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Return Rates in Two Temperate Breeding Orioles (*Icterus*)

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ABSTRACT.—We monitored two migratory oriole species, Baltimore (*Icterus galbula*) and Orchard (*I. spurius*) orioles, for information on return rate and pair fate over 4 years. The return rate after migration for Baltimore and Orchard orioles was low (38 and 35%, respectively). Pairs were more likely to dissolve due to non-return of one or both members than they were to reunite or change mates. Pair members infrequently returned to the study site and previous pairs had little opportunity to reunