

An Overview of Psittacine Reproductive Behavior and Infertility Problems

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Introduction

The order Psittaciformes is currently the most threatened group of birds which makes understanding psittacine social and reproductive behaviors an imperative for the success of captive breeding programs. However, describing such behaviors is a daunting task given that the order Psittaciformes encompasses a broad range of very diverse species whose behaviors vary widely. It is important to recognize that parrots will invariably display both social and reproductive behaviors often out of context to their environment or situation because they are wild animals and have not yet achieved a significant level of domestication. These behaviors directly impact both the aviculturist and the pet-owner because they may not be expressed in the appropriate context in the captive environment as they would in the wild. This may lead to maladaptive or misinterpreted behaviors resulting in reproductive failure or undesirable behaviors in the home.

Aviculture was a rather esoteric pursuit of the upper classes, but a confluence of events occurred in the early 1970's that ultimately escalated the demand for birds. Initially, the exotic bird trade began to grow rapidly because owning and displaying parrots became a fashionable status symbol. This demand increased the market availability of birds worldwide and the number of private import stations increased. Networks of trappers shipped the birds in large numbers to wholesale pet distributors who took the birds directly to market for collectors and those seeking pets. Birds were

traded freely on the open market and there was little to restrict their import, but the import network was unreliable and availability of many species varied widely.

However in 1972-74, a worldwide pandemic of exotic Newcastle disease (END) caused considerable losses in the poultry industry and resulted in the institution of the quarantine system in the U.S. which was designed to prevent the entry of the disease and protect domestic poultry. Additionally, conservationists recognized that the numbers of many species of parrots was diminishing rapidly in the wild. This concern by wildlife officials resulted in the regulation of international trade through instruments such as CITES (convention on the trade of endangered species), and domestically through U.S. legislation in the form of the endangered species act (ESA). International trade was regulated CITES regulations and the ability to import a particular species depended on its endangered or threatened status.

While breeding stock of some species had been domestically produced for some time, most aviculturists relied on the importation system to supply or replenish their collections. African, Asian, and South/Central American species were readily available, but the supply of Australian species was already completely reliant on domestic production because that country had been closed to export for many years. However, the passage of the U.S. Wild Bird Conservation Act (WBCA) in 1992 resulted in the cessation of importation of all wild-caught psittacine species except under special circumstances and USFWS approved cooperative breeding programs.

With the WBCA in effect, the

avicultural industry had to focus on producing breeding stock from domestically reared birds. While the supply of wild-caught stock was eliminated, another source of sexually mature birds was available from birds no longer wanted as pets. However, problems immediately resulted from using birds for breeding stock that had been previously kept as pets and these difficulties still persist today. This is because little attention has been given to the proper socialization of the birds during their path to sexual maturity.

As the birds mature, they began to display breeding behavior which is often incompatible with the normal expectations of a companion animal. These behaviors include territoriality displays such as screaming and biting, and mating behavior such as regurgitating and masturbating with the human surrogate mate. These birds are often surrendered to aviculturists for breeding purposes because these types of behaviors are not well tolerated by the owners, or the owner believes that the bird would be happier in a mated situation. The problem with this thinking becomes evident when aviculturists attempt to use these former pets as breeding stock and discover that many species of birds socialized for the pet-market are not well adapted to be breeders. Moreover, these former pets can manifest maladapted behaviors in breeding situations placing themselves or their mates in danger. Unfortunately, this situation persists today and threatens domestic production because of the lack of attention to proper socialization for end-use as breeding stock.

Compounding this problem is that the wild-caught breeding stock is aging

rapidly, and reaching the end of its reproductive viability. Therefore, establishing techniques of socialization that will ensure successful captive propagation in perpetuity is vital to the survival of aviculture and future generations of birds. This is especially important in those species where re-introduction is a goal since captivity may be the only way to sustain the population until the habitat can be restored.

The fostering of natural behaviors and providing environmental enrichment are approaches that have been demonstrated to improve reproductive success and avian general welfare. Techniques such as flocking and permitting self-selection of mates promote a healthy and successful breeding environment. Therefore, this paper will address captive management procedures that emulate natural behaviors such as flocking, mate selection, and staging the appropriate reproductive environment in the aviary. It will also briefly address the wild behaviors observed in the context of a human environment and speculate about the underlying causes of maladaptive or misplaced behaviors, particularly in regard to the pet bird. Lastly, recommendations will be made in regard to correcting some maladaptive behaviors. It is hoped this information will allow the clinician to analyze the behaviors observed in the home and aviary and place them in proper context of the environment and use of the bird.

