Some behaviour patterns of Trumpeter Swans

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Abstract

Behaviour of habituated and imprinted Trumpeter Swans was studied in southern Ontario. Trumpeters have an aversion to physical contact which causes frustration at the time of copulation. The swans use displacement bathing as a pre-copulatory display. Male Trumpeters have control over the moult of primary feathers and can "let go" at an opportune moment. The wing-rattling threat displays of Trumpeters are derived from displacement drying behaviour after bathing. Very loud duetting by pairs or companions proclaims the presence of a predator. Trumpeters fight by grasping the feathers of the upper back and striking simultaneously with both wings. These blows usually fall on either side of the opponent and do not connect with the body. Injury seems to be very rare. Brood dominance hierarchies are established by size but those of equal size may be determined by brief fights. Large broods may have difficulty in recognising differences in brood size and may confront one another by crowding with very loud trumpeting until one brood finally gives way. In response to stress or arousal, swans lift one or both closed wings above the back.

Introduction

In 1983, a program was started to restore Trumpeter Swans (*Cygnus buccinator*) (hereafter Trumpeters) to Ontario. It involved captive breeding and release of cygnets and yearlings to establish a breeding population of wild birds. Success resulted in a self-sustaining population by 2006. Both captive breeding and establishment of birds in the wild have provided opportunities for the study of Trumpeter behaviour. Many of the observations here described were made at four small ponds at Aurora (44° 00'N 079° 28'W), Ontario, where captive and wild breeding pairs and their offspring lived over a 35 year period. The site is described in Lumsden (2017). A group of subadults was kept there until they formed pair bonds and were dispersed to

co-operators who bred from them. Wild-pairs, individuals, groups or broods visited these ponds intermittently, decoyed by the captive residents and by the food offered. Observations were also made at LaSalle Park in Burlington (43° 19'N 079° 47' W), where swans were baited and a banding station was operated. Marking of birds with unique coded wing-tags facilitated the observations of individuals over time. In late January, there could be as many as 150 swans concentrated in as little as 2 ha of ice and open water, thus providing an opportunity for study of their interactions. Observations were also made at Bluffer's Park in Toronto (43° 42'N 079° 14'W) and Washago (44° 45'N 079° 20'W), where there were opportunities to watch swans responding to one another. This paper describes a number of previously undescribed behaviour patterns of Trumpeters and discusses them in context with general waterfowl behaviour.

Behavioural Elements

There are four elements that appear repeatedly in Trumpeter behaviour patterns. In various combinations, they convey a rich variety of information. First: At close quarters or within visual range, *head bobbing* signals can function as a greeting, as advertisement or, with other elements, as a threat. Second: *Marking time* grading through to vigorous *stamping* behaviours are derived from inhibited locomotion. They are the product of conflict, that of aggression countered by fear. They vary greatly in intensity and are combined with other elements. Third: *Vocalizations* communicate intentions, particularly at a distance. They express warning, greeting, search, advertisement or when combined with other elements, threat. They may vary in frequency, in volume or in quality. Fourth: *Posture and movement* express threat, intention or they invite a response, usually at close range.

Habituation

Fear of humans is largely suppressed by daily exposure and lack of persecution. At Aurora, people were present in the swan pens daily during various activities. Swan grazing in the ponds over the years had largely eliminated the macroflora which had been important in their diet so it was necessary to provide additional food. Adult swans were fed corn in hoppers. When young, the cygnets received a special starter pellet ration soaked in water which was spread on a piece of plywood. Three times per day the cygnets would come running to get their food and consequently became very tame. A mowed and fertilized lawn provided very nutritious grazing in the summer months (Lumsden *et al.* 2015). When the cygnets reached flying age, they were hand caught for banding. For many days thereafter, there was considerable modification to the "normal" indifference to human presence. It took perhaps four weeks before their behaviour returned to "normal". At LaSalle Park, the swans were exposed daily to the public and almost daily to project staff. This made it possible to bait and operate a banding station where many birds could be hand caught for banding.

