CAPTIVE BIRD WELFARE AND ENRICHMENT (PART 2)

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FORAGING AS A NATURAL BEHAVIOUR

Self-destructive and stereotypical behaviour problems are prevalent in captive bred birds, especially psittacine species. Some of the most troublesome of these aberrant behaviours are feather picking/destruction and self-mutilation. It has been suggested that 1 in 10 captive parrot species develop psychogenic feather picking behaviour (Meehan, et al., 2003) Similar behaviours termed 'self-injurious behaviour' (SIB) have been recognized and studied in primates and have been compared to those noted in birds (feather damaging behaviour or FDB) (Orosz and Delaney, 2003; Novak 2003).

The author strongly encourages the reader to review those comparisons made by Drs. Orosz and Delaney between SIB in primates and FDB in birds (Orosz and Delaney, 2003). Stereotypies are abnormal repetitive behaviours that most commonly develop in animals kept in enrichment deficient environments and are also described in pet birds (Meehan et al., 2004).

Foraging likely represents a natural behaviour of wild birds and other animals. Foraging is simply the act of searching for and finding food. Based on field studies, it appears that many avian species spend the majority (> 50%) of their daily activity foraging and feeding (Koutsos et al., 2001). As a generalization, parrots actively feed in the morning and the evening (Koutsos et al., 2001). Because foraging occupies a significant portion of a bird's daily activity, it likely has social and behavioral importance. Meehan et al. (2003) has stated that 'foraging is one of the most severely constrained classes of behaviour in captive parrots', which leads one to consider the potential implications of this common behavioral deficit on bird welfare (Meehan, et al., 2003).

Captive orange-winged Amazon parrots (*Amazona amazonica*) monitored remotely using video cameras were noted to demonstrate behaviours associated with grooming (such as 'preen self') primarily in the morning and evening. These birds had 'a complete diet at arm's length' and were noted to ingest food about 3 to 6 minutes per hour throughout the day (for a total of 30-72 minutes per day). The observers noted that for a 'huge amount of time', the birds were 'inactive' (Oviatt and Millam, 1997). This is in contrast to wild parrots that are reported to actively forage for significantly longer times such as the Puerto Rican Amazon parrot (*Amazona vittata*) that spends an average of 4 to 6 hours a day foraging for food (Meehan, et al., 2003).

Numerous studies have been conducted on the behavioral aspects of foraging in wild birds. Foraging behaviour in wild birds represents a trade-off between the risk of predation (while busy searching for food) and the benefit of energy gain (Olsson et al., 2000). This statement suggests that birds must forage optimally in effort to reduce their risks. However this is not to say that a bird will simply eat rapidly, deplete a food source and leave. In fact, one study showed the herbivorous birds (such as the Bewick's swan *Cygnus columbianus bewickii*) allocate twice as much time to foraging as do herbivorous mammals (Van Gils, 2007).

The following examples demonstrate the many different feeding styles of birds. It also highlights the importance of understanding 'species typical behaviour' when devising enrichment plans for select species.

For example, studied wild type fowl demonstrate a costly foraging strategy that entails moving frequently between food patches and ingesting less than similarly evaluated domestic chickens. The wild type fowl would leave a patch of food before it became depleted to seek out another patch. This was interpreted as a survival strategy by the wild type birds (keeping longer distances between food patches, not depleting food so that the bird could find another food source and return if needed and possibly keeping more alert by staying more vigilant and spending less time eating at any one location) (Olsson et al., 2000). In contrast, domestic fowl tend to stay close to and deplete an individual food patch before moving to a new area. This strategy allows for maximum energy retention but relies on some degree of protection to be effective such as an enclosed, protected or monitored farm area.

Mallard ducks (*Anas platyrhynchos*) will deplete food patches in shallow water (even if less food is available) before foraging in deep water (Guillemain et al., 2000). Deep water foragers have their eyes underwater and are presumably at greater risk of predation than those in shallow water that can better observe their above water environment (Guillemain et al., 2000). As expected, the dominant ducks tend to occupy shallow water while subordinates are left to forage deeper water when the feeding area is limited.

