HEMATOCRITS AND ERYTHROCYTE NUMBERS FOR COOPER'S AND SHARP-SHINNED HAWKS

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Key words: Packed cell volume (PCV); red blood cell count; accipiter; hematology.

Hematocrits and RBC counts have been used to evaluate the “health” of the oxygen transport system in raptors. Few values of hematocrit and erythrocyte (RBC) numbers have been reported for North American accipiters. Values for Northern Goshawks (Accipiter gentilis) and Cooper's Hawks (A. cooperii) were reported by Elliott et al. (1974) and by Hunter and Powers (1980). Our objective was to provide a larger database of hematocrit values and RBC counts for healthy wild accipiters. The scant information on hematocrit and RBC counts of raptors is mostly from captive, relatively inactive birds at low altitudes. In contrast, the migrating accipiters in this study had been actively flying, probably for several hours each day at relatively high altitudes, prior to being captured. Indirect evidence suggest that healthy, migrating raptors may have significantly different hematocrits and RBC counts than healthy captives. For example, it is well known that living at high altitudes stimulates increased production of RBCs. Secondly, acute dehydration can increase the RBC count without a concomitant increase of red-cell mass; Hart and Berger (1972) speculated from experimental investigations of three avian species (non-raptors) that dehydration occurs in migrating birds.

METHODS
We trapped accipiters on the ridgetop (elev. 2,740 m) of the southern end of the Goshute Mountains, Elko County, Nevada, in September 1983. Once captured, the hawks were immobilized by slipping them into a loose-fitting can or tube where they remained at rest for 20 min to 1 hr before a blood sample was collected. Each bird was placed

1 Received 29 October 1984. Final acceptance 21 August 1985.

| TABLE 1. Hematocrits of Cooper's and Sharp-shinned hawks. Values in the table are means ± SD (n) followed by (ranges) in %.
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| TABLE 2. Red blood cell counts for Cooper's and Sharp-shinned hawks. Values in the table are means ± SD (n) followed by (ranges).
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on its back, and feathers around the elbow of either wing were swabbed with water to expose the brachial vein. This vein was punctured with a lancet, and blood was collected in one or two heparinized capillary tubes and a 10−μl Unopette capillary pipette. The tubes were centrifuged at 16,580 G for 11 min and the PCV measured with a mm ruler. Capillary tubes were centrifuged within 6 hr of drawing the blood. Blood samples were kept at 10° to 15°C between collection and centrifugation. The Unopette capillary pipette was emptied into a previously opened Unopette reservoir containing 1.99 ml of diluent (Unopette Test 5850/5851; Unopette is a trademark of Becton, Dickin- 
son and Co., Rutherford, NJ 07070). Erythrocyte numbers were determined with a hemocytometer from 2 to 3 samples of this mixture. Mean hematological values were compared by means of Student’s t-tests.

RESULTS AND DISCUSSION
The mean hematocrits of Cooper’s Hawks (49.2%) and Sharp-shinned Hawks (49.5%) were not significantly different (Table 1). For both species, hematocrits did not differ between the sexes or between immatures and adults.

Hunter and Powers (1980) reported a hematocrit of 45.0% for one Cooper’s Hawk and 52.8 ± 3.2% for two Goshawks of unknown sex. Seal (cited in Elliott et al. 1974) measured an average hematocrit of 43.3% for four captive Goshawks of unknown sex and age.

Erythrocyte counts of Cooper’s (3.74 × 10^6/mm^3) and Sharp-shinned Hawks (3.39 × 10^6/mm^3) were not significantly different (Table 2). The counts for immatures did not differ significantly from those of adults, nor did males differ significantly from females for either species. Campbell and Dein (1984) indicate that in general the number of RBCs and hematocrit increase with age and are higher in male than female birds. Although our data on accipiters contain no statistically significant differences, they are consis-
tent with this trend. Hematocrits and RBC counts in the literature are too few to make any meaningful comparisons between captive raptors and our sample of free-
living raptors.

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CLUTCH OVERLAP IN AMERICAN COOTS

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Key words: Clutch overlap; reproduction; clutch size; 
pARENTAL care; Coots.

It is unusual for parents to begin a second clutch while 
their first brood is still dependent upon them for parental 
care. However, by overlapping two clutches, which to-
ether may be more than a pair could rear as a single 
clutch during the most demanding investment period, par-
ents may overcome the constraints that clutch size main-
tains over the total number of offspring produced (Burley 
1980). Thus, in three reported cases of clutch overlap 
(Siegfried and Frost 1975, Burley 1980, Hays 1984), the 
period of simultaneous investment in two broods occurred 
during the least demanding phase of offspring develop-
ment for the first clutch. The length of the breeding season 
relative to the developmental rate of the young may be an 
additional constraint which prevents parents from rear-
ing two broods unless they overlap successive clutches. 
Accordingly, clutch overlap in Common Terns (Sterna hi-
rundo) occurred only among pairs breeding early in the 
season (Wiggins et al. 1984).

The general success of overlapping clutches remains to 
be determined, and an examination of this uncommon 
behavior may suggest specific factors which constrain par-
ents from rearing more young. During a four-year study 
of the American Coot (Fulica americana), I noted seven 
cases in which pairs overlapped two clutches and attempt-
ed to rear both broods. The period of overlap was greater 
than that reported for any other birds. I discuss here the 
characteristics of clutch overlap in coots and the potential 
environmental factors and parental investment patterns 
which influence this reproductive behavior.

I studied the breeding biology of coots along the north-
wester shore of Lake Washington (LW), Seattle, Wash-
ington during 1980 and 1983 and at the Turnbull National Wild-
life Refuge (TNWR), Spokane County, Washington, dur-
ing 1981 and 1982. Coots from these areas typically rear 
one brood per season. Nests were located by wading or 
canoeing through the marshes and were checked daily. 
After eggs were laid, I numbered them with a waterproof 
marker. All eggs were weighed with a Pesola 50-g scale to 
the nearest 0.1 g and measured with vernier calipers. U.S. 
Fish and Wildlife aluminum leg bands and individually 
color-coded wing tags or neck collars were placed on adult 
birds caught at night with nest traps (Crawford 1977).