

Articles

Brown-headed Cowbird Parasitism of Northern Mockingbirds in Ontario

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Starting about the mid 1800s, the Brown-headed Cowbird (*Molothrus ater*) began to spread eastward into Ontario in the wake of clearing of the original forests for agriculture. It was probably absent from the Port Hope region, somewhat east of the Greater Toronto Area (GTA), between 1817 and 1840, but was present in the southern counties of Ontario by 1886 (De Vos 1964). At that time, the Northern Mockingbird (*Mimus polyglottos*) had barely reached Ontario, having been first recorded in the Province in June 1860 (Wright 1921). But during the twentieth century, it gradually spread northward into Ontario as part of a general continent-wide expansion along the northern limits of its range. The colonization of southern Ontario by mockingbirds was initially very slow and erratic, and there were only a handful of breeding records for the GTA prior to 1950. Indeed, in his popular book, *Ontario Birds*, Snyder (1951) described the mockingbird as "too rare and restricted in its range in Ontario to be dealt with in any detail".

However, by the time of the first Ontario Breeding Bird Atlas in

1981-1985 (Cadman et al. 1987), the Northern Mockingbird had become well-established in the Niagara peninsula, although its contiguous breeding range ended at Hamilton. At that time, there were only ten 10-km squares with breeding evidence mapped across the GTA, and of those, only one square indicated confirmed breeding (Curry 1987). Published in the same year as the first Atlas, *Breeding Birds of Ontario: Nidiology and Distribution, Volume 2: Passerines* (Peck and James 1987) contained no reference to Northern Mockingbird nests being parasitized by Brown-headed Cowbirds in Ontario. And to emphasize the point, a subsequent update commented that: "although the Northern Mockingbird is reported to be an acceptor species (Rothstein 1975), the absence of parasitism in Ontario is noteworthy" (Peck and James 1998a).

Prompted by the spread and increase in numbers of Northern Mockingbirds in the GTA, which had become apparent even before the first year of fieldwork for the second Atlas, we began a more intensive survey across the area, and

during the period 2001-2004, we found nine cases of cowbird parasitism among 483 active mockingbird nests, as described below. For convenience, the 10-km square reference for each nest site has been provided (North American Datum

1983) as used by the second Ontario Breeding Bird Atlas Project (2001-2005). Details concerning these nests will be provided to the Ontario Nest Records Scheme (ONRS) when the main findings of this study have been published.

Nest 1: 16 May 2002, York R.M. [17PJ25]. On 10 May, a completed and lined mockingbird nest was found at 1.0 m height in a small spruce (*Picea* sp.). Three mockingbird eggs and one cowbird egg were in the nest on 16 May. The eggs were warm and the female mockingbird was seen to be at the nest on 16 and 17 May. The first egg date for this clutch (assuming four mockingbird eggs) is estimated to have been between 11 and 13 May. When checked on 24 and 28 May, the eggs were cold, no adults were seen and the nest appeared abandoned. It may have been deserted because of an unseasonably cold spell from 17 to 20 May, which we believe caused several other nests to be deserted, as opposed to the presence of the cowbird egg. During the last visit on 4 June, one mockingbird egg was broken on handling, revealing a yellow yolk with a pinhead-sized embryo.

Nest 2: 1 June 2002, York R.M. [17PJ35]. An unhatched cowbird egg and three mockingbird nestlings about five days old were found in a nest at 1.1 m height in a 1.5 m spruce. Hence, the calculated first egg date would have been 13 May for a clutch of four eggs. These well-grown nestlings were accidentally disturbed on 5 June when they were nine or ten days old; the cowbird egg was still inside the nest. Assuming that it had been incubated together with the mockingbird eggs for the whole period, it was likely infertile. However, occasionally a female cowbird may lay an egg after the completion of the host's clutch or even after the host's eggs have hatched (Walkinshaw 1949).

Nest 3: 19 July 2002, City of Toronto [17PJ33]. A nest of a pair of mockingbirds was found to contain a single, cold cowbird egg. This nest was 1.2 m high in a small spruce and there were no mockingbirds in the area. On 14 August, the nest was found to be empty, with the cowbird egg missing and the nest lining loose and tossed up, perhaps indicative of squirrel depredation. Considering that the date of this nest does not conform with the other eight nests, it is possible that it was also initiated and parasitized much earlier, then subsequently abandoned. We also suspect that human interference might have occurred at this nest, as it was located near a well-used walking trail in a park.