Studied wild-caught captive chaffinches (*Fringilla coelebs*) with higher peck rates were considered better foragers and also better detectors of predators simply because the birds had more 'head up' time and were more vigilant (Cresswell et al., 2003) As was noted in the domestic fowl, captive raised chaffinches were less vigilant to potential threats than their wild counterparts. Captive rearing may decrease a bird's natural nervous tendencies and at the same time increase a bird's risk of predation if released into the wild.

Lesser spotted woodpeckers (*Dendrocopos minor*) were noted to feed more in the afternoon than morning and spent less time feeding with greater food availability (Olsson et al., 2000). This study implied that when enough food was present, the woodpeckers resorted to other non-feeding activities (such as nest excavation or sitting idle to reduce their predation risk and energy loss) (Olsson et al., 2000).

Still other avian species use completely different foraging methods that help them adapt to their environment or physical limitations. Many Paridae species (tits and chickadees) gather seeds then hide them in many locations to be later retrieved in lean times. This storing of excess food in the environment rather than as fat is found in multiple animal species and is termed caching (Healy and Hurly, 2004).

Black-capped chickadees (*Parus atricapillus*) and scrub jays (*Aphelocoma coerulescens*) have been shown to remember both where and what food they store with impressive accuracy. Many food storing avian species have a large hippocampal volume with size that increases the longer and more food a bird is capable of storing. These food storing capabilities have been equated with episodic memory, a cognitive feature previously thought to be exclusive to humans (Healy and Hurly, 2004).

Caching foragers have also been shown to remember food sites differently than non-caching species. As a generalization, food-cashing birds prefer spatial cues, while non-caching species use both spatial and object-specific cues to solve memory tests (Sandford and Clayton, 2008). For example, zebra finches (*Taeniopygia guttata*) (non-cacher) have been shown to use either color or a spatial cue to locate food. Zebra finches are nomadic foragers and tend to deplete food patches and move on to another location but may return to check previous locations. Interestingly, zebra finches deprived of food tend to adopt energy saving behaviours as opposed to other species that increase their foraging efforts in times of deprival. In contrast, Clark's nutcracker (*Nucifraga columbiana*) has been shown to recover about 72% of its caches in one field season and tends to use spatial cues (Sandford and Clayton, 2008).

In preparation for migration, hummingbirds prefer to hold territories and limit their foraging bouts to less than a minute in effort to save and store fat while using fast burning carbohydrates (Suarez and Gass, 2002). This is very important for a species with metabolism so high that if it only used liver and muscle glycogen during flight, the bird would literally deplete its energy stores within several minutes (Suarez and Gass, 2002). This may in part explain the sometimes highly aggressive behaviour of hummingbirds around choice flowers and feeders. Dominant hummingbirds are capable of defending and staying in choice spots, thereby saving and storing energy, without constantly flying to multiple feeders and burning precious energy.

Birds may forage differently in the presence of other avian species. In general, vigilance tends to decrease in birds when foraging in flocks. More specifically, the birds in the center of the foraging flock are the least vigilant while those on the periphery are the most vigilant. The belief being that flock foraging decreases predation risk as there are collectively more eyes being vigilant (Dias, 2006; Beauchamp 2007).

Studied starlings (*Sturnus vulgaris*) foraged more slowly when in social, compared to solitary, food patches (Vasquez and Kaceinik, 2000). The starlings were more drawn to food patches with social groups and would hurry their foraging when away from the flock and slow down when close to it (Vasquez and Kaceinik, 2000).

The specialist frugivorous tanager (*Spindalis portoricensis*) tracks fruit abundance by relying on the loud calls of the gregarious and omnivorous tanager (*Nesospingus speculiferus*) to locate new foraging areas. While the omnivorous tanager eats equal parts plant and animal, the specialist eats almost entirely plant material. When in the mixed flock, the frugivorous bird (*S. portoricensis*) will mimic the foraging behaviour of the ominivorous tanager to the point of 'testing' food items not normally in the specialist's diet. This appears to be a commensal relationship between the species (Vasquez and Kaceinik, 2000).

