containing over 100 choughs spiraling in a thermal above the Sherpa village of Dingboche (15,084 feet, 4571m); the flock drifted toward the face of Phokalde (19,160 feet, 5805m) in the upslope flow.

Fisher and Peterson (1977) state, without supporting evidence, that the alpine chough has probably reached the summit of Everest. In all the literature the author has read on Everest, no discussion of the summit has mentioned the appearance of the bird. It is important to document whether a bird has ever been sighted on the summit; the reports by Welty (1975) of choughs at 8230m on Everest indicate the birds have been sighted near the summit which is at an elevation of 8870m.



Figure 2. Aerobic alpine choughs at high elevation at an undisclosed location. The photograph is on the cover of a catalog, Spring 1991 from Coronet Film & Video, 108 Wilmont Rd., Deerfield, IL 60015.

Austin and Singer (1961) identify the alpine chough as the yellow-billed chough. They report that the choughs individually and in flocks perform all sorts of flight evolutions around their cliffs, wheeling and dashing back and forth, climbing high and diving with closed wings, even turning somersaults, all seemingly for the fun of it.

The author observed similar behavior of choughs, also that they were excellent at thermaling and in contrast to the sloppy goraks. Wilcox (1991) presents a photo of a yellow-billed chough perched on a rock at the summit of Kala Pattar. Often they appeared to fly like effective cross-country sailplane pilots.

Because of their high-speed glides and extreme maneuverability, they are the Namche Bazar "fighter pilots."

Steppe eagle (Aquilanipaiensis)

Fleming, et al. (1979) reports a steppe eagle was found dead on the South Col in 1965. The bird is brown and, hence, could not be confused with the black goraks or choughs.

Lammergeier (Gypactus barbatus)

Both Fleming, et al. and Fisher and Peterson report the Lammergeier (bearded vulture) being in the vicinity of Everest at 24,000 feet (7270m); the bird is brown and has a span of up to 9 feet, so it cannot be confused with the gorak and choughs.

The author made numerous sightings of brown soaring birds, most likely either the Lammergeier or the Steppe eagle. At 1030 LST on December 4, a pair of large, brown birds were seen to contact a thermal directly off the end of the Syangboche airstrip and climb slowly (estimated 200 ft/min) circling opposite each other with locked wings just like two disciplined glider pilots. The birds appeared not to "top" the thermal but rolled off, flexed their wings and rapidly glided (penetrated) up the Dudh Kosi valley toward Tengboche.

From this summary, it appears the goraks, choughs, Lammergeier and Steppe eagle are the low-altitude Everest flyers and the choughs the high-altitude flyers. Further, the goraks and choughs appear to be the most frequent fliers of Everest. Venables (1991, personal communication) supports this conclusion.

3. Bird aerodynamics

The updraft strength required for the choughs to soar and, thus, perform their aerial aerobatics can be estimated from the minimum sinking speed (V_{ms}) of the bird. The V_{ms} value is obtained from the bird glide-polar: sinking speed (V_z) versus forward speed (V). Pennycuik (1989) provides the necessary algorithm to calculate bid glide-polars:

$$V_z = DV/mg \quad (1)$$

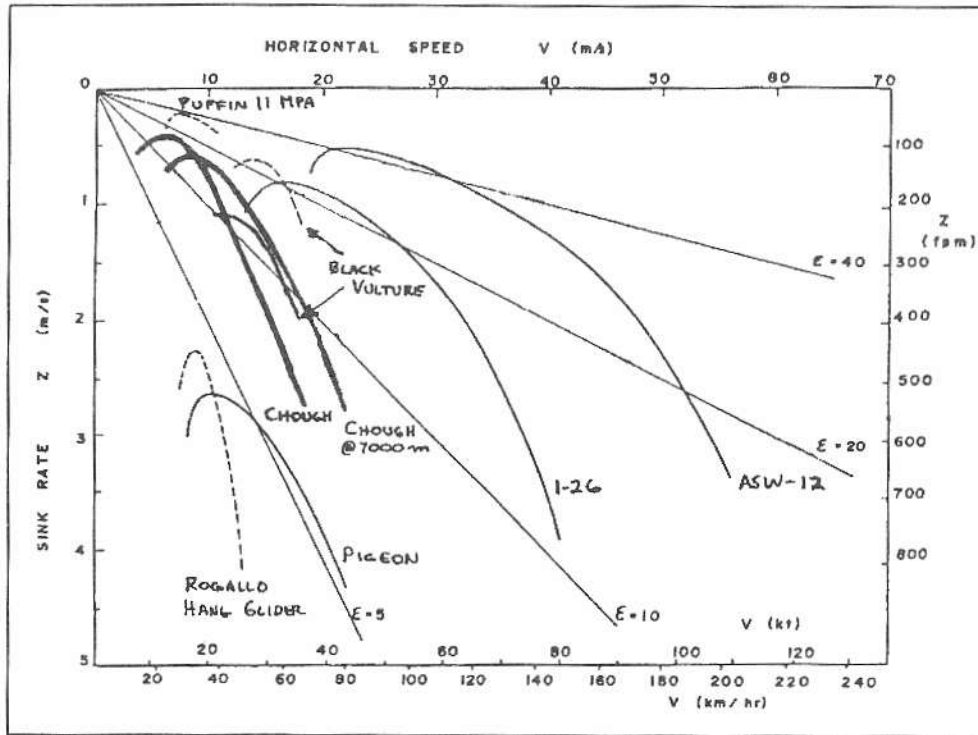


Figure 3. Still-air, sea level glide-polars for several natural and manmade flying devices from McMasters (1974). The various diagonal lines represent L/D (lift/drag) values.

where D is the drag of the bird, m is the mass of the bird and g is the acceleration due to gravity. The drag is expressed as

$$D = D_{par} + D_{ind} + D_{pro} \quad (2)$$

where D_{par} is the parasite drag (drag caused by a bird's body moving through the air, "wetted" area), D_{ind} is the induced drag (drag caused by a bird's wing tip vortices) and D_{pro} is the profile drag (drag caused by a bird's cross-sectional area normal to the path of flight). The D_{par} values are determined from drag coefficients based on cross-sectional area ($0.00813m^{0.666} m^2$ where m is in kg) of 0.25 for birds like geese and swans, 0.40 for small birds and an intermediate value for pigeon-sized birds. The D_{ind} values are determined from using an "induced drag factor" of 1.1 and the fully extended wing span. The D_{pro} values are determined from a profile drag coefficient based on wing area of 0.14. So, to calculate the bird glide-polar from (1), we need the mass, wing span and wing area of the bird.

Fleming, et al. report the head-to-tail measurement for the red-billed chough is 46 cm, 40 cm for the yellow-billed chough and 66 cm for the gorak. From Figure 2, the wing span of the chough appears to be twice the head-to-tail distance or about 0.96m for the red-billed chough. The mass of the red-billed chough was linearly extrapolated from the 0.46 kg mass of a crow (*Corvus corone*) reported by Campbell and Lack (1985) to be (46 cm/66 cm) x 0.46 kg = 0.32 kg. They also report the best-glide speed (V_{bg}) of the crow as 14 m/s, aspect ratio of 6.8 and wing loading of 36.7 N/M². The wing-area of the chough was estimated from Figure 2 span (0.96m) times chord (0.15m) times 0.8 (a best-estimate for the area of a rectangle occupied by the wing) or 0.144m². This wing

results in an aspect ratio 6.4 and wing loading of 21.8 N/m² (0.32 kg x 9.81m/s²/0.144m²) all reasonable values.

The above mass, wing span and wing area for the red-billed chough were used with (1) to calculate the glide polar at sea-level and at 7000m altitude. The results are superimposed on glide-polars of other birds and sailplanes compiled by McMasters (1974) in Figure 3. These results illustrate that choughs may have one of the lowest sinking speeds of soaring birds (0.46 m/s at sea-level, 0.66 m/s at 7000m) although they do not approach that of the Puffin man-powered aircraft (0.2 m/s). This exceptionally low sinking speed of the chough may be one explanation for their exceptional soaring skills.

4. Air motions and bird flights

The author estimated air motions in the vicinity of Mt. Everest to determine feasibility of a soaring ascent of the peak in a sailplane (Hindman, 1986). He predicted a strong region of hill-lift in the West Cwm in a west wind. Wick's soaring ascent of the Lhotse face in a Pilatus Porter STOL aircraft (Hindman and Wick, 1990 a,b) verified that a strong region of hill lift can exist in the West Cwm. Further, the typical banner cloud in the wake of Everest indicates strong rising air in that region. The air flows around the Everest massif deduced from these studies and from the author's cloud observations (Hindman, 1993) are illustrated in Figure 4.

The following scenarios are proposed to explain the reported bird sightings in the vicinity of Mt. Everest.

The thermaling flight of the goraks observed by Porzak at Base Camp most likely enables the birds to fly over the treacherous Khumbu icefall into the West Cwm. Once in the Cwm the hill-lift may carry the goraks to advance Base Camp; the strongest region of this lift has carried a Pilatus Porter to above its ceiling on the face of Lhotse.

The report of the dead Steppe eagle at the South Col by Fleming, et al. may be explained by the bird being inadvertently caught in the strong hill-lift on the Lhotse face which forced it to land in the Col to avoid being blown into Tibet; thereafter the bird could not penetrate into the fierce west wind in the "world's highest wind tunnel" (the South Col) and, thus, froze to death.

The choughs reported by Venables and his climbing companions on the Kangshung face just below the South Col most likely blew over from the West Cwm through the South Col; Venables did not see them ascend up the east face far below. If this observation is true, most likely the choughs soared the Lhotse face to reach the Col.