Nest 4: 3 May 2003, York R.M. [17PJ25]. A mockingbird nest at 1.0 m height in a honeysuckle (*Lonicera* sp.) bush contained three warm eggs. Two days later, at 1030h, it was found that a cowbird egg had been deposited in this nest, which still had three mockingbird eggs. All these eggs were warm, and the female was on the nest but did not scold. On 10 May, there were only two mockingbird eggs (both with single 2 mm punctures on the side) and the cowbird egg (Figure 1). The nest was tidy and undisturbed, but the eggs were very cold. Although the pair was about 150 m away, they did not come to defend the eggs. On 15 May, the puncture on one of the eggs was larger than before (now about 5 mm long) and the egg yolk was visible through the hole. The cowbird egg was still intact and the nest was clearly abandoned. Assuming that the cowbird had not yet removed an egg on 4 or 5 May, the first egg date for this clutch of three was 1 May. This case is interesting in that it suggests the cowbird may have returned subsequent to its egg-laying visit. Perhaps in attempting to remove one or more eggs, it ended up puncturing them instead? Another possibility is that some other species, such as a House Wren (*Troglodytes aedon*), was involved, although we never observed any at that site.



Figure 1: Northern Mockingbird nest with Brown-headed Cowbird egg, York R.M., 10 May 2003. Note that both mockingbird eggs have small punctures. Photo by Winnie Poon.

Nest 5: 18 May 2003, Peel R.M. [17PJ03]. At 1900h, a nest with three mockingbird eggs and one cowbird egg was found at 0.9 m height in a 2.5 m spruce on the side lawn of a parking lot. The mockingbird eggs hatched successfully, and three nestlings about three days old were seen on 31 May. But there was no cowbird egg or nestling in the nest on that date. When checked again on 15 June, it was found that the three nestlings had fledged but died afterwards. One had been squashed by a car in the adjacent parking lot, and another was dead on the lawn near the nest. Both were at least 10 days old, but may have fledged prematurely (perhaps as a result of human disturbance). The third nestling's fate was unknown. The calculated first egg date for this clutch (assuming four eggs) was 14 May.

Nest 6: 9 May 2004, City of Toronto [17PJ22]. A single cowbird egg was found in a mockingbird nest at 0.9 m height in a 4 m spruce. The egg was very cold. The male mockingbird stayed close-by but did not scold when the nest was checked. A visit to the nest on 19 May found that the cowbird egg was missing, the nest was undisturbed and there were no mockingbirds around.

Nest 7: 9 May 2004, Peel R.M. [17PJ02]. A mockingbird nest found at 1.0 m height in a 2.3 m spruce had three mockingbird eggs and one cowbird egg. Two of the mockingbird eggs were intact but one was broken in half with the yolk dried up. A fourth mockingbird egg was balanced among spruce twigs and needles just outside the nest; this egg was punctured with two small 1.0 mm holes on the side, about 3.0 mm apart (Figure 2). All the eggs were very cold and the nest was clearly abandoned, as the pair had already re-nested nearby with three eggs laid. The calculated first egg date for the re-nesting was 7 May; therefore, the cowbird egg was probably laid during the first few days of May.



Figure 2: Brown-headed Cowbird-punctured Northern Mockingbird egg, Peel R.M., 9 May 2004. Photo by Winnie Poon.

