

UNDERSTANDING RAPTOR FEATHERS:

Functions and Captive Management



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As Wildlife Rehabilitators, the more that we understand about the birds in our care, the better we can help them in their rehabilitation process. This paper will discuss the functions of feathers and how it relates to the wildlife rehabilitation of raptors. Topics covered include: what feathers do, how birds maintain them and how they grow. Next, this paper will discuss what feathers tell you about the bird and captive management of feathers in raptors, including tail sheathing. Raptors have a tendency to damage their feathers while in captivity, generally due to improper management. Understanding feathers and their important roles in the avian world can help wildlife rehabilitators in their captive management.

Functions: What feathers do

Feathers are unique to birds and provide numerous functions. They protect and insulate the body, aid in camouflage, communicate behavior, assist in the recognition of age, sex and species and make flight possible.

Birds are lightweight and have very thin skin under their protective covering of feathers. Feathers are said to be “the strongest (natural) material for their size and weight known.” Feathers also provide the most efficient type of insulation, thus reducing the loss of body heat. This efficiency helps maintain a bird’s normal temperature, typically between 104 and 112 degrees. Smaller birds have higher temperatures than larger birds.

Coloration of feathers assists certain species in camouflage and can also aid in the recognition of sexual maturity. Immature plumage denotes little or no threat to adults. In some species, adults have a seasonal breeding plumage with strikingly colorful designs or feather types announcing sexual readiness. Feathers and their colors help to identify species, not only to humans, but also to other birds, e.g. if the red-wing patch of an adult male Red-winged Blackbird is dyed black, the bird is not socially accepted by other Red-winged Blackbirds.

How birds display their feathers communicates many different things, such as breeding readiness, and passive or aggressive behavior. Non-striated muscles control the raising and lowering of feathers. This is an autonomic (involuntary) system. Some species like egrets raise their aigrette or mating plumes during courtship. Others like Eastern Screech-owls stand erect with their feathers matted down to their body in a defensive “you can’t see me” stance. Hawks will indicate alarm by raising their head feathers, referred to as ‘hackling’.

An important feather function is to help in thermoregulating or controlling body temperatures. Slightly raised body feathers indicates the bird’s body temperature is cool and it is attempting to increase insulation. Ruffling the feathers, also known as rousing, helps in maintaining correct positioning--as the feathers are lowered, they fall properly back into place. This is often done after preening.

How birds maintain feathers

Birds maintain their feathers by bathing and preening. This maintenance plays an important role between molts. A molt is an exchange of worn feathers for new ones and typically occurs annually. Bathing is a maintenance behavior that can be done in dirt or water. Dirt or dust bathing is not a substitute for water bathing. It is believed to help reduce parasites, dander, oil and moisture in the plumage. Sun bathing is done to maintain body temperature and also to help the bird remove parasites. The heat from the sun is thought to deter parasites and bring them to the surface so that they can be removed during preening. Bathing in the sun also provides Vitamin D, as well as drying wet feathers. Some species, such as Barred Owls, will lie flat on the ground with wings outstretched and head tilted upright, almost appearing injured, while sunbathing. Water bathing is done in a number of ways: during rain, in wet leaves after a rain, or in a shallow pool or stream. For birds such as swifts or swallows, diving into a pond provides a refreshing bath. Water baths clean the plumage but, more importantly, also stimulate preening.

“Preening is the basic and most important single act that a bird performs in the care of his feathers.” (Simmons, 1964) Preening is done with the tip and lower mandible of the beak, gripping one feather at a time at its base and working down the entire shaft. This helps to remove oil, dirt, parasites and sheaths from growing feathers. While preening, a bird occasionally rubs its beak on its oil gland, located at the base of the tail. The oil gland secretes a light oily substance when squeezed which is then preened into the structure of the feathers and indirectly maintains their water repellency. The sheath or covering of new feathers is also removed as a bird preens. Some birds, particularly passerines or songbirds, are known to preen with crushed or live ants. “Anting” is related to feather maintenance. It is believed that the chemical properties of ant fluids act as an insecticide to kill or discourage parasites.

How feathers grow

Feathers are keratin (mostly protein) structures grown by papillae in the skin. The hereditary genes in the papillae determine the color and shape of the feathers. Feathers thrust out through follicles in the skin and emerge with a thin-layered covering called the sheath, which is preened off, as the feather grows outward. Follicles play an essential role in feather growth. A damaged follicle can cause a feather to become deformed. When a feather first emerges, it is said to be “pinned.” Pin or blood feathers still have a supply of blood at the base where they leave the skin. The blood supply stops when the feather completes growth, but if the emerging feather is damaged or broken at the base, it will bleed—hence, the name “blood feather.”

The typical feather structure consists of a shaft or rachis, hundreds of barbs and thousands of barbules. Parallel barbs grow from the central shaft. Each barb has hundreds of barbules, which interlock with barbules of the adjacent barb. At the base of each feather are the after-feathers, which are soft, downy barbs where the barbules do not interlock. The shaft stays in the feather follicle until it is pushed out during a molt by new feather growth.

There are many feather types that serve several different functions: contour, semi-plumes, down, filoplumes, powder and bristle feathers. **Contour** feathers cover most of the body and include coverts, primaries, secondaries, and tail feathers. The **semi-plumes** are a cross between the contour and down feathers and actually grow in the same tract as the contour feathers. The **down** feathers are small, soft, and fluffy and, like the semi-plumes, they help in thermal insulation. The **filoplumes** are wispy, hair-like feathers that are always accompanied by other feathers. **Powder** feathers are minute in size and appear as a powdery substance sometimes seen leaving the body when a bird ruffles its feathers. The whisker-like **bristle** feathers are small, stiff, barbless feathers found mostly in the head region.

All feathers wear and must be replaced at the time of molt. Birds molt at least once a year, usually after the breeding season and before migration. Some species may have partial molts twice or even three times a year, especially around the head and neck area. Some species molt partially into or out of breeding plumage. In order to maintain flight during a molt, most birds' wing and tail feathers grow in symmetrically and one or two pairs at a time. This adaptation causes the least disruption to their flight. A few species of birds (i.e. some species of waterfowl) molt flight feathers simultaneously, rendering the bird flightless for a time, usually during incubation. A molt occurs during a time of year when food availability for that species is usually abundant.

What feathers can tell you about the bird

“Feathers make up 4-12% of a bird's body weight.” (Pettigill, 1962) Proper nutrition during the molt is essential since producing healthy feathers consumes a significant amount of a bird's energy. If a bird becomes stressed or lacks nutrients when a new feather is developing in the papillae stage, the nutritional blood is temporarily restricted. As the feather grows out of the skin, a weakened area called a *stress mark* or *fault bar* can be seen perpendicular to the shaft, appearing transparent when held up to the light. This weakened line has more potential to break or split. Broken or damaged feathers can be a handicap and will not be replaced until the bird molts again. The terms “stress mark”/ “fault bar”/ “hunger traces” all refer to this weakness in the feather.

An abnormal or stress molt can occur during the feather growth stage if the stressor is extreme. The feather(s) will literally stop growing since the body shifts into survival mode and must supply blood (energy) to vital organs instead of the developing feathers. Feather growth will resume once and if the stressor is removed. These stress molt feathers are typically pinched off at the base of the quill and do not fall from the follicles immediately. However, they can drop at a rapid rate or simultaneously. New feather growth will push out the stress molt feathers, as long as the feather follicles have not been damaged or closed up on their own. Stressors include starvation, hunger, poor nutrition, illness and injury.

The feather follicle plays an important role in feather growth. When a follicle is damaged by trauma, including surgery, a deformed, stressed feather can occur at that site, even in subsequent molts. Even the act of pulling a feather out manually leaves the follicle unoccupied and may cause it to close up. This closed or damaged follicle can lead to the development of a deformed or ingrown feather, which can result in a serious infection. That is why the manual removal of mature feathers, especially primaries, is not recommended. The only feather that should be pulled out immediately is a broken blood feather since it can cause massive blood loss and even death. It could also leave a permanently damaged follicle. If the entire blood feather is pulled out, the body should soon begin producing a replacement feather.

Feather condition can be an overall indicator of a bird's general health, including nutritional intake. It also provides information about their short-term history (or the events preceding its arrival at a rehabilitation center). Matted feathers can result from an injury or puncture wound; frayed tail feathers can mean the bird has been on the ground for a length of time; and stress-marked feathers can indicate a poor diet history or a pre-existing injury.

Captive Management of Raptor Feathers

Naturally, the physical handling of a raptor can result in disturbance to the feathers. Birds often repair a slight disturbance of plumage by preening, which can be induced by a light misting of water. This misting should be done on birds housed indoors for long periods of time to retain the feathers' water repellency, also called *weatherproofing*. A healthy feather will bead water, which then rolls off, never saturating it. **Exception:** Weak birds should never be misted, since preening requires energy and the dampness could drop the birds' body temperature. Weak birds need to conserve energy for recuperation, leaving feather condition to be addressed in the future when the bird is stable.

Damage to feathers may occur or exist due to external parasites such as mites, lice and flat or pigeon flies, which are commonly found on ill or injured birds. Parasites can be controlled with a prescribed treatment of a suitable parasiticide drug, or an appropriate feather mite spray that your veterinarian recommends. Often these sprays will reduce the water repellency of feathers, so please remember to mist birds lightly with water to encourage preening. Most parasiticide sprays are available in pump spray, which is preferred since aerosol sprays can cause serious irritation if inhaled. Beware of applying spray around a birds' eyes and nares (nostrils). Instead, spray can be misted onto a paper towel, which can be safely wiped over the birds' head in the same direction as the feathers.

Feather damage can also occur during a raptor's recuperation, making proper perching in a kennel essential, when applicable according to injuries. This is for several reasons: comfort and safety of the bird, reduction of feather damage and prevention of foot problems, specifically bumblefoot. **EXCEPTION:** Birds with injuries that require padded bedding (e.g., unstable, weak, convulsive, unable to stand and/or fracture of leg, back or pelvic area) should not be offered a perch until capable of using one. As the bird progressively improves it can be offered a perch and a pad so the bird has a choice.