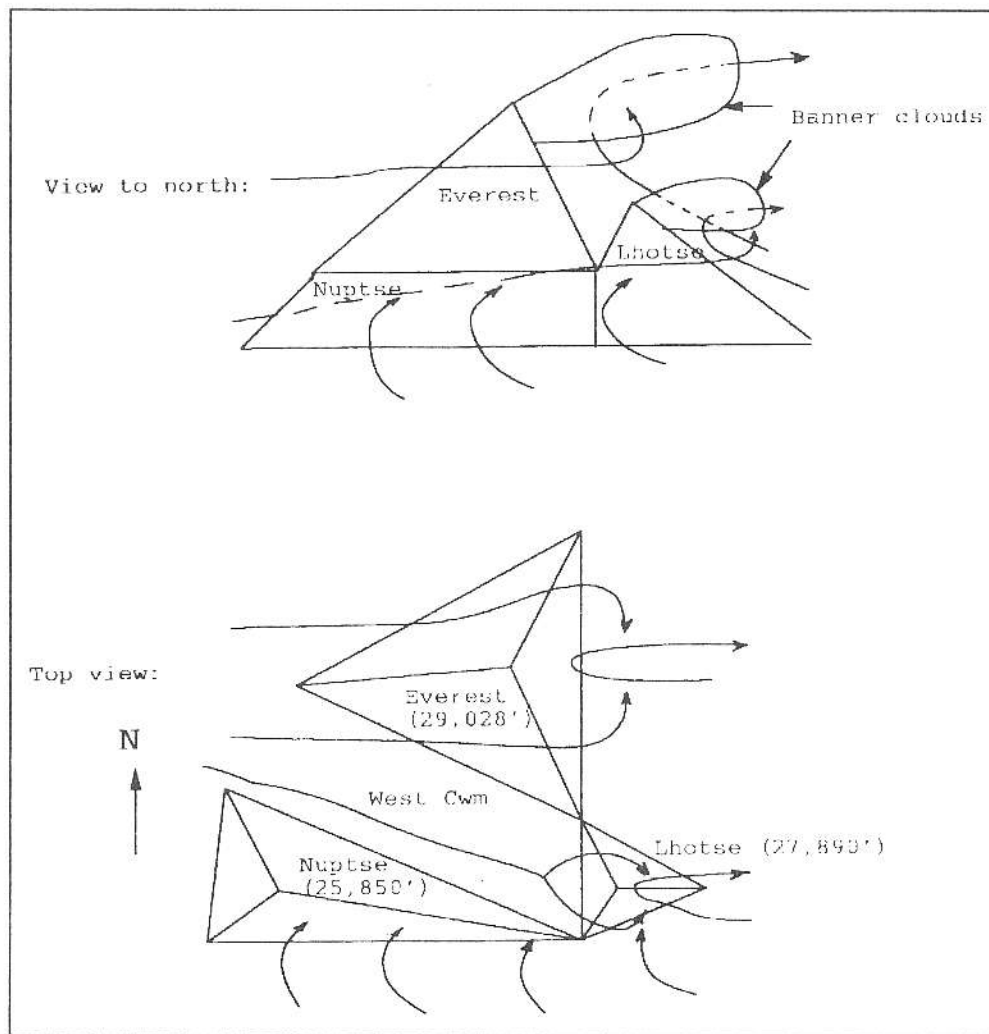


Figure 4. A schematic of the Everest-Lhotse-Nuptse trinity and the air flows deduced by Hindman (1986), Hindman and Wick (1990 a,b) and cloud observations made by the author during November-December, 1992 (Hindman, 1993).

It is tempting to postulate that choughs could soar in the rising air in the wake of the Everest pyramid; this rising air (when moist) forms the banner cloud. If this postulate turns out to be true, the up-draught must be greater than the 0.66 m/s minimum sink speed of the choughs at altitude (see Figure 4). Further, the air must be turbulent in the lee of Everest but the turbulence would have to be sufficiently coherent for the choughs to move from one rising eddy to another and avoid the sinking eddies.

It is assumed the birds cannot fly to these altitudes under their own power; the calculations to verify this crucial assumption have yet to be performed; Pennycuik (1989) may provide the computational framework. Therefore, the birds had to soar to reach the extreme altitudes. This conclusion is reasonable because the locations of the bird sightings in the West Cwm and Kangshung face are in regions of known rising air. The choughs appear to be the "surrogate" soaring pilots of Everest. Careful observations of their flights may reveal possible safe routes to the summit for a skilled sailplane pilot.

5. Conclusions

The highest flying bird on Mt. Everest appears to be the chough, which has been observed "dancing in the wind" (either soaring or performing aerobatics for the observing climbers) just below the south Col at about 26,000 feet and on the summit pyramid at 27,155 feet. The glide-polar of the red-billed chough was estimated. It was found that this bird may have one of the lowest sinking speeds of any soaring bird; a possible explanation for the superior aerobic and soaring skills of this creature.

The bird sightings occurred in regions of known rising air around Everest support the conclusion that the choughs soared to the remarkable heights. The birds are assumed not to be able to fly to these heights under their own power, an assumption requiring supporting observations and calculations.

Other questions remain to be answered. Why do the choughs fly so high? Are they curious about the brightly clad climbers, are they begging for food or do they fly just because the lift is there? Also, since 1952 many climbers have reached the Everest summit by all but the NE ridge route. To the author's

knowledge, no bird sightings have been reported from the summit. It may be impossible for the choughs to ascend to the summit or a sailplane, for that matter.

Nevertheless, other flight activities have taken place at the Everest summit. A paraglider descent from the summit was planned but not executed due to an inability of the pilot to climb to the summit (Dowling, 1991). However, a successful paraglider descent from the summit was reported by Wilcox (1992, personal communication) and by Tourancheau (1992, personal communication); paraglider flights on Everest's lower slopes have been reported by Schellhammer (1992). Finally, hot air balloons have flown over the summit as reported by Dickinson (1992); the flights were reported to be "the ultimate ascent." The ultimate ascent remains to be performed - either by a soaring bird or a soaring human.

6. Acknowledgments

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