Figure 1. Female Trumpeter Swan (bird on the right) that courted by pressing her breast to the author's thigh. *Photo: Karin Lumsden*

Imprinting

Trumpeters imprinted to humans are often relatively fearless, which makes them particularly useful for behavioural studies. Imprinting not only establishes the following response (Lorenz 1937, 1991) but also establishes imprinting to a sexual partner (Hess 2017). When imprinting is to humans, there are unexpected outcomes. Lorenz (1991) describes how an imprinted male Jackdaw (*Corvus monendula*), which he hand-reared, reached sexual maturity and courted a dark-haired girl. His hand-reared Jackdaws attempted to courtship feed him by stuffing juicy worms into his ears. He also relates how a female Greylag Goose (*Anser anser*), which had some contact with human caretakers and preferred to associate with humans, showed sexually motivated pre-copulatory head dipping toward him. Tinbergen (1958) described how a captive raised female Jay (*Garrulus glandarius*) courted one of his students. She would hop onto a branch near him, raise her crown, neck and shoulder feathers, droop her wings, turn broadside to him and produce the rattling "Kroch" call.

I moved a female two year old Trumpeter, incubator hatched by William Carrick and imprinted to humans, to Aurora in April 1995. She followed me closely for 1.5 days whenever I entered the pen and pressed her breast to my thigh in courtship (Figure 1). She was closely followed by a two year old male. On the second day, the male pursued her relentlessly and she stopped paying attention to me.

When the sex drive asserted itself in the case of the Jackdaws, the Jay, the Greylag and the Trumpeter mentioned above, they recognised humans as conforming to the "form" to which they were sexually imprinted and they courted accordingly (Lorenz 1937).

Sexual imprinting to humans does not, however, preclude ultimate mating with a con-specific. The persistent male that followed the female Trumpeter as she responded to her imprinted attraction to me, finally overwhelmed her with his powerful innate courtship patterns which I could not duplicate. She quickly formed a bond with the persistent male and they bred in 1996.

The initial descriptions of imprinting have been further expanded in studies by Hoffman and Soloman (1974), Herman and Panksepp (1978) and De Paulo and Hoffman (1980). They proposed that endorphin addiction underlies imprinting. Maternal contact stimulates a brain endorphin reward which reinforces this behaviour.

Explorative Behaviour

Lorenz (1991) describes nibbling as explorative behaviour, e.g. when swans nibble at unfamiliar objects and learn about them. The imprinted female Trumpeter nibbled at my loose weaved sweater and when I lowered my head she nibbled at my hair. This swan's behaviour was additionally unusual. Later in the summer, I was on my knees pulling grass and weeds out of a flower bed and putting them into a bushel basket at my side. This was an activity that she had not seen previously as it was undertaken that summer for the first time. She came alone from the pond 35 m away across the mowed lawn to where I was kneeling. She picked up the weeds from the basket and dropped them beside it on the grass. She was familiar with grass and weeds rooted in the soil on which she had fed but unfamiliar with grass and weeds pulled out of the ground. This appeared also to be explorative behaviour.

Bathing and Preening

All species of swans, geese and ducks use the same sequence of postures and movements when bathing and preening. These comfort movements must have had an evolutionary origin that goes back at least as far as their common ancestor, some time in the mid Tertiary, many millions of years B.P.

Trumpeters bathe frequently but particularly after a fight and after copulation.

Figure 2. When bathing, the swan thrashes the water with its wings. *Photo: Harry Lumsden*

The bird repeatedly dips the head, neck and anterior part of the body under water and rising, slops water over the back. The bird continues by thrashing the surface of the water with vigorous partially open wings (Figure 2). It may even roll over onto its back. The drying and preening process is done on land. Standing upright, the bird begins by drying the belly with rapid vertical strokes of the bill. Then with neck curved, tail spread and wings raised but primaries not spread, the bird vigorously shakes its wings (see below) (Figure 3). Preening follows by prodding and nibbling at the quills and base of the feathers and running the feathers from most of the upper body through the bill, presumably to maintain imbrication of the webs. Waterproofing is accomplished by nibbling and rubbing the head and upper neck over the uropygeal gland at the base of the tail which transfers wax when rubbed on the plumage (Johnsgard 1965).

Individual Distance

All species of swans and geese seem to have a deep seated aversion to making physical contact with one another, in particular Trumpeters and Canada Geese (*Branta canadensis*) (Lumsden, pers.obs.). They do not allopreen (i.e., preen other individuals) and they strictly maintain individual distance (Conder 1949), which develops in the brood period and prevails throughout life. The only exceptions occur in courtship and copulation and when females brood cygnets. Swans ensure physical isolation by threat when another swan approaches within a body

Figure 3. When drying after bathing, the swan vigorously shakes its wings. *Photo: Harry Lumsden*

length (Lumsden 2016). This maintenance of individual distance is effected by posturing with extended neck and lowered head, directing a single peck at the offender. In most of these threats, the victim retreats and no contact is made. Occasionally, the aggressor manages to seize a feather on the back or flank for an instant and the victim pulls free.