Wild Behaviors

Birds do not abandon their wild behaviors simply because they are captive reared or hand-fed. This will become especially evident when the bird reaches sexual maturity and begins to display both sexual and social wild behaviors. It is important to understand that most captive psittacines are essentially wild birds on the road to being domesticated. However, domestication is like a spectrum of behavior change, and the level of domestication depends on the longevity of a particular species' relationship with man, and whether man

has interceded to select traits desirable for captive propagation. Aviary birds are not domesticated but display modified behaviors that are adapted to captive conditions. The same is true for the pet bird found in the household, but usually the behaviors will be directed towards human surrogates rather than other birds. Therefore, they will manifest many of the same innate behaviors observed in the wild but tailored to the conditions imposed by captivity.

Bird behaviors have been shaped by millennia of evolutionary selection, and attempts to modify or subvert these natural expressions may result in maladapted behaviors causing either failure to reproduce or undesirable behaviors in the home. Therefore, it is important to recognize that any adverse or maladapted behavior is probably an extension of a wild behavior taken out of context. In the aviary, proper socialization techniques can help address much of the reproductive problems encountered by the aviculturist. In the home, the owner must understand how to properly channel or address these wild behaviors, and accept the fact that no amount of training or attention can prevent their expression.

The ultimate shaping of adult parrot behavior is partly a product of the method of rearing, but more significant is the

bird's environment from weaning to the onset of sexual maturity. There are two primary behavior modalities that appear to eventually shape the adult behavior of the bird; those are reproductive and flock-related social interactions.

Reproductive Strategies and Their Impact on Behavior

There are two general breeding strategies by which animals are categorized; K-strategists or R-strategists. There is a spectrum of behavior between these two strategies, but describing the extremes is a useful exercise in understanding breeding behavior. K-strategists are those animals that have low reproductive rates, long parental contact periods, and many of the survival behaviors are learned from the parents or group. The K-strategists rely on intelligence and training to ensure survival of their offspring (genes). K-strategists usually demonstrate strong pair-bonding; there is little promiscuous behavior and long-term bonds are common. This means that K-strategists must be allowed to self-select mates and cannot easily be force-paired. R-strategists have high reproductive rates, short or no parental contact periods, and survival skills are predominately instinctive or innate. The R-strategists are highly promiscuous and rely on sheer numbers of

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offspring produced to ensure survival of their genes. Selection of mating partners is more capricious and opportunistic. Naturally, there is an entire spectrum between the K and R strategies and many species fall somewhere in-between. For example, macaws would be considered predominately K-strategists where budgerigars would be R-strategists.

Flock Dynamics

The majority of parrot species are highly social creatures that live in flocks or enlarged family groups outside of the breeding season. Sexually immature juveniles live in a flock entirely until they reach reproductive age and select a mate. During the breeding season, sexually mature pairs will separate from the flock to reproduce. After fledging, chicks either join the parental flock or may choose a new flock which helps to promote genetic diversity of the species.

Little is known about psittacine flock dynamics and the science is still in its

infancy. However, experience suggests that when birds are permitted to flock in the non-breeding season, they perform better reproductively. Additionally, chicks reared in an avian flock system appear to perform as superior breeding stock and are well acquainted with the appropriate reproductive behaviors and breeding cues. Therefore, it is essential that both behavioral components, both flock and reproductive, be intact if the bird is to be a successful breeder. This discussion on flock and reproductive behaviors will be expanded below.

Chick Production and Neonatal Management

The bulk of the chick production in the U.S. has relied on wild-caught pairs. However, these birds have reached the end of their reproductive usefulness and the task is falling to domestically produced stock. Domestically reared stock often performs better than their wild-caught counterparts if the proper socialization

techniques have been employed. Socialized domestic stock reaches sexual readiness more quickly and is better adapted to the stressors of captivity such as caging, reduced territory, and the presence of humans. This part of the discussion will examine the socialization management of both the chick and the adult breeding flock and outline approaches to rearing, socialization and pairing, and aggression control.

Rearing of Chicks and Early Socialization

There are basically four types of rearing approaches: 1) complete parent rearing; 2) partial parent rearing with hand feeding to weaning; 3) co-parenting, and 4) artificial or foster incubation with complete hand-feeding to weaning:

If the aviculturist has a well-socialized pair that will incubate and rear the offspring to weaning, complete parent-rearing appears to be one of the better approaches for producing reliable breeders



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providing that the birds reach sexual maturity in the context of an avian flock. One overlooked aspect of parent rearing is the potential importance of vocalization and recognition of vocal patterns specific for that particular species. This may be critical for flock cohesion and recognition of groups because a local "dialect" is used for identification and communication among family groups. Parent-rearing may be more important for some species compared to others, but further work needs to be done to establish how important this parent-contact and communication may be in many parrots.

Parent reared offspring are also highly desirable for use as breeding stock because it is "perceived" that they may be better prepared for reproduction. Whether this is assumption is true as compared to properly socialized birds reared by other methods has not yet been established. But evidence suggests that the means of rearing may be less important than the proper socialization of the chick.

When using complete parent-rearing, the aviculturist must be patient and prepared for some failures. Inexperienced

pairs may falter at some stage of the rearing process, whether that is a failure to incubate, failure to feed offspring, or even attacking or abandoning the chicks. Immature or inexperienced pairs must be given sufficient time to "experiment" with rearing and often 3-4 years of production may be lost until they succeed. Having the young pairs observe adult behavior as pre-sexually mature juveniles helps to favorably form their later reproductive responses. Parent rearing also reduces the number of clutches produced per season. This is not necessarily a bad result, because some pairs may be pushed to over-produce and the reproductive lifespan is shortened as well as the fact that their genes become over-represented in the gene pool.

Partial parent-rearing with hand-feeding to weaning is one of the most common approaches in aviculture. The aviculturist will typically harvest chicks at 10-18 days of age depending on the species, just prior to the eye-slits opening and the chicks are hand reared to weaning. The chicks produced in this manner are usually healthier and more robust due to many factors. This approach may also

allow the pair to produce another clutch, but again, care must be taken not to allow overproduction. Problems associated with this approach mainly deal with preventing diseases from entering the nursery. Mixing multiple species or clutches from different pairs or aviaries in the same nursery has the potential to introduce infectious diseases such as polyomavirus or psittacine beak and feather disease.

If birds are to be hand-fed, the aviculturist needs to ensure the proper social as well as nutritional care of the chick. Chicks should be kept in groups preferably by related clutch or species of similar size and age. Housing chicks of disparate sizes or ages together can be disastrous. Chicks held in clutches display more vigorous feeding responses, benefit from the thermotaxis provided by other chicks' bodies, and seem socially better adjusted as they approach weaning. This "clutch mentality" seems to be one of the first social interactions learned by the neonate. Chicks reared in isolation may not perform as well or readily adapt to new social situations and environments compared to chicks reared in clutches.



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Co-parenting is a relatively new approach being pioneered by some aviculturists. The chicks are fed in the nest by the breeding pair and the aviculturist will take the chicks from the nestbox and handle them daily. The aviculturist may also give some supplemental feeding to the chicks as well. Typically, the parents are physically excluded from the nestbox by use of a "lock-out door" (usually at feeding time for the adults) and the chicks are removed through the inspection door and handled and/or fed. After handling, a "cooling off" period is recommended before the parents are allowed to re-enter the nestbox to diffuse any displaced aggression. Some exceptional pairs may permit direct intervention by the aviculturist while remaining in the nestbox, but this is unusual behavior. The use of co-parenting depends upon the demeanor of the particular individual breeding pair and the judgment of the aviculturist.

Incubator-hatching followed by hand-rearing to weaning permits the aviculturist to control the entire process. Incubation can be accomplished by natural means, such as fostering the eggs under reliable brooding hens, or artificial means like commercial incubators. Natural incubation has a higher hatch-rate than artificial incubation. While an extremely labor-intensive process, hand-feeding from day one helps to prevent the entry of infectious disease into the nursery and permits multiple clutching from the same pair but there is also significantly higher mortality.

Importantly, partially parent-reared and incubated chicks should not be co-housed until after weaning, and it is vital to have two separate nurseries for each group. One nursery is for partially parent-reared chicks and the second for the immunologically naïve incubator-hatched chicks. The two populations are housed and handled separately and never mixed until the chicks have weaned.

Socialization of Birds

Psittacine chicks must be properly socialized for their end use to achieve

optimal results. If chicks are not properly socialized, then problems may develop such as maladapted behaviors in the home or aviary and failure to reproduce.

The Formative Period: Weaning to Sexual Maturity

Domestically bred chicks that have been properly socialized in an avian flock usually demonstrate good reproductive success in the aviary. However, evidence suggests that many species of psittacine chicks that have been hand-reared and socialized for pet purposes, and that have also reached sexual maturity as a pet, usually do not perform well as breeding stock. This is presumably because the chicks identify more with their human surrogates rather than with other birds. These findings suggest that the formative period for most parrots occurs between weaning and the onset of sexual maturity.

This concept primarily applies to K-strategist species where an extended learning period is normally required in the wild to learn both social and survival skills. R-strategists innately possess much of the necessary knowledge required for successful reproduction and survival. While K-strategist species may have some innate social and survival skills, it seems that most of the knowledge needed for survival, proper social interaction, and reproduction is gained during the formative learning period after weaning and up to the onset of sexual maturity. For reproductive success, this knowledge can only be effectively acquired while maturing in an avian flock.