Foraging in wild birds may even play a role in competitive exclusion of some species. When compared to wild lands, urban habitat generally have less species diversity (Shochat et al., 2004). One study tested the hypothesis that some introduced species (such as the European starling [*Sturnus vulgaris*] and house sparrow [*Passer domesticus*]) are more efficient foragers and are able to outcompete less efficient foragers (often native species) in urban versus wild areas. The study (conducted in an urban and wild desert location) pointed out that predation risks were higher in the wild environments. The subsequent reduced predation risk and higher resource abundance drove the increased density of birds in the urban environment but the more efficient urban foragers excluded the native species leading to decreased avian diversity. The end result is more birds but fewer species in the urban environment. This was attributed to the ability of the invasive urban specialists' ability to more effectively consume the available resources and force the less efficient wild bird species out of the urban environment (Shochat et al., 2004).

A BRIEF COMMENT ON TREATING FDB

While FDB are common, their causes are often complex as are their treatments. The author wishes to make it clear that many approaches to managing and/or treating FDB have been proposed and published elsewhere. Socialization, diet, underlying disease, environmental stressors and other causes may contribute to FDB and should be addressed when managing these abnormal behaviours. As noted below, strong correlations between foraging (or, lack of foraging) and the development of FDB and other abnormal behaviours have been made in birds. Foraging is presented as a tool to help manage selected abnormal behaviours in birds.

HOW LACK OF FORAGING MAY AFFECT BEHAVIOUR

The question then becomes 'if you remove the ability to perform a natural behaviour, how does that affect other behaviours?'. In very simple terms, the behaviours of birds can be divided into 3-4 categories. These include: foraging, socializing with other birds, grooming/self-preening and sleeping/resting. Although 'sleep/rest' may not be categorized as a 'behaviour' it likely represents an important aspect of a bird's health and may have behavioral implications. In a captive situation, several behaviours are likely disrupted, one of which being foraging. If for example, the ability to forage is removed that leaves 2 to 3 other behaviours: socializing with other birds, grooming/self-preening ± sleep/rest. Looking even further at birds that are isolated and have limited contact with even humans (caged bird) may leave grooming/self-preening and sleep/rest as the only 'natural behaviours' a bird can conduct.

The author is proposing the idea of behaviour displacement. When one behaviour is altered or abolished other behaviours become more emphasized. With this theory in mind, if a bird is denied one or more behaviours (ie: foraging, socialization) then the remaining behaviours (grooming/self-preening and sleeping/resting) and/or abnormal behaviours are emphasized. This is not to say that lack of foraging will lead to overzealous feather grooming, FDB or inactivity, but it may be a risk factor and component.

Although many species differences exist and direct conclusions may not be made, feather picking is considered a 'redirected foraging behaviour' in chicks (*Gallus gallus domesticus*) (Huber-Eicher and Wechsler, 1998). In domestic chicks (*Gallus gallus domesticus*) foraging activity has been inversely correlated with the rate of feather pecking (Huber-Eicher and Wechsler, 1997; Huber-Eicher and Wechsler, 1998).

Substrate exposure plays a big role in the development of certain behaviours in chicks. In studied broilers raised from hatch to 8 weeks of age, those birds raised on plastic slotted floors spent more time standing, pecking at the wall, feeder, themselves or other birds and had higher feather loss and damage scores compared to those raised on wood shavings litter (Hocking et al., 2005). Huber-Eicher and Sebö (2001) showed that raising chicks on wood shavings, compared to those raised on a plastic grid, for the first two weeks of life spent significantly more time foraging and less time feather pecking and had fewer damaged tail feathers at 5 and/or 14 weeks of age. (Huber-Eicher and Sebö, 2001) The authors further recommended that 'laying hen chicks raised in aviary systems do get access to litter from day 1 on'. A separate study evaluated chicks raised either on wire or with access to sand or sand and straw up to 4 weeks old. When the birds were in lay, the wire-raised hens developed higher rates of mortality (mostly from cannibalism), feather pecking and laid fewer eggs (Huber-Eicher and Sebö, 2001).

