

FOOTPRINTING OF RAPTORS FOR IDENTIFICATION

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ABSTRACT - The feet of 15 Peregrine Falcons (*Falco peregrinus*) and 25 Red-tailed Hawks (*Buteo jamaicensis*) were photographed for evaluation of the dorsal scale patterns of their toes. Visual analysis of the middle toes (digit #3) showed recognizable scale pattern differences between toes from individual birds as well as for all related and unrelated birds. Scale patterns remained unchanged for birds that were available in successive years. It is suggested that the toe scale pattern is unique for any Peregrine Falcon or Red-tailed Hawk and could be used for permanent individual identification.

Methods of differentiating individuals within certain species, including man, have been explored and used for many decades. Artificial markers consisting of either bands, tags, tattoos or hot or cold brands are used to identify individuals when readily identifiable and unalterable natural markers do not exist. However, there are a few species in which each individual has unique, unchanging markings which can be recorded and used effectively for purposes of identification. The most notable example is the use of fingerprinting in humans. Other examples where unique markers have been used for individual identification are the stripe patterns of zebras, the reticulation on the pelage of giraffes, the noseprints on bovine animals, or the dorsal fin shapes and spots on killer whales.

Most birds have scale patterns on their feet and legs, but there is no evidence that the scale pattern of any species has ever been analyzed for the purpose of developing an identification system. The foot scale patterns of Peregrine Falcons (*Falco peregrinus*) and Red-tailed Hawks (*Buteo jamaicensis*) were characterized to determine their usefulness in individual identification.

MATERIALS AND METHODS

Individual birds representing 2 raptor species were chosen for photographic evaluation of the scale pattern of the dorsal aspects of their toes. Birds included in the study were 15 Peregrine Falcons and 25 Red-tailed Hawks. Several were siblings and three were compared in successive years.

Feet were placed so that the entire dorsal aspect of the 3 forward pointing toes (digits # 2,3,4) could be photographed with a close-up lens. Black and white prints (5"x7") were developed and the scale patterns of the toes of all birds were visually analyzed. Only the middle toes (#3) were considered in this study. For evaluation and comparison among individuals, scales of corresponding areas on each toe were characterized according to size, arrangement of scales in relation to adjacent scales, and network of interscale spaces. For convenience of comparison, the area occupied by the dorsal scale(s) closest to the talon was designated as row 1L3 (scale row 1, left foot, digit #3) for the first scale of the middle toe of the left foot and 1R3 for the right foot. Subsequent scales were designated 2L3, 2R3, etc. depending on how many rows of scales were discernible.

RESULTS

Evaluation of photographs taken of the dorsum of the middle toes of 15 Peregrine Falcons and 25 Red-tailed Hawks clearly showed that the scale patterns of each bird differed from the corresponding scale arrangement of all other birds (Fig. 1-4). The number of scale rows varied between the 2 species studied. The evaluation included comparison of 2 sibling (male) Red-tailed Hawks (Fig. 3) and 4 sibling (3 females, 1 male) Peregrine Falcons (Fig. 1 and 2 showing related females E.S., C.F., L.B.). Comparison between right and left foot of each individual bird further revealed that scale patterns were never identical.

Birds which were available the year following the first evaluation and had completed a full molt of their plumage were re-evaluated and shown to have unchanged scale patterns in 2 successive years (Fig. 1 and 4).

Obvious differences for scale patterns for Peregrine Falcons were frequently noted between rows 6 to 8 and commonly between rows 11 to 18 and beyond. The differences in the scales of rows 1-5 and 9 and 10 were more subtle relating primarily to scale size and the ratio of width to length (Fig. 1 and 2). Readily visible differences of scale patterns for Red-tailed Hawks started at rows 5 or 6 and remained distinct for all following rows (Fig. 3 and 4).

DISCUSSION

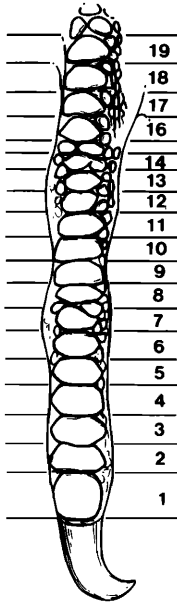
The principal objective of this study was to develop an identification system for Peregrine Falcons. It was important that the system be simple and could be used for identification of individual birds. Red-tailed Hawks were included primarily because they are a common raptor with a prominent foot scale pattern and were readily accessible for study through the raptor rehabilitation facility at Washington State University.

All birds were identified by the use of photography and by visually comparing the scale patterns

Peregrine Falcon

C.F.

Right Foot



Peregrine Falcon

E.S.

Right Foot

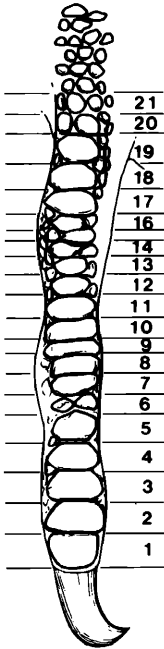
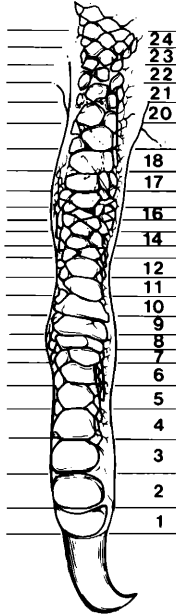


Figure 1.