Courtship

Courtship starts with gentle but persistent pursuit of the female by the male. She finally stops retreating and permits him to press his breast to her flank. Later this kind of touching becomes mutual. The pair faces one another with breasts touching, wings folded and in the male, slightly raised over the back. The necks are fluffed with erect feathers in the male and are curved with the bills pointing down in appeasement. In another courtship ritual, the male swims toward the female with head turning from side to side. Mutual head turning is reported for Mute Swans (*Cygnus olor*) (Ciaranca *et al.* 1997), but I have not seen mutual turning done by Trumpeters.

Copulation

Copulation is initiated with a display that consists of dipping the head and neck below the water surface and slopping water over the back. Both sexes perform this ritual perhaps once or twice or it may be repeated many times before the female flattens herself on the water and the male mounts (Delacour and Mayr 1945, Johnsgard 1965). A post copulatory display also was described by Johnsgard (1965); after copulation, the pair faced one another with necks arched, they called and the female wing-flapped and both preened. Tinbergen (1952) was not sure whether this preening was ritualized or the bird was responding to disordered plumage. Verwey (1930, cited in Tinbergen 1952) and Kortlandt (1940, cited in Tinbergen 1952) have pointed out that copulation brings about a situation they normally avoid, that of physical contact.

Copulations were first seen during the period of rapid yolk development (RYD) (see below). They continued during incubation and were last seen soon after the cygnets hatched. These latter copulations may serve to solidify the pair bond before the onerous duties of brood care begins.

Nesting

When searching for Trumpeter nests in southern Ontario using a canoe, Intini (2009) found that the pair usually quietly slipped into the surrounding vegetation and watched from a distance.

Trumpeters do not carry material directly to the nest. The male sits on the water with his back to the nest site. He reaches forward, grasps material and drops it over his shoulder to one side. By changing position and moving closer to the nest site and doing this over-the-shoulder movement repeatedly, he transfers material closer and closer to the nest site. The female participates and does most of the actual nest construction (Banko 1960). Cooper (1979) also found that one captive female did most of the nest construction, however, Henson and Cooper (1992) found that wild males spent over twice as much time as females building the nest mound.

Figure 4. Female Trumpeter Swan stirring her eggs.
Photo: Harry Lumsden

The timing of nest building relative to physiology is of interest. Using Grau's (1976) technique for measuring rapid yolk development, I found that Mute Swan yolks took $\bar{x}$ 9.17 ± 0.44 days (range 9-10, N=6) to develop in the ovary before the follicle ruptured and the yolk entered the oviduct (Lumsden, unpublished). It is assumed that yolks of Ontario Trumpeters have a similar speed of development. If we allow two days for albumen, membrane and shell deposition, RYD would begin about 11-12 days before laying (see also Alisauskas and Ankney 1992). Most clutches (63%) in Ontario were initiated during 21-30 April (Lumsden 2016). RYD would have begun about 10-18 April. I have seen nest building behaviour as early as mid-March in years when the first eggs appeared about 1 April. Thus it seems that Trumpeters start nest building just before RYD begins.

Incubation

Only female Trumpeters incubate the eggs, as do females in most waterfowl species. I observed that they broke a late incubation session every 15 to 20 minutes but did not leave the nest. They rose with wings held out from the body, reached down into the nest and with the underside of the bill, stirred the mass of eggs (Figure 4). This altered the eggs' horizon and in effect over time "turned" them. The incubating females usually rotated their position about 15° before they settled on the eggs again. In hot weather, the females continued to incubate the eggs by standing on them (see below) for much of the middle of the day. They alleviated heat stress by hyperventilating.

Cooper (1979) found with the captive pairs he studied that the female would take a daily recess from the nest which lasted an average of 21 minutes. After covering the eggs, she left the nest and spent this time actively drinking, bathing and preening. She was usually accompanied by the male. At Aurora, the male Trumpeter also usually accompanied the female on her bathing and feeding recesses and did not attend the nest (Lumsden, pers. obs.). In these captive situations, they were perhaps influenced by the security of the surroundings and in Aurora, by the very small size (0.4ha) of the pond.