In chickens, the inability to access substrates appropriate for dust bathing or foraging is highly correlated with feather picking in laying hens (Nicol et al., 2001). Furthermore, dust bathing in chickens is 'affected profoundly by both substrate type and the birds' previous exposure experience'. Chicks rarely dust bathe with straw but do so readily with shavings litter. If chicks are exposed to shavings for even 10 days at an early age they are significantly less likely to feather peck when housed on wire at a later age compared to chicks never exposed to shavings. However regardless of previous exposure, adult chickens housed on shavings showed more ground pecking and less feather pecking than did birds kept on wire. High stocking densities and compacted litter are significant risk factors for feather pecking in growing chickens and further supports the hypothesis that birds redirect pecking behaviour towards feathers in the absence or inaccessibility of appropriate substrate. Chickens may also increase feather pecking at 'point of lay'. Also, changing substrate after a bird has developed a preference for a particular substrate during the rearing phase can precipitate feather pecking (Nicol et al., 2001).

At this time, the non-medical risk factors associated with 'feather picking' in populations of psittacine birds have been limited to:

- being an African grey parrot (*Psittacus erithacus*);
- being female;
- not displaying curiosity via play behaviours (Briscoe et al., 2001); and
- lack of foraging (Lumeij and Hommers, 2008).

Recently, Meehan et al demonstrated that by enriching the environment with appropriate foraging substrates and increasing physical complexity, psychogenic feather picking in young orange-winged Amazon parrots (*Amazona amazonica*) was both prevented and reduced (Meehan, et al., 2003).

In Meehan et al's study with orange-winged Amazon parrots, both physical and foraging enrichments were used on test subjects (Meehan et al., 2003). The physical enrichments included alternate perching sites and moveable, climbing and swinging objects that were intended to increase the physical complexity of the cage. Foraging enrichments required the parrots to chew and sort through, manipulate and/or open objects to get to food and were intended to provide the parrots with an opportunity to perform some amount of work to retrieve the food. A control group received no enrichments. After 3 16-week periods, the control group began receiving enrichments and parrots from the enriched group were removed from the study. All birds were parent raised to weaning (18 weeks) and then moved to individual cages. Visual barriers were designed such that birds could only see the parrot in the adjacent cage but vocal contact was possible throughout a common room. A feather scoring system was developed to evaluate feather self-damage. The end results after the 48-week test were that the birds used foraging over physical enrichments and that feather scores significantly improved as a result of enrichment. The authors concluded that they 'strongly recommend that all populations of captive parrots be provided with a varied enrichment protocol designed to elicit foraging behaviours and enrichment interaction' (Meehan et al., 2003).

In chickens, genetic predisposition has been shown to influence foraging behaviour and the development of feather picking (Klein et al., 2000). There is also a strong genetic basis for cannibalism in poultry (Overall and Dyer, 2005). Genetic predisposition for feather destructive behaviours brings up an even greater concern in the psittacine population as 'feather pluckers' deemed unsuitable for pet homes may be instead placed in breeding situations.

Studies in other avian species have shown additional support for foraging. While it may be assumed that a foraging bird would attempt to obtain food as efficiently as possible (in effort to reduce the risk of predation and maximize energy stores), both pigeons (*Columba livia*) and domestic fowl prefer to peck at a key to find grain rather than eat the same freely available food (Ingliss and Ferguson, 1986; Neuringer 1969). Neuringer (1969) concluded that pigeons would prefer to peck at a disk many times to earn a food reward than simply eat freely available food (Neuringer, 1970). Neuringer (1969) also stated 'responding for food, like playing and exploring, appears to be a natural part of the behaviour of animals and does not necessarily depend upon any prior motivating operations' (Neuringer, 1969).

In studied starlings, the birds chose to obtain a high percentage of mealworms by searching through covered holes rather than freely from a dish (Ingliss and Ferguson, 1986). While the starlings would increasingly eat mealworms from the open dish, the birds obtained almost a quarter of their food from the covered holes even after 8 hours of starvation. As starvation progressed, the birds consumed less hidden mealworms but it was clear that the starlings preferred to search the experimental holes (Ingliss and Ferguson, 1986).

Case studies will be presented during the lecture to help identify abnormal behaviours and devise foraging plans for captive birds.