There are three important considerations in perch selection: height, diameter and texture. A perch should be just high enough off the bottom of the kennel so that the tail clears the floor and low enough so that the bird's head isn't touching the ceiling of the cage. Proper diameter and texture of the perch should reflect the bird's natural perching. For example, falcons sit on cliffs and ledges in the wild, so these species should be housed on flat surfaces; hawks, which perch in trees, should be perched on round branches with rough/grippable texture.

Because of its potential for serious and permanent feather damage, wire caging is not recommended for housing recuperating birds of prey. Raptors, due to their exceptional vision, tend not to see the wire, but look beyond it to 'freedom' (similar to a human looking out a screened window and focusing on the view rather than the screen). Housing in wire cages can cause eye and cere trauma, foot injuries, fractures and serious feather damage. Feathers often split and fray from constant contact with wire, which can result in having to keep a bird for an entire molt before release. This can and should be prevented by proper housing! Kennels with wire doors may be covered on the inside by a cloth or towel for added protection.

Tail sheath: What it is & how to apply one

While a raptor is in indoors or in confined housing, the use of a tail sheath, or protective covering around the tail feathers, can prevent feather breakage by providing support and reducing damage. A tail sheath should be applied to a stable long-tailed raptor, i.e., all hawks, accipiters, falcons, ospreys, eagles, some kites and Barred Owls. Short-tailed raptors, e.g., Eastern Screech-owls, Burrowing Owls, Great Horned Owls and Mississippi Kites, do not require a tail sheath under typical circumstances.

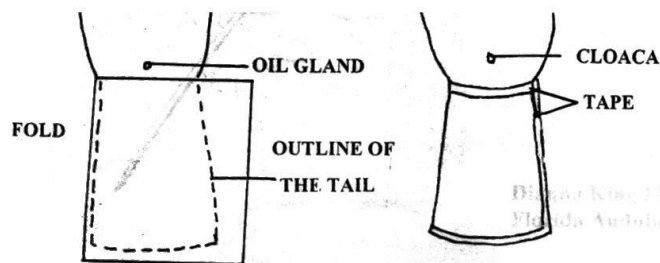
If it is medically appropriate to the bird's condition, a tail sheath should be applied to stable raptors, even if some tail feather damage already exists. This should be done immediately after the initial examination and before the bird is placed in a kennel. **NEVER** apply a tail sheath to a bird that is unstable, weak, unable to stand, convulsive, or has a fracture of the leg, back or pelvic area. A tail sheath should be removed just before a bird is moved to a (slatted wood, not wire) mew or flight cage. If a sheath becomes wet, or is heavily soiled, it may need to be replaced. Care should be used in applying tail sheaths to juvenile raptors with new feather growth.

A tail sheath can be made out of envelopes, manila folders, or unexposed radiograph (x-ray) film. Radiograph film works best due to its firmness and lightweight characteristics, but exposed (used) film can cause staining of the tail if it becomes wet or is applied to wet feathers.

TO APPLY A TAIL SHEATH:

While someone holds the (preferably hooded) bird belly-side outward or upward:

1. Fold sheath along the side of the tail, completely covering the top & bottom of the tail feathers. Locate the cloaca & oil gland, positioning sheath below them.
2. Trace along the outside of the tail with a pen onto the sheath; remove sheath from the tail and trim along the outline. All sharp corners should be rounded.
3. Refit the sheath onto the tail and make any alteration. The sheath should just fit over the tail and under the cloaca and oil gland without any feathers exposed. A reliable general guideline is to position it 1 inch below the base of the feather quill.
4. Tape around the top of the sheath with elastic or medical type tape (avoid masking tape since it is prone to splitting feathers), positioning $\frac{1}{2}$ on the sheath and $\frac{1}{2}$ on the tail covert feathers. Recheck the sheath's position, making sure to **never** cover or enclose the cloaca or oil gland.
5. Tape sheath closed along the cut edges. Place tape $\frac{1}{2}$ on one side, $\frac{1}{2}$ on the other side. The tail should now be completely enclosed in the sheath. Gently tug on the sheath to insure that it is firmly secured. Be sure to consider the length of the tail (with the tail sheath) when selecting a perch for the raptor.



Note: other suggestions to secure the sheath include stapling (which is not recommended due to the potential for feather damage) and Velcro, which is a timesaving alternative to tape, yet can be costly.

IMPING

Imping is feather repair. It is a process of re-attaching a donor feather onto a bird's broken feather by using a small splint inserted into the feather shafts. It is a long tedious task that can be very stressful on a bird. Imping is not as reliable as the bird's healthy feathers. Keeping healthy feathers on a bird while in captivity is always preferred.

Understanding feathers and their functions is an important consideration for rehabilitators in their captive management of raptors. An appropriate natural diet, proper housing, and the use of a tail sheath are the best methods of preventing plumage problems. Prevention of problems related to captivity is critical to the success of raptor rehabilitation.