In the wild, there is variation among male Trumpeters in attendance at the nest. Bollinger and King (2002) wrote that male Trumpeters in Alaska attended the nest during female absences but did not sit on the eggs. Henson and Cooper (1992) found that wild males always stood guard at the nest when females took a recess and that nest sitting by male

Trumpeters while females were on recess occurred, but is not as well developed as it was in Tundra Swans (*Cygnus columbianus*) (Earnst 1992). Mitchell (1994) summarized the literature and reported that both sexes attend the nest, but that incubation is essentially by the females who attended the nest 66.5-95.7% of the time vs. males who attended for only 1.0-1.75% of the time.

Back Carrying of Cygnets

Mute Swans, Black-necked Swans (*Cygnus melanocoryphus*) and Black Swans (*Cygnus atratus*) regularly carry their cygnets on their back (Kear in Scott 1972) but Trumpeters have very rarely been recorded doing so. Hammer (1970) and Bailey *et al.* (1980) reported back carrying in Alaska. In Ontario, Rob Millar (pers. comm.) photographed a cygnet, one of a brood of 10, on a parent's back in 2011 at McLarens Creek on Sturgeon Lake.

Moult

Most laying female ducks and geese have the ability to control the moult of belly feathers and down into the nest prior to incubation, thus providing an insulating layer. However, Whistling Ducks (*Dendrocygna* sp.) do not line their cavity nests in this way (Scott 1972) and Trumpeter Swans retain their belly feathering throughout incubation (Mitchell 1994). Cooper (1979) described in detail the nesting behaviour of captive Trumpeters based on two years of study, noting that they have a poorly developed brood patch and that much of the heat provided to the eggs must come from the feet. He described a nesting captive female pulling down from her lower breast in both years. The quantity amounted to about 10% of that in a nearby Canada Goose nest and was not enough to form a blanket to cover the eggs. It did not result in a visible brood patch. This may have been an unusual female, however, it is consistent with observations of Trumpeter nests checked in Ontario, none of which contained more than an accidental down filament or belly feather and none of the females handled had developed a brood patch.

When we were checking clutch size, habituated Trumpeter females stood up on their nests and revealed that their feet were spread on top of the eggs, not under them (S. Foerster pers. comm., Lumsden and Drever 2002). The heavy scales on the upper surface of the toes are not conducive to transmitting heat. The fleshy pads on the underside of the joints and the ball of the foot can carry a rich blood supply and are well adapted for transmitting heat. When banding Trumpeters in summer, one is constantly struck by the very high temperature of their feet, which are also important in thermoregulation (Haftorn and Reinertsen 1982).

There is another feather tract that is under moult control. At Aurora, Trumpeter males have always moulted before females, usually in mid-June. They can fly again before the female drops her primaries. This is consistent with the pattern of male moult timing in Tundra Swans (Earnst 1992, but see Scott 1972). On 19 June 2006, male Trumpeter 810 moved to the shore of the pond at Aurora and stood preening for about 20 minutes. When he moved on, he left a pile of primary feathers where there were none

before. Examination showed nine left and six right primary wing feathers. Within a few metres, there were four more primaries, one left and three right. He apparently had the ability to "let go" and moulted his primaries at one time, at his choice.

Brood Defence

At the banding station at LaSalle Park, nearly all the cygnets were caught by hand each year for banding and wing-tagging. Because the same banders handled these birds throughout the winter, year after year, the adults finally became habituated and did not respond aggressively, or noticeably so, when a cygnet was caught (K. Intini, pers. comm.). However, when I, as a stranger, caught a cygnet there on 24 January 2018, the parent male threatened to attack, uttering a short sharp duet call (Lumsden 2013), he circled with wings open and primaries partially spread.

Threats in defence of a brood can be very varied. On 13 June 2017, the Aurora pair H24 and 839 threatened me when they stood in shallow water with necks fully extended upward. Facing one another, they shook their wings without spreading the primaries and trumpeted repeatedly and loudly (Figure 5). This is the quivering-wing display described by Cooper (1979) which his captive pair used when they threatened Canada Geese flying over.