Socializing Chicks for Breeding: The Importance of Flocking

Properly socialized domestic chicks have been shown to breed earlier than their wild-caught conspecifics and are better adapted their captive environment. However, there are still some species where we do not yet completely understand the appropriate socialization approaches or stimuli that result in consistent reproductive success. Since smaller R-strategist

species do not require extensive learning periods, the approaches outlined in this part of the discussion are directed at the larger psittacine K-strategist species that display seasonal and more complex breeding behavior.

Flocking with other birds is the method used to socialize chicks and prepare them for life as a functional adult bird. Flocks in captivity are a collection of the same species or genera that may be of variable ages and pairing status, brought together for the purpose of social interaction, reaffirmation of bonds, selection of mates, and as a learning environment for juveniles. Commonly kept parrot species only live outside of the flock when breeding. It is important to note that not all flock structures are equal, and flock composition and cohesion amongst macaws may be very different from that of cockatoos.

When the chick is intended for breeding, it should be flocked until sexual maturity with conspecifics or at least with the same genus. This is why limiting collections to single genera or to species from the same continent affords the aviculturist the luxury of rearing substantial numbers of chicks in similar age cohorts and flocking them together to mature. Restricting the range of the collection also tends to reduce the potential of diseases that are not adapted to those species from spreading into the collection. Therefore, focusing the collection has the added benefits of better flock and disease management.

Flocking is the natural social and educational system for many species of birds. It is within the flock that the chicks learn the necessary social behaviors to become functional adults. The importance of flocking cannot be ignored in the scheme of captive husbandry both as a learning environment for juveniles and as bonding/mate selection exercise for adults. This is one of the most neglected and misunderstood areas in aviculture. The composition of flocks in the wild includes breeding pairs, mature unmated birds, and juveniles. The experience acquired by juveniles as members of the flock provide

them with invaluable tools and information on how to properly function within an avian society and select a mate.

Regarding the social behavior of the larger K-strategy parrots, it appears that instinct only provides some of the necessary information for successful breeding and in many species of these parrots; it appears that the majority of the social behaviors are learned. The smaller R-strategy parrot species appear to have more “hard-wired” knowledge regarding mating and rearing chicks, but this innate information appears to be lacking or absent from the larger species.

Factors Necessary for Successful Reproduction: The Pair Bond and Selecting Mates

The factors that stimulate breeding behavior in the larger species of parrots are poorly understood, but it is likely that they are multi-factorial and vary with species. Many birds are signaled by environmental cues such as day-length, cooler

inducing temperatures, a rainy period followed by dry weather, a secure territory, availability of nest boxes, and perhaps most importantly, a strong pair bond.

Most K-strategy parrots will retain their own bonded partner within the flock structure, but “divorces” do occur and the option for change of partner must be offered. The idea that parrots “mate for life” is being challenged. It is certainly not true for R-strategist species who display promiscuous behaviors. However, the larger parrot species tend to maintain more long-term bonds, e.g. macaws, but the option to “divorce” should always be offered. Birds that are allowed to self-select mates have better production records. In all of the commonly kept parrots, it is the hen that makes the selection of a suitable male and that need must be accommodated in captivity in order to achieve a successful pairing. If a forced pairing is attempted, it will most likely not end in successful reproduction and may result in the injury or death of the hen or cock.

Allowing flocking of breeding pairs in the non-breeding season facilitates the potential exchange of mates to a better suited pairing. Flocking also has the added benefit of conditioning the birds by allowing increased flight freedom and exercise. This physical activity coupled with social interactions works synergistically to increase flock vitality and production.

Flocking

How then is flocking accomplished? Understandably, the aviculturist and veterinarian may experience some trepidation at the thought of free-fighting a group of birds unfamiliar with each other. Injury or even death may result if not performed properly and frequent observation is critical for the first 24-72 hours. This responsibility will fall upon the aviculturist who must make certain that there is no inappropriate aggression that results; however there will invariably be some squabbling until the social hierarchy is established. However, parrots do apparently not display

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a traditional “pecking order”, which is observed in gallinaceous birds. The aviculturist may also need to physically examine suspect birds for weight loss after several days since this may be difficult to determine visually. The following are a loose set of guidelines for flocking:

1. Flocking procedures are not intended for improperly socialized birds. Flocking may exacerbate any maladapted behaviors for birds that were not properly socialized from weaning to sexual maturity. Flocking is not meant to be a therapy for birds that have been reared for pet purposes and then placed into a breeding situation. Placing birds that are not properly socialized into a breeding environment may only serve to exacerbate maladapted behaviors or result in injury.
2. Flocking procedures may not work for all psittacine species. There is little published information regarding the natural history and innate wild behaviors of psittacine birds. Some species may react adversely under these circumstances and more research will be needed before recommendations can be made for all species.
3. Flocking must be performed outside of the breeding season for sexually mature birds, otherwise aggression and injury may occur. Birds that are of mating age will display extreme territorial aggression during the breeding season and injury or even death may occur if flocking is attempted during this time. Highly aggressive species or individuals may need to be placed into a “pairing cage” which will be discussed later. However, juvenile non-sexually mature birds remain in a flock year-round until they become sexually active and select a mate. Sexually mature unmated birds, and older non-reproductively viable birds are left in the flock year-round to act as mentors.
4. Flocking must be staged in a neutral territorial environment and the

introduction must be simultaneous. You cannot simply use a breeding pair’s cage and throw in strangers. All birds must be placed into a cage that is unfamiliar to them and not associated by look or proximity to their own individual breeding cages. Under no circumstances should a nest-box be included in the flocking cage. Some aggressive species may need to be flocked in a pairing cage rather than group. The aviculturist will need to use careful judgment in making this decision. However, given a suitably designed flocking enclosure, even the most aggressive species may be successfully flocked. If the aviculturist plans to add birds into an already well-established flock, then the birds may have to be introduced to the newcomers in an “introduction cage.” The flock establishes a territory and may defend it against perceived intruders. Any newcomers may be added by placing them into a free-standing cage equipped with perches, a feeding station, and shelter within the flocking cage. This may allow the flock to assimilate the new addition into the social hierarchy, but it is important to note that this approach is not always successful. The aviculturist will have to be mindful of “toe biting” injuries of both newcomers and flock-mates during this time. After a suitable introduction period, the aviculturist may release the newcomers into the flock but must re-instate the same monitoring procedures used when the flock was first established because of the potential for injury.

5. Flocking must be performed at the appropriate population density and in an adequately sized cage that is equipped with abundant sheltered perches and feeding stations. Flocking enclosures encompass many forms. Preferably, the flocking cage should be a free-standing flight. Some aviculturists have advocated a “commons” area connected to the breeding cages

by a hallway or common room, this arrangement has the pitfall of having breeding cages in close proximity to the flocking cage and perhaps more risk for injury. It is important that enclosures be of sufficient size to allow the birds to maintain their own “personal” space known as ‘individual distance’. In roosting galahs, this distance has been determined to be about 0.2 meters, although bonded pairs may roost close together and display allopreening. This distance will vary for other psittacines. Therefore, it is best to err on the liberal side of size of the enclosure, and ensure that the population density is kept appropriate to #bird/unit-space. Large floored flights are most suitable for species that spend significant time on the ground such as many species of cockatoos. Suspended cages can be used with more arboreal species. It is also important to have visually screened areas within the flocking cage so that an intimidated individual may escape harassment. The individual distance cannot be maintained if the cage size is inadequate or there are not enough sheltered perches. This distance may be less in younger birds but it is established and defended in mature birds and bonded pairs. Aggression in mature birds may be observed as combat or bullying away from perches and food. Aggression in younger birds may be displayed as barbering, where the less aggressive chicks will have their feathers chewed or they will auto-mutilate out of stress. This may be a result of overcrowding in too small of an enclosure or an insufficient number of sheltered perches. The “alpha” birds that are responsible for the bullying should be removed from the flock for a period of time, and then later re-introduced through methods described above. This will give the flock the opportunity to re-order and may eliminate the bullying. Birds initiating formation of

the pair bond and defending territory should be segregated into individual breeding cages at the onset of the breeding season. It must also be noted that homosexual pairs or sibling-sibling pairs may form. Removal and separation of these pairs allows the flock to restructure; later these birds may individually be reintroduced for proper mate selection.

6. Flocking may occur as a group flock or pairing cage. Ideally, birds should be allowed to occupy the same large, well-equipped space. This simulates the most natural situation. However, some species or individuals may display extreme aggression and mate selection will need to be accomplished in a pairing cage. This will be discussed later.
7. Flocking should ideally be performed with the same species. The best results are obtained when birds of the same species are grouped together. If this is not possible, then flocking should be done with birds from the same genus. Mixing genera is not recommended especially in young birds since this may lead to confusion. However, further work needs to be done regarding the influence of other species on mate selection.
8. Flock-age composition may vary with species. Care must be taken when mixing bonded pairs together, and close observation is necessary until the flock is settled. Again, flocking must be done outside of the breeding season and in neutral territory. Large flight cages are imperative for more aggressive species. Generally, all ages are mixed together, and it is a common practice to leave the juvenile and unmated adults in the flocking cage year-round. It is the responsibility of the aviculturist to monitor the introduction process carefully and assess compatibility of the flock.
9. Flock members should be free of infectious disease and in good body condition. Obviously, flocking

requires close contact and could provide the opportunity for the transmission of infectious diseases. Therefore, the birds should be free of any abnormalities or infectious disease that could be a threat to themselves or the flock. Birds displaying weakness/illness will be attacked, killed, ostracized or serve to infect other members of the flock.

