

cess ranged from 66.7% (1990) to 78.3% (1989) (Table 3). An average of 3.9 eggs was laid per nest and an average of 3.5 young was fledged per successful nest. For all seasons and study areas combined, approximately 65% of the eggs laid resulted in fledged young (0.72 successful nests x 3.5 average fledged per nest / 3.9 eggs laid per nest).

The three study areas differed in nest success and productivity. Over the three-year breeding period, bluebirds at the Morton Arboretum site had an average success rate of 76.6%, and an average of 68.2% of the eggs laid resulted in fledged young. The bluebird nests at the McKee Marsh site, on the other hand, had an average success rate of 63.5% and only 56.6% of the eggs laid resulted in fledged young. The Fermilab site had too few bluebird nests to make valid comparisons.

Failures

During the first year of the study, House Wrens were the major known cause of bluebird nest failure, resulting in a 6.7% loss of bluebird eggs. This rate dropped to 3.0% during the second year and rose to 4.7% during the third year (Table 4). House Wren competition was most prominent at the arboretum site which has a greater abundance of the brushy, shrubby habitat that the wrens prefer.

During the second year of the study, predation by raccoons (*Procyon lotor*), as evidenced by tracks and type of destruction, was the major known cause of nest failure. Raccoons caused no loss of eggs at any of the sites in 1989, but were responsible for a 10.7% loss of bluebird eggs during 1990. At McKee Marsh during that year, 25% of the bluebird eggs were lost to raccoons. With the installation or application of anti-predator devices, the overall failure due to raccoons dropped to 4% in 1991.

Tree Swallow competition was a cause of bluebird nest failure only at the McKee Marsh site (11.5% egg loss in 1990), where boxes were situated in much more open habitat than at the other two sites. The placement of a second nest box within three to six meters of a box at which bluebird and tree swallow competition was occurring almost always resulted in successful nesting by both species, one in the original box and one in the new one. In one instance however, Tree Swallows nested in both boxes, at a distance of only 2.5 m apart; a rare occurrence for such a territorial species.

Human interference with nests or young was not a major factor until the third year of the study, but did cause 7.4% of the eggs to fail that year, mainly from vandalism (destruction of nest boxes, removal of hardware etc.) to occupied nest boxes.

Unknown causes of failure include such factors as infertile or ab-

Table 3. Eastern Bluebird nesting data for three DuPage County, Illinois study sites.

	1989A*	1989M	1989F	1989T	1990A	1990M	1990F	1990T	1991A	1991M	1991F	1991T
Number of nests	33	12	1	46	64	22	1	87	62	8	5	75
Number of eggs laid	144	45	5	194	277	61	0	338	251	31	15	297
Eggs/nest (clutch)	4.4	3.8	5.0	4.2	4.3	2.8	0	3.9	4.1	3.9	3.0	3.6
Eggs hatched	109	36	4	149	208	40	0	248	195	21	5	221
(percentage)	(75.7)	(80)	(80)	(76.8)	(75.1)	(65.6)		(73.4)	(77.7)	(67.7)	(66.7)	(74.4)
Eggs hatched/nest	3.3	3.0	4.0	3.2	3.3	1.8	0	2.9	3.2	2.6	1.0	2.9
Nestlings lost	12	2	0	14	17	12	0	29	24	6	0	30
(percentage)	(11.0)	(5.6)		(9.4)	(8.2)	(30)		(11.7)	(12.3)	(28.6)		(13.6)
Young fledged of eggs laid	97	34	4	135	191	28	0	219	171	15	5	191
(percentage)	(67.4)	(75.6)	(80)	(69.6)	(68.9)	(45.9)		(64.8)	(68.1)	(48.4)	(33.3)	(64.3)
Young fledged of eggs hatched	97	34	4	135	191	28	0	219	171	15	5	191
(percentage)	(88.9)	(94.4)	(80)	(90.6)	(91.8)	(70)		(88.3)	(87.7)	(71.4)	(100)	(86.4)
Young fledged/nest	2.9	2.8	4.0	2.9	2.9	1.3	0	2.4	2.8	1.9	1.0	1.9
Successful nests-at least one fledged	24	11	1	36	50	8	0	58	49	5	1	55
(percentage)	(72.7)	(91.7)	(100)	(78.3)	(78.1)	(36.4)		(66.7)	(79)	(62.5)	(20)	(73.3)
Productivity-young fledged/successful nest	4.0	3.1	4.0	3.6	3.6	3.5	0	3.6	3.5	3.0	5.0	3.3
				3.8**								3.8**

*A=Morton Arboretum, M=McKee Marsh, F=Fermilab, T=total

**Productivity calculated with (top number) and without (bottom number) Fermilab data, which skews results.