There was a totally different response from H24 when I again confronted him at close range when he was guarding his 15 day old brood. He threatened me with curved neck, lowered head and wings raised but unspread primaries. He vigorously shook his wings (Figure 6). Note in

Figure 5. Wing quivering display in defence of brood. *Photo: Harry Lumsden*

Above: Figure 6. Wing rattling display in defence of a brood.

Below: Figure 7. Curved neck display in defence of a brood. *Photos: Harry Lumsden*

this figure that the posture of the cygnet is similar to that of the male. H24 was under conflict. He was subject to a powerful urge to attack and defend his brood but at the same time was restrained by fear. Although habituated to people, he also recognised me as a dominant member of his community who lacked fear when he threatened. He was deeply frustrated and resorted to a displacement pattern (Tinbergen and van Iersel 1947). He borrowed movements from the bathing sequence, those of shaking and drying the feathers of the wings after bathing (Figure 6, see also Figure 2). It has been called the Wing Rattling Display and has been described for Greylag Geese (Lorenz 1991) and for Canada Geese (Raveling 1970). This ritualized displacement bathing now signals threat. In June 2017, when I slowly approached H24 and his brood at Aurora, the pair stood side by side in threat with their necks deeply curved, heads held low and bills pointed toward the ground (Figure 7). Uttering low trumpeting notes, they raised their wings alternately above the back without spreading them. This curved neck posture was also seen in other contexts among the swans at LaSalle Park in winter. They were performed by a pair that was accompanied by a brood, by four cygnets but not by their parents and by two adults without cygnets.

Brood Breakup

Trumpeter families are remarkably stable and they normally remain intact until March or April. Some families depart LaSalle Park together and may arrive at the nesting territory intact. Some other parents at LaSalle Park abandon their cygnets and leave for their territories alone. These abandoned cygnets remain as a group until they also leave. If they are from a large dominant brood, some individuals, but not all, continue to assume that they are dominant even though their parents are absent and regularly threaten and chase the adult plumage birds they encounter. Aggression was seen to be involved with some family breakup, e.g., some males and females aggressively chase and reject their cygnets, such as a female at Washago who was seen repeatedly and aggressively chasing her own cygnets on 10 March 2011. Her mate at that time paid no attention to them.

Vocalization

The calls of Whooper Swan (*Cygnus cygnus*), Tundra Swan and Trumpeter Swan cygnets are deeper and lower pitched calls than the cheeping of Mute Swan cygnets. Their quality indicates the mood of the cygnet—lost, cold, sleepy, hurt, threatened, or contented (Kear in Scott 1972). Cygnets start to call before hatch when they start to breathe while still in the shell as embryos. In 1987, a tape recorder and microphone were placed in a nest among the six pipping eggs of a Trumpeter at Aurora. The calls of the hatching cygnets were high pitched and soft. Brief syllables were uttered once or rapidly up to three times and were repeated again and again. As the eggs cooled, there was a continuous and emphatic chorus from the six embryos. After about 15 minutes, the female returned to the nest and resumed incubation. As the embryos warmed, their calls slowed and finally almost stopped. After settling, the female called with five low-pitched, very low

volume grunting calls and after a pause uttered a single grunt and then remained silent for the next 12 minutes. The tape did not record a contact call with answers from the cygnets such as reported by Kear (in Scott 1972). That sequence may not develop until after the cygnets hatch.

The Bobbing Display (with elaborations) forms the basis for much communication among Trumpeters. In its mildest form, the pair stands or walks with neck erect and utters a single brief trumpet call. This usually does not evoke much of a response from neighbours. When the head is bobbed and a double trumpet call is produced, other birds in the vicinity may reply with a similar performance, perhaps in greeting. When the bird stamps its feet on the spot or in water producing splashes, it expresses a threat. This kind of stamping is an example of "inhibited locomotion" (F. McKinney, pers. comm.) brought about by conflict between aggression — the drive to advance and attack — countered by fear of possible consequences.

On 12 April 2012 at Aurora, one swan uttered a single low volume, short, soft trumpet call. All the neighbouring swans immediately stopped what they were doing; they raised their heads to an upright alert posture and remained silent and still for nearly a minute before relaxing. No cause of this warning was detected. When separated from a companion or a mate while walking, a lone bird may utter a very loud brief unmusical bark.

Duetting Trumpeters utter short, sharp, very loud brief trumpet notes which are immediately answered by a companion or a mate, whose notes are uttered within less than 0.5 second. The calls that make up a duet are repeated at 3-4 second intervals. Male calls are uttered at a deeper pitch than those of females. When disturbed by predators, the leader in the duet was the male (Lumsden 2013) but when the threat was to the brood, the leader was the female (de Vos 1964, Lamprecht *et al.* 1985). Duetting is loud enough to warn the community of the presence of danger and its function is to reassure the partner of presence and support (Lamprecht *et al.* 1985). It may be the precursor to mobbing (Lumsden 2013).

On 18 May 2013, a coyote stood at the edge of the Aurora pond about 12 m from the raft supporting the nest. The female stood up on the nest and the male sat in the alert upright posture on the water between the raft and the bank and they duetted. In the winter when a number of visiting swans were present, two coyotes trotted across the ice. The group sat in the water in the upright alert posture and duetted. Swan response to dogs varied depending on what the dogs were doing. Familiar dogs at Aurora were ignored. Strange dogs were watched in the alert posture and only evoked the duet call if they showed uncontrolled behaviour.

On 2 February 2012, the adult pair A70 and J42 at Bluffer's Park distinguished me from other humans as a predator by duetting. I had previously caught them and all their three years production of cygnets for banding and tagging. They were not heard to respond to other humans with this alarm call (Lumsden 2013).

Murmuring is a vocalization that consists of continuous, low-pitched, very low volume, rapidly uttered calls. Murmuring may be used by an individual or by groups of related Trumpeters and has been heard in all seasons, uttered by both sexes and broods. Its very low volume suggests communication only with nearby associates. It was usually heard when food was present or was anticipated. On 11 March 2012 at LaSalle Park, a pair stood close and parallel to one another among many feeding swans. In the curved neck posture, they moved their heads slightly up and down as they uttered these quiet murmuring calls. On 20 Dec 2013, a single adult male with curved neck murmured as he walked toward a bucket of corn. On 16 Nov 2012 at Bluffer's Park, a male with his brood, all with curved necks, approached me producing these very low volume calls. A brood of six well-grown cygnets at Bluffer's Park in September clustered together with curved necks and head held low. They swam toward the shore in anticipation of food and produced a chorus of murmuring calls. In this case, the parents were some metres away and did not call or accompany the brood.

Triumph Ceremony

After an altercation or with the arrival of strangers, a pair may rush toward one another stamping their feet vigorously with necks fully extended upward, the male and sometimes the female showing a thick neck appearance by fluffing the feathers. The wings are fully extended and waved and the tail is spread. All this is accompanied by very loud trumpeting. The pair is simultaneously expressing mutual support for each other and threat to others with this "triumph display."

Raised-Wing Display

This display was described by Cooper (1979) when it was directed at him when he inspected a nest. In Aurora, when strange swans flew over, the resident territorial pair stood close together, spread and waved their wings, stretched their necks upward and bobbed. They trumpeted in a similar way to that in the triumph ceremony but they did not stamp their feet. This raised-wing display did not deter strangers from landing. At Aurora, when visitors did land once in October, there was no threat or attack launched by the territory holders and the four additional swans present on this occasion did not respond to the visitors in any way.

Ground Staring

Ground staring seems to be a territorial defence display which is seldom seen outside the nesting season. The neck is arched so that the head and bill point to and are close to the ground. The neck feathers are fluffed. When performed in the water, the head may be submerged and the bird may blow bubbles (de Vos 1964).

Fighting

Trumpeters are formidable fighters. They fight over territories or over assertion of brood dominance in fall. A female with cygnets in the nest may rise with one side facing the intruder and strike with one wing. In territorial disputes, they grasp the feathers on the lower neck or upper back of their opponent and with simultaneous powerful blows with both wings, strike with the carpal joint of the wing. The opponent is held in such a way that the blows usually fall harmlessly on either side of the body and do not connect.

The real contest is with pushing, finally followed by pursuit. Trumpeter blows are very powerful. One caretaker of captive swans in the Ontario restoration project sustained a broken jaw, another received three cracked ribs. Trumpeters also have huge capacity to injure one another but records of such injuries are very scarce. H24 killed a flightless male yearling when the latter was caught in a fence and the pair 438 and 490 killed 309 at Wye Marsh in July 2001, probably when he was flightless.