10. Flocking procedures must be closely monitored throughout the process. Flocking may take several months as with bonded pairs to several years with juveniles to achieve the desired outcome depending on the species. Juveniles may need up to 3 years to properly mature. During this time, it is imperative that continual monitoring be performed to detect any evidence of undue aggression and to identify those birds that are initiating pair bonding behavior. The pair selection process cannot be rushed and some individuals may take longer to choose their mates.
11. Flocking should be performed with birds that are of known sex and are readily identifiable by either leg bands or microchips. The aviculturist must ensure that the flock is composed of a balanced sex ratio and eliminate and sibling pairings. A marking system that is semi-permanent and easily visible some distance away from the flocking enclosure should be used so that when pairing behavior occurs, birds are readily identifiable.

Pairing Cage Flocking and Mate Selection

For individuals or species exhibiting highly aggressive behavior that prevents their ability to participate in flocking exercises, a pairing cage may be employed for mate selection. A pairing cage is a large standard cage in which several smaller individual cages (typically four – one in each corner) are incorporated into the larger enclosure. Each individual internal cage is equipped

with its own perches and feeding station. The larger enclosure is equipped with a feeding station and perches positioned beside each individual cage. Typically, several males of the same species are placed singly into each of the individual smaller cages within the larger enclosure outside of the breeding season. Then hens of the species are then placed into the larger enclosure. The males or hens do not have to be sexually mature, in fact, it is best to offer the hen a choice of ages. The enclosure should be equipped with a screened area and feeding station so that the hen may hide from the males if she needs privacy. The males then are physically prevented from injuring each other or the hen although toe-biting injuries may result. The hen is left free from direct intimidation and is allowed to select her mate. The hen will make her selection known by preferentially sitting by the male of her choice and engaging in social bonding behavior. However, if the female fails to select a mate; then she is either not ready to mate, has not found a suitable partner, or is not properly socialized to receive a male. If the female succeeds in choosing a suitable partner, then the bonded pair may be removed to suitable breeding cage.

Reproductive Behavior and Breeding Requirements

Seasonality

Breeding seasonality varies greatly in captive psittacines. R-strategy parrots such as budgies, cockatiels, and lovebirds breed year round under the right conditions. However, most large K-strategy psittacines display breeding seasonality where they establish and defend their territory. Usually, this occurs from early spring to mid-summer depending on the species. Sporadic breeding occurs anytime but usually

the peak chick production season is typically spring through early summer. During this time, aggressive displays increase as the birds become more possessive of their cage and nestbox. Rather than be fearful, they will challenge any intrusions into their space by bird or human. Tightly bonded pairs will be seen to engage in extensive allopreening and the male will be observed feeding the female.

Aviaries

It is important that the breeding enclosure be properly structured and equipped with visual barriers on the sides with an appropriate next box. Aviary structure has been addressed in other articles, but visual barriers on the side of the breeding cage are essential to prevent territorial squabbles. In some species, pairs may allow viewing their neighbors "straight-on" from the front of the cage, but demand seclusion and privacy in the part of the cage where the nest box is stationed. Other species prefer more complete screening that blocks most of the visual field from neighbors. However, some parrots will breed in highly social environments with no visual exclusion and this varies with the species. If visual screening appropriate for that species is not implemented, the pair will expend the majority of its breeding energy on territorial defense rather than reproduction.

Auditory aggression is poorly understood, but some species prefer to be out of calling range of another pair of the same species. There is some evidence suggesting that "dominant pair" can suppress conspecifics in close proximity by both visual and auditory cues.

Mating, Incubating, Brooding, and Feeding of Chicks

Pairs will usually be seen to mate frequently during the time leading up to egg-laying. Copulation may be public as with cockatoos or secluded evidenced only by vocalizations from the nestbox as with many macaws. The female bears the brunt of incubation except with species like cockatiels where the burden is more equitably shared. Males tend to clumsy and inefficient when incubating and the hen quickly returns to the nestbox after she has fed and watered. Both members of the pair will aggressively defend their nestbox against intrusion. Caution must be exercised when inspecting eggs or chicks since the pair could damage either due to displaced aggression. Both males and females share in brooding and feeding of chicks. This is a labor intensive job and the pair must cooperate if they are to rear their chicks successfully to fledging. Unless the aviculturist harvests the chicks prior to weaning, the pair will fledge the chicks at which time the young birds must quickly

be removed from the cage otherwise injury may result. Some birds that have reported to demonstrate cooperative or altruistic behavior like eclectus parrots may permit the chicks to remain, but typically the male will attempt to drive them from the territory.