Nest 8: 15 May 2004, Peel R.M. [17NJ94]. At 1155h, we found a mockingbird nest at 1.0 m height in a 2.4 m Blue Spruce (*P. pungens*). It contained a single cowbird egg. On the ground below the nest was a damaged mockingbird egg, with a 5.0 mm lengthwise puncture on the side and the yolk semi-dried; this egg had probably been removed by the cowbird within the previous few days (Figure 3). The cowbird egg was warm and the female mockingbird was seen emerging from the nest tree, but it is uncertain whether it had actually been on the nest. The pair scolded slightly during nest checking but were later seen to be building a new nest nearby. It so happened that at 1215h, we observed a female cowbird come to a spruce beside the mockingbird nest tree. The mockingbirds were not present at this time. It entered the top of the spruce at about 3 m height, where we subsequently found that a House Finch (*Carpodacus mexicanus*) nest was located, and remained hidden in the foliage for about 20 seconds. The cowbird then emerged, briefly looked around, re-entered the nest, and almost immediately re-emerged with an egg held lengthwise. In the space of a few seconds, it crushed the egg in its bill, swallowed it and flew off. The House Finch nest was too high for us to examine the contents, but this rarely witnessed occurrence confirms that a Brown-headed Cowbird was actively monitoring other nests in the immediate vicinity. On 12 June, the cowbird egg was found to be missing from the mockingbird nest, and it was not on the ground below. The nest lining was extensively disturbed (tossed up). Since the nest had been abandoned for some time, it seems likely that the cowbird egg was removed by an unknown mammalian predator, perhaps a squirrel (Sciuridae).

Nest 9: 24 May 2004, City of Toronto [17PJ12]. On 19 May, we found a completed and lined empty mockingbird nest at 1.8 m height in a 4 m spruce. The nest contained three mockingbird eggs plus one cowbird egg on 24 May at 1955h. We could not find any removed mockingbird



Figure 3: Northern Mockingbird egg ejected by Brown-headed Cowbird, Peel R.M., 15 May 2004. Photo by Winnie Poon.

egg caught in the spruce or on the ground below. Although one adult mockingbird came off the spruce, it did not scold. It was uncertain whether the female had been on the nest, since the eggs were cool. On 10 June, there were three mockingbird nestlings, about five days old, but there was no cowbird egg in the nest, on the spruce, or on the ground below. On 20 June, the nest was empty; the singing male was close-by but not agitated. The nestlings might have fledged but the outcome was unknown. The calculated first egg date for this nest was 23 May.

Parasitism Frequency

In total, nine cases of Brown-headed Cowbird parasitism were found during a four-year study period (2001-2004). During this period, a total of 483 *active* mockingbird nests were found in the GTA (12 in 2001, 111 in 2002, 180 in 2003, and 180 in 2004), for an overall *observed* parasitism rate of 1.9%. Prior to this study, there were no published reports of Brown-headed Cowbird parasitism involving Northern Mockingbirds in Ontario (Peck and James 1987, 1998a), but their data were based on

a much smaller sample of 74 nests (107 as of 1998), which had been reported to the Ontario Nest Records Scheme. This confirms what was previously known (Friedmann 1934, Friedmann et al. 1977), namely that the Northern Mockingbird is an *infrequent* victim of Brown-headed Cowbird parasitism compared to many other species of passerines which are commonly found within its range. In the GTA, the list of such species which may occur in the same types of habitat as Northern Mockingbirds, and

which have relatively high parasitism rates, would include: Willow Flycatcher (*Empidonax traillii*; 26.8%), Yellow Warbler (*Dendroica petechia*; 29.6%), Northern Cardinal (*Carduelis carduelis*; 21.1%), Chipping Sparrow (*Spizella passerina*; 32%), Song Sparrow (*Melospiza melodia*; 23.2%), and House Finch (*Carpodacus mexicanus*; 42.2% as of 1987, but dropping to 27.5% by 1998). The parasitism rates quoted are those reported for Ontario by Peck and James (1987, 1998a, 1998b). Of those listed, only the House Finch occurs frequently in the mockingbird territories we have investigated; the others are found only rarely (very rarely in the case of Willow Flycatcher and Yellow Warbler).

Parasitism rates are typically under-reported due to a number of biases related to the response of the host (Friedmann et al. 1977). For species which eject the cowbird egg, one would not know that parasitism had occurred, unless the observer actually saw the incident in progress. And if nests are deserted, they are simply less likely to be found. But in our study, we frequently checked all the potential nesting habitat in the vicinity of an active nest, looking for evidence of previous usage of the site. So we may have found more cases than would have occurred by chance, as represented by the ONRS data.

Parasitism Timing

Seven of the parasitized nests were found in May, with only one nest

found in each of June and July, but probably all the cowbird eggs were laid in May. The calculated first egg date for Nest 2 was 13 May, while the single cowbird egg in Nest 3 could have been there from May as well. Egg dates for Brown-headed Cowbird range from mid to late April until mid July (Lowther 1993). In Ontario, reported egg dates for Brown-headed Cowbird range from 17 May to 5 August, while those for Northern Mockingbird span the period 23 May to 8 August (Peck and James 1987). However, we have found that some mockingbirds can begin nesting as early as mid April, with the earliest GTA egg date so far recorded being 14 April, and they typically attempt two or three broods per season in the GTA (RBHS and WP, unpublished data). So there is no lack of mockingbird nests in June and July, but nearly all the observed parasitism occurred early in the season, with eight of nine cases observed before 22 May.

A single Brown-headed Cowbird can lay up to 40 eggs during one breeding season (Lowther 1993). In southern Ontario, it was found that the average laying period for Brown-headed Cowbirds fell between 4 May and 28 June; this period marking the dates between which 50% of female Brown-headed Cowbirds had laid their first egg, and after which 50% had ceased laying for the season (Scott and Ankney 1980). These data were obtained for the area surrounding

London, Ontario, about 200 km southwest of the GTA, but would likely apply to the GTA as well.

Given the number of Northern Mockingbird nests which were found in our study, we can look at the data in terms of *available* host nests by five-day period. Five-day periods were selected on the assumption that for a typical mockingbird clutch of four eggs, the five days starting on the day before the first egg represent the optimal period for parasitism to occur. Using only those nests where the first egg date can be allocated to a specific five-day period yields the results shown in Table 1. Only data for April and May are presented; there were of course many nests in June and July also, but those were probably not relevant to the parasitism which was observed. The parasitism rate, based on the total number of mockingbird nests *known* to have been available in May alone, was actually 4.5%, greater than the *overall rate* of 1.9% but still quite low compared to the other species listed previously.

Parasitism Response

Although the Northern Mockingbird has been categorized as an "accepter" species, the other mimids regularly found in Ontario, Gray Catbird (*Dumetella carolinensis*) and Brown Thrasher (*Toxostoma rufum*), have been described as "rejecter" species. Furthermore, the designation as an accepter species appears to have been based on

experiments involving no more than five nests (Friedmann et al. 1977). A rejecter species is one which responds to the parasitic egg by physically removing it. This is considered to be a more highly evolved condition, since "nest desertion and egg burial may not be anti-parasitic adaptations but by-products of standard avian behavior patterns" (Rothstein 1975). Unfortunately, our observations are somewhat equivocal as to whether the Northern Mockingbird should be considered an accepter species. In most cases (six out of nine), the attempted parasitism was followed by abandonment of the nest, often with subsequent re-nesting nearby. In the cases of Nest 5 and Nest 9, the mockingbirds *may* have responded by ejecting the cowbird egg, but this cannot be known for certain. In the two cases where a nest in which young mockingbirds hatched held a cowbird egg, it either did not hatch (Nest 2) or disappeared at some time during incubation or while the young were less than five days old (Nest 9).

Nest 1 and Nest 4 showed some initial acceptance of the cowbird eggs, since they were found to be warm and the females were still on the nest; so nest abandonment must have been a delayed response. However, desertion of Nest 1 may have been caused by an unseasonably cold spell, rather than the cowbird egg itself. The case of Nest 2, where the cowbird egg was allowed to remain in the mockingbird nest even to the fledgling stage, shows

Table 1: Initiation of early-season Northern Mockingbird nests in the GTA, by 5-day period.

Date	April							May							Total	%
	1-5	6-10	11-15	16-20	21-25	26-30	Unk	1-5	6-10	11-15	16-20	21-25	26-30	Unk		
2002																
# Nests					1	3	1		2	3	3	6	6	13	38	
# Parasitized										2				1	3	7.9%
# Deserted						1			1	2	1	2	1	4	12	31.6%
2003																
# Nests					3	5	4	8	7	4	3	9	12	22	77	
# Parasitized								1		1					2	2.6%
# Deserted						2		3	1			1	1	2	10*	13.0%
2004																
# Nests			1	1	6	11	2	11	8	6	5	9	3	21	84	
# Parasitized								1		1		1		1	4	4.8%
# Deserted						1	1			1				5	9*	10.7%
Totals																
# Nests			1	1	10	19	7	19	17	13	11	24	21	56	199	
# Parasitized								2		4		1		2	9	4.5%
# Deserted						4	1	3	2	3	1	3	2	11	30**	15.0%

Note: Nests initiated in June, July and August are not shown in this table. Unk = unknown date.

* Includes one nest deserted in April or May. ** Includes two nests deserted in April or May.

that it may be accepted on occasion; but why this cowbird egg failed to hatch remains unknown. One possibility is that the egg size difference leads to inefficient incubation of the smaller cowbird egg (G.K. Peck, pers. comm.). Average egg dimensions are 18.5 x 24.5 mm for Northern Mockingbirds from Pennsylvania/Maryland (Derrickson and Breitwisch 1992) and 16.42 x 21.45 mm for Brown-headed Cowbird (Bent 1958); see also Figure 1 for relative sizes.

Table 1 also shows the number of deserted nests by five-day period, and these data are expanded in Table 2. Nests were counted here if they previously held one or more eggs, and still held one or more eggs after being judged as deserted. Cases where all the eggs disappeared were attributed to depredation. The numbers in 2002 were influenced by an unusual, late cold spell during the period 17-20 May. It is difficult to be certain of the reason or reasons for nest desertion, but cold weather and partial depredation were the most frequently attributed causes, followed by "unknown". Some of these "causes" may be linked; for example, a nest already deserted due to chilling during a cold spell would presumably be more prone to subsequent depredation, and might have been recorded in this category when in fact the underlying cause was weather-related. We suspect that unusually cold or wet weather is a primary cause of nest desertion for GTA mocking-

birds, partly because we have seen a few cases where all the young were dead in the nest following similar weather events. One may conclude that cowbird parasitism is not the most important factor influencing nest desertion in the GTA.

Furthermore, the impact on overall nesting success must be very minor. Using the simplistic criterion that a successful nest is one which fledged at least one young, we observed an overall success rate of 56% (ranging from 50% in 2002 to 63% in 2004; n=483). The corresponding failure rates ranged from 18% in 2004 to 32% in 2002, and the outcome of the remaining nests was unknown, due to insufficient monitoring.

Nest Tree Species

Except for Nest 4 which was in a honeysuckle bush, all the mockingbird nests that were parasitized were in small spruces. These nests were only partially hidden and could be easily seen through the spruce branches. In the case of the honeysuckle, it was still leafless and the nest was particularly exposed with almost no overhead covering. As the majority of mockingbird nests (about 59%) found in the GTA during the 2001-2004 seasons were in small coniferous trees, with about 44% in small spruces (RBHS and WP, unpublished data), it is not unexpected that most parasitized nests were also found in the same tree species. However, it is possible that more of the early nests are

Table 2: Deserted Northern Mockingbird nests in the GTA, 2002-2004.

Assumed Reasons	April			May			June			July			Aug			Total
	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	2002	2003	2004	
Cold weather or rain		2		4*	4	1		1				1				13
Partially depredated				4	2	1		1	1			1				10
Unknown cause				2	2	1			3		1	1				10
Cowbird parasitism			1		1	2				1**						5
Broken/damaged egg				1	1	1										3
Badly built nest			1				1	1								3
Human Disturbance	1					1						1				3
Unhatched egg											1	1				2
Totals	1	2	2	11	10	7	1	3	4	1	2	5	0	0	0	49

* Including 1 parasitized nest. ** Probably occurred in May.

found in spruces, while later in the season more use is made of deciduous species of shrubs and trees (we have not yet analyzed the data for this possibility). But we think this is unlikely to be significant because GTA mockingbirds continue to use spruces throughout the season, and in many territories they provide the only suitable nesting sites. Given that the majority of parasitized nests occurred in small spruces, the degree of concealment or overhead cover would not have changed significantly during the course of a season, so this is most unlikely to have had an impact on the observed frequency of parasitism.

Discussion

A number of interesting questions are raised by our findings, such as why are the early nests most impacted, but overall so few appear to be

parasitized? We suggest a possible explanation. During April and early May, cowbirds in the GTA have only a limited range of host species' nests available to them, of which those most frequently found in the same areas as mockingbirds include American Robin (*Turdus migratorius*) and House Finch. But the American Robin is a known rejecter species and would be an unsuitable host for this reason. The House Finch is of course a very recent colonist in Ontario, with the first nest recorded at Niagara-on-the-Lake in 1978 (James 1978). During the period 1980-1994, it spread quite rapidly throughout southern Ontario, initially occupying the major urban areas. However, the House Finch population appears to have declined in recent years (Tozer 1997). It too is a completely unsuitable host for the Brown-headed Cowbird, since the

young are fed a diet of seeds, and no young cowbirds are successfully fledged from House Finch nests. Although it was heavily parasitized by the Brown-headed Cowbird in the early years, the parasitism rate has declined significantly, perhaps in response to this negative selection pressure (Peck and James 1998b).