Brood Confrontations

Much of the threat and fighting seen among the parents of broods at LaSalle Park that occurred in fall was directed at establishing a hierarchy of dominance. It has long been recognized that dominance depends upon brood size in Canada Geese (Raveling 1969, 1970), in Whooper Swans (Kakzawa 1981) and in Tundra Swans (Badzinski 2003). Additionally, observations show that broods dominate pairs and pairs dominate singles.

In fall when Trumpeter broods are small (three cygnets or less), dominance is quickly established among broods of equal size by threat or a parental fight. However, when broods are large (4-7 cygnets), the birds may have difficulty in assessing brood size and lengthy confrontations may occur. On the water, two large broods may approach with much bobbing and trumpeting. Within about two metres, the bobbing slows, the necks are held erect and with bills wide open, heads jerked upward and very loud trumpeting ensues. The adults, with the brood clustered behind them, continue to approach their opponents until their breasts almost touch. All are stamping vigorously so that there is massive splashing. The confrontation may continue for nearly a minute until one family finally gives way and gradually retreats.

It is apparent that sometimes more than the four parent adults participate. We speculate that these additional adults, crowding in behind the cygnets, may be members of broods of previous years that have rejoined the new family. We cannot confirm this from our observations because distance prevented wing tags from being read. These confrontations were not seen to end in a fight.

Locomotion and Intention Movements

Take-off into wind is normally accomplished on water by flapping and pattering along the surface until flight speed is reached and the bird can lift off. On land, the swan runs in a similar manner with the length of the take-off run depending on mood. When fearful, the birds can take off in a surprisingly short distance and when really frightened (e.g., if obstructed by a fence) they can take off almost vertically. When landing in a restricted area, they can parachute down on heavily beating wings.

Trumpeter leaders signal their intention to fly away on the water with head bobbing and with curved neck, repeatedly extending it forward while swimming fast in the take-off direction (Black 1988). They repeatedly utter short sharp trumpet notes, and may have to repeat these movements two or more times before the brood or group pays attention and joins the movement to take off.

Water Treading Display

The Water Treading Display was described by de Vos (1964). It is performed only by territorial males. While vigorously stamping feet and with the body raised to about 45°, the neck is extended fully forward, the closed (i.e., not spread) wings are raised from the back to a horizontal position. The neck feathers are fluffed, giving a thick neck appearance. This display is also performed by the Whooper Swan and Bewick's Swan and was called the Water Boiling Display by Kemp and Revett (1992) and Brazil (2003), who remarked that it was done by the male only.

Wing Flap

The male rises in the water and flaps his wings one to three times. Normally the bird does not stamp his feet. The wing flap functions as an advertising and threat display. It is directed at an intruder that is normally some distance from the territory. On 13 October 2017, a male with a brood at Tommy Thompson Park flew around and landed in his territory close to a photographer. He directed the Wing Flap display at her. His vigorous stamping and splashing added considerable threat to this advertisement (Figure 8).

Wing-Lifting

In the Wing-lifting display on land or water, Trumpeters sometimes briefly raise the closed wings so that they are above the back (Figure 9). The bird may raise only one wing, each wing alternately or both simultaneously. All ages and both sexes were seen to wing-lift. Frequently no stimulus was detected that may have released this behaviour, however in several cases it followed stressful encounters.

I caught and banded M13 on 6 October 2013 and subsequently (as I approached her on 11 October 2013 when she was standing on the shore), she entered the water lifting both wings simultaneously. Once, after harassing a nesting pair of geese, female 839 began to tip and feed. She occasionally wing-lifted, once even when her head was under water. Her mate, the male H24, also wing-lifted as he walked on the bank nearby. They were presumably still aroused after their encounter with the geese. On 17 March 2018, at the Stronagh pond in Aurora (44° 00' N 079° 28' W), a swan was threatened and chased briefly. As it settled down, it wing-lifted for about a minute. In November 2012, a brood of two adults and four cygnets flew into the Aurora pond and H24 and 839, the territorial pair, did not respond. However, a resident sub-adult female C04, and her companions were very aggressive, chasing the strange male of this family. For 22 minutes after the chase, the visiting brood wing-lifted.

In September 2001, two dogs broke into the swan pen at Aurora and chased a brood of two well-grown cygnets that could not yet fly. The cygnets took refuge in the water and would not come ashore. The dogs swam after them, chasing them up and down the pond for a long time. Finally, the exhausted dogs came ashore and were removed. The cygnets climbed onto the nesting raft and settled into a lengthy period of preening and wing-lifting. These comfort movements were abnormally prolonged beyond what the functional care of the plumage warranted. The speed of wing-lifting gradually slowed and finally stopped. It is clear that many of these observations of wing-lifting were of stressed or aroused birds.

Above: Figure 8. Wing flap display. A threat with vigorous stamping. *Photo: Amanda Kerr.*

Right: Figure 9. Wing-lifting. *Photo: Harry Lumsden*

Appeasement

Appeasement is expressed by swans by pointing the bill down. Once when a brood with marked parents first arrived at LaSalle Park in fall, the cygnets found themselves among a host of strange adults. Frequently they expressed submission by adopting an appeasement posture with necks erect and bills pointed down, and they swam close to their parents. In contrast to the cygnet's behaviour, their parents, by reason of their brood, automatically achieved dominance over subadults, singles and broodless pairs. They maintained a posture with neck erect and head and bill horizontal.

Response to Predators

Young cygnets, which appear to be growing and developing well, sometimes disappear one by one over a period of days. I infer that such disappearance is often due to the feeding activity of Snapping Turtles (*Chelydra serpentina*) (Lumsden

2013). When breeding pairs of Trumpeters as well as non-breeders see a turtle, they attack by mounting its back and stamping vigorously. At the same time they call, uttering short sharp duet calls with their mate or companion (Lumsden 2013). At the Tottenham Conservation Area (44° 01' N 079° 49' W), a turtle once attempted to lay her eggs in a Trumpeter nest. The swan was incubating when the turtle was photographed on the nest from 11-15 June 2018. Its presence disturbed the pair, which mobbed and stamp attacked it. They failed to deter it and finally deserted their nest. Hansen *et al.* (1971) saw a stamping attack perpetrated on a swimming beaver.

At Aurora on 21 March 2013, two coyotes trotted across the ice within 15m of four swans which sat on the water maintaining the upright posture (Lumsden 2013). There was no panic; they just remained alert and silent. The coyotes did not look directly at the swans and showed no outward evidence of interest. On 9 April at Aurora, a coyote was lying on the far bank of the pond. About 50 m away from him, the adult male H09 sat on the water silent but very alert with three others.

Trumpeters respond to the presence of foxes with relative indifference. At first light on a March morning in 2017, six swans stood on the ice near the open water. A fox was sitting on the ice about 6m from them, eating swan excrement. The swans showed no inclination to seek refuge in the water and stood silent. This episode ended when the fox trotted away up the bank, jumped the fence and disappeared. On 2 April 2018, a fox trotted along the shore within a few metres of swans in the water. The swans followed its progress in the forward posture (Lumsden 2013).

Mink have been reported taking cygnets (D. Foxall pers. comm.) and twice big male mink attacked adult swans at Aurora but did not succeed in killing them. The swans, while much bloodied, survived. Swans respond to mink with an alert posture and approach mink in the same manner that they did to foxes.

I have one report of a Bald Eagle (*Haliaeetus leucocephalus*) in Ontario killing a Trumpeter. This was witnessed by Sylvia Hutchens on the Trent-Severn waterway on 12 January 2017. The swan, M53, was a three year old male. Only bones of this bird were recovered by David Best on 3 April 2017. Necropsy by Dr. D. Campbell (Canadian Wildlife Health Cooperative) reported that lead levels in the humerus of this bird (22ug/g) were markedly elevated above that of healthy birds in which 0 lead would be normal. This indicated significant exposure to lead over this bird's lifetime. It is probable that the behaviour and functioning of this swan was compromised by lead poisoning. It thus attracted attention and fell victim to the eagle. At LaSalle Park on the shore of Hamilton Bay, ducks are regularly hunted by a yearling Bald Eagle. The swans pay little attention to it and no attempted attacks on the swans have been observed.

Acknowledgments

Gerry Markhoff and Allan Scott provided transportation and helped with a blind. Vernon Thomas provided many titles from the University of Guelph Google Scholar Search Engine and suggested many improvements to the manuscript. Diana Lumsden typed numerous drafts. I am most grateful to the editors C. Weseloh, K. Abraham and C. Risley for their many suggestions which greatly improved the MS.

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