Aggression and Maladapted Behaviors in the Aviary

Birds may display aggressive behavior for a variety of reasons, defense of mate, defense of territory, defense of a food source, invasion of the individual distance, frustration due to a mate not displaying the proper social responses and behaviors, displaced aggression due to territorial squabbles, discipline of juveniles, and maladapted behavior as a result of improper socialization. Some aggression is part of the normal behavioral pattern of any bird as long as the aggression is a measured response to some perceived threat. However, excessive, misdirected, or irrational aggression is abnormal and indicates that a bird may not be properly socialized for the situation stimulating the response. Aggression can occur anytime during the year, but it is during the breeding season both in aviary and home that the frequency of attacks and injury escalates. Aggression can occur with any species of parrot, but it is in cockatoos that this aggression is most

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pronounced. There has been much written regarding methods of assuaging this aggression, some of which have been quite controversial. The discussion below will use cockatoos to illustrate many of the points, but these may be extrapolated to other species.

Parrot Reproductive Aggression

Cockatoo mate aggression and injury has been seen in aviaries in the United States and Europe although it reported to be less common in Australia. The reason for reduced aggression in Australia may be two-fold because aviculturists maintain cockatoos in flights rather than suspended cages and hand-rearing of chicks is not a common practice. Most Australian parrots are quite terrestrial in their habits and full flights work well for them. If the male is showing aggression, full flights offers access to the ground to an intimidated hen because the hen is forced to the ground

while the male maintains his perch superiority giving the aviculturist time to intervene during an aggressive episode. The other reason that Australian aviculturists may have less problems with aggression is because chicks are not hand-fed and therefore will almost invariably receive the proper socialization for breeding success because they are treated as birds and left in the aviary to mature.

Mate aggression leading to severe injury or death is a manifestation of captivity and socialization and has not been reported in the wild. Naturally, aggression is observed in all species and is a normal part of behavior, but the constraints of captivity have exacerbated aggression. As evidenced above in the discussion of lack of aggression observed in Australian aviaries, two problems are speculated to underlie the causes of aggression; firstly, the inappropriate socialization

of the breeding stock and secondly, failure to allow the mate selection process to occur naturally. However, it is also possible that one of the pair has become ill or infirmed and is no longer suitable as a mate.

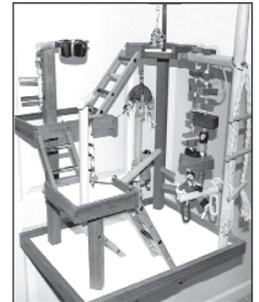
Parrots Socialized for Companionship

Parrots that have not been properly socialized are less likely to make successful breeders. Even though there are exceptions to this observation, it is not the rule and will vary with species. Parrots socialized for human companionship will manifest maladapted behaviors in the aviary. They do not appear to "recognize" their mates as one of their own kind and seem to identify with humans as their flock conspecifics. These birds will ignore or be terrified of their cagemate and gravitate toward any contact from humans. During the non-breeding season, many of



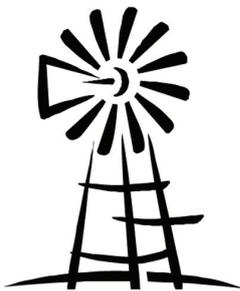
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these birds not socialized for breeding will merely be tolerated by their partner. At the onset of the breeding season the situation changes. Improperly socialized hens, especially cockatoos, will at best be intimidated by the male and not mate or at worst, be terrorized, injured, or killed by an aggressive male because his advances are not met with the appropriate responses. The male likely perceives the hen to be “defective” and will attempt to drive her from his territory. Breeding hens will display submissive posturing which is either ignored by the improperly socialized male or results in the male attempting drive away the hen from his territory because she is perceived as an intruder. This male prefers the human surrogate to one of his own kind. Therefore, using an improperly socialized bird in a breeding situation is a recipe for disaster. The result of this type of pairing

is why aviculture has a deficiency of breeding age cockatoo hens and an abundance of “aggressive” males.

Other species of parrots will vary in their aggressive response. Macaws tend to be passive-aggressive in that they will often not directly attack a bird they perceive as problematic, but will intimidate it from the food sources. Amazon parrots are more demonstrative about their preferences and often fights occur within seconds of introducing birds into the breeding cage. Eclectus hens will often attack or kill a submissive male as will Indian ringneck parakeets. Interestingly, Amazon parrots that have been pets for years may be successfully employed in breeding programs. They may eventually get the mechanics of sex right but their parenting skills are almost always impaired and they will either ignore or savage their eggs. Cockatoos and African grey parrots

will almost never succeed in breeding if they have reached sexual maturity in the home.