Nonetheless, it seems likely that early in the season many cowbirds concentrate on finding House Finch nests, as suggested by Graham (1987). In Ontario, the House Finch starts nesting early, with an egg date of 21 March recorded (Kozlovic 1988), and overall egg dates of 22 March to 6 August given by Peck and James (1998b). It also offers nest dimensions (inside diameter 5.0 to 7.0 cm) within the range (3.8 to 7.6 cm) which seems most favoured by cowbirds (Peck and James 1987). The House Finch often utilizes small coniferous trees in areas also frequented by mockingbirds. Peck and James (1987) reported that 107 of 119 House Finch nests (90%) were in coniferous trees, and of those, 48 were in spruce. In the GTA, small spruces are very frequently planted for landscaping purposes in most new industrial areas, also in new parks, and for screening along major roads, railways, the edges of shopping mall parking lots, and elsewhere. All these situations represent micro-habitats in which we have frequently found Northern Mockingbirds, and we suggest that while individual cowbirds are monitoring their House Finch victims, they inevitably find a few

Northern Mockingbird nests as well.

But the Northern Mockingbird is not an ideal host for the Brown-headed Cowbird. On the contrary, it is watchful, aggressive, and defends its nest and territory staunchly against all possible dangers, including hawks, dogs, cats and human investigators! No doubt any cowbird "caught in the act" would be attacked severely. Furthermore, the mockingbird egg is probably just a little too large for the cowbird to deal with efficiently. We suspect that a Brown-headed Cowbird cannot hold a typical mockingbird egg between the mandible and maxilla, as we observed in the case of the House Finch egg. It therefore attempts to impale a mockingbird egg with its bill tips, as in the photograph of a Brown-headed Cowbird with an impaled egg of a Chestnut-sided Warbler (*Dendroica pensylvanica*) in Bent (1958). This could account for the punctures we have seen on several eggs, and particularly the case of Nest 7 where we found an egg with two punctures close together, caught in spruce twigs and needles just outside the nest. We suspect that the Northern Mockingbird egg is slightly too heavy to be transported after having been impaled, so the cowbird is forced to jettison it quickly, or the eggshell "bridge" separating the two punctures gives way and the egg is dropped.

There is an opportunity here for a patient observer to find out exactly how a Brown-headed Cowbird attempts to remove and

carry off a mockingbird egg. But it would be a matter of real luck to observe this, given the low frequency of parasitism recorded. We suspect that by late May, more nests of a wider variety of more suitable hosts become available to the cowbirds, as most of the summer migrants return to their territories and initiate nesting activities. Thus, as the season progresses, Brown-headed Cowbirds can ignore mockingbird nests, which based on our findings are unproductive as far as the cowbirds are concerned.

We now have a possible explanation as to why the ONRS data did not contain any reports of cowbirds parasitizing mockingbird

nests. The first egg date for the data set analyzed by Peck and James (1987) was 23 May. Whether by chance or otherwise, it seems that the ONRS cards at that time only included nests initiated somewhat later in the season than many found in our study. If so, the ONRS data set would have missed the peak period for cowbird parasitism.

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Distinguished Ornithologist Award

The Distinguished Ornithologist Award is granted by the Ontario Field Ornithologists to individuals who have made outstanding and authoritative contributions to the scientific study of birds in Ontario and Canada, who have been a resource to OFO and the Ontario birding community, and whose research on birds has resulted in numerous publications and a significant increase in new ornithological knowledge. Recipients to date have been: Earl Godfrey (1997), Ross James (1998), Murray Speirs (2000), George Peck (2001), Bruce Falls (2002), Bob Curry (2003), and Jim Rising (2004). The editors of *Ontario Birds* (Bill Crins, Ron Pittaway and Ron Tozer) form a committee responsible for proposing candidates for this award to the OFO Board of Directors.