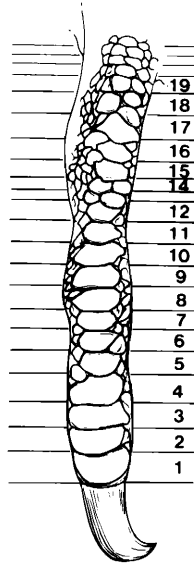
Peregrine Falcons

22555-070

Left Foot



T.E.
Right Foot



L.B.
Right Foot

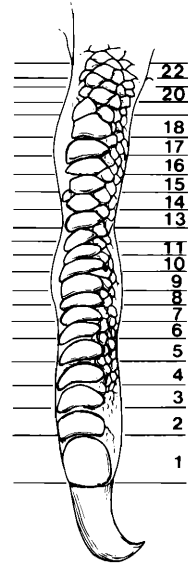
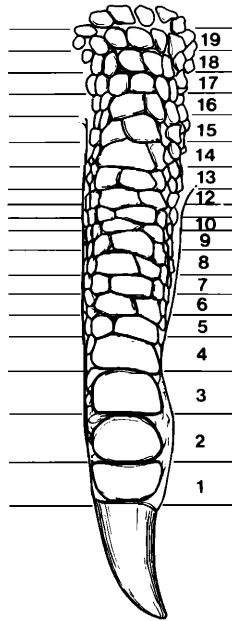


Figure 2.

Red Tailed Hawks

22555-033
Left Foot



22555-034
Left Foot

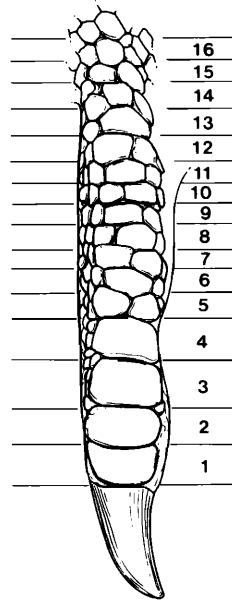


Figure 3.

Red Tailed Hawk 8411-131 Left Foot

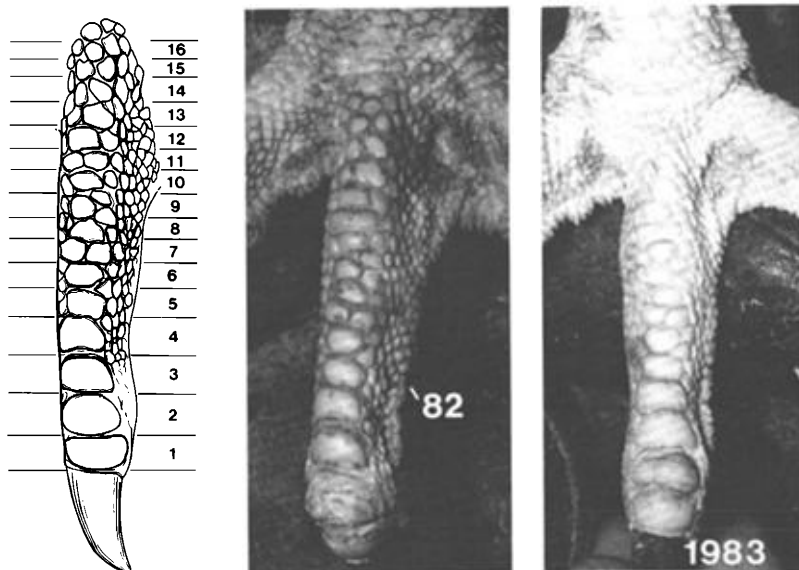


Figure 4.

and shapes of only the middle toe of both feet. In most instances, a mere glance at the scale patterns revealed distinct differences between left and right middle toe of individual birds as well as any 2 birds (including siblings) and these differences remained constant over an extended period.

While it was not difficult to identify birds by photography of the toe scale pattern, it became apparent that magnification of feet and scales was not always uniform since the camera was held at varying distances and angles in the first year of the study. For purposes of this study, measurement of scales was considered unimportant, but scale size and dimensions should certainly be considered in perfecting a reliable identification system. This could be accomplished by making a clay print or by placing the foot on a grid with known dimensions. A study exploring the use of some techniques which will yield a good estimate of the scale size and dimensions is currently underway.

The availability of a reliable identification system for Peregrine Falcons would be of considerable value in light of the status which this bird has occupied in the history of civilization, in general, and in its contemporary management in particular. Proper identification of individual Peregrines held in captivity has been a concern of state and federal

wildlife officials for many years. Illegal substitution of lost or deceased birds by replacement of federal bands or the switching of federal bands on stolen birds has been known to occur but nearly impossible to prove. The system of identification described herein would preclude the substitution of one falcon for another and thereby greatly facilitate the management of Peregrine Falcons held in captivity or other bird species to which the system would be applicable. Regardless of whether analysis of foot scale patterns by photography or another system will prove to be the simplest and most feasible approach to the identification of Peregrine Falcons (and other birds), a "footprinting" system offers great promise to document the uniqueness of a raptor so identified.

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