Parrots Socialized for Breeding

Parrots that are socialized for breeding usually make the transition to a producing adult easily, although inexperienced birds or pairs may take several years to succeed. However in the case of proven pair aggression (including wild-caught birds), the cause of aggression may be very different. Here the pair bond has undergone some type of change or one or both of the pair perceives that conditions are not appropriate for breeding. While it has been known for some time that visual barriers are essential to prevent territorial squabbling between breeding pairs, little attention has been given to other environmental cues such as temperature and rainfall. In galahs, when



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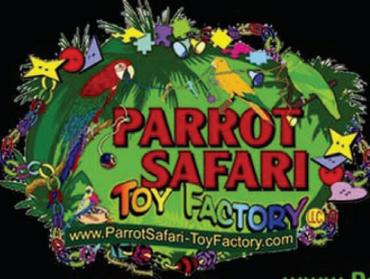
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rains are insufficient to produce a reliable food source for offspring, the hens may not come into breeding condition and may not be receptive to the male's advances. However, the males do enter breeding mode and will display territoriality and attempt to court their mate. In this case, the females are free to fly off or ignore the male's attempts. Many South and Central American parrots will not come into breeding condition if rains in temperate North America persist well into early summer. These species are keyed in on a dry season following the monsoons. In a breeding cage, that female is trapped and subject to aggression. Therefore, aviculturists must be mindful that there are environmental cues that stimulate and regulate the breeding process.

The other and most important reason for proven-pair aggression in that the pair bond may be dissolving. Another pair of parrots of the same species may be in close proximity and the birds may interact. The hen has decided that the other male may be more suitable. She may dissolve the pair bond unilaterally and ignore her former mate. This situation may exist for some time until the onset of breeding season at which time the hen fails to give the appropriate response to the male's advances, and aggression may ensue. The elasticity of the pair bond varies with species and individual bird. Most pair bonds in K-strategy psittacines are long term, but the option to select a new mate should be offered and flocking procedures are designed to allow that re-assortment. In contrast, highly prolific R-strategy species display a higher degree of promiscuity. This may be because the larger parrots have a long-term investment in rearing the offspring and defending territory, and therefore must maintain the integrity of the pair bond to succeed.

Lastly, there may be sub-clinical illness in one of the pair. If the female or male shows signs of illness or weakness, then the bird may be subject to attack. It appears that the healthy mate will attempt to get the weakened bird back upon to a perch away from predators, or may attempt to drive the bird away if it is perceived as an attraction for predators.

There are some subtle and less subtle clues that the pair bond is in danger. Infertile eggs produced from a historically productive pair may suggest a problem. Increasing aggression suggests that the pair might need to be separated. Often, the squabbles are minor, but if unrelenting, severe injury could result later. Failure to display social bonding behavior such as mutual defense of the nestbox, roosting a far distance apart, failure to display allopreening, or constant squabbling suggest that the pair bond may be weak. Careful observation and quick action are important avicultural management tools.

Managing Aggression in the Aviary

There have been surgical procedures described in the literature, specifically for cockatoos, that will prevent injury from occurring. These procedures are typically modifications of the male's beak such that he cannot exert sufficient pressure or gain purchase on the female in order to inflict injury. While these procedures are well intentioned, they do not typically achieve the desired goal of successful reproduction. None of the proponents of these techniques have supplied sufficient data to show that performing these procedures as described will succeed in allowing the pair bond to cement and lead to reproductive success. However, these procedures will prevent the infliction of injury by the male. It is better to solve the underlying reasons for the dissolution

of the pair bond and avoid surgical intervention. By employing proper avicultural management approaches such as flocking and mate selection procedures, mate aggression can be avoided or reduced. Finally, it must be emphasized that the reproductive viability of the birds diminishes as they age. The longevity observed in captivity does not necessarily correlate with that seen in the wild. And more likely, the reproductive lifespan of psittacines is more abbreviated in the wild than captivity. Therefore, normal geriatric processes may contribute to reduced fertility and reproductive viability and cause a mate to be perceived as unsuitable.

Summary

This discussion was intended to provide the reader with insight into psittacine behavior, and address some remedies to avoid or resolve reproductive problems encountered with these birds in the aviary. The generalizations found within this paper may not be applicable to all situations and species, but hopefully provided the reader with a foundation by which to understand and interpret many types of psittacine reproductive behaviors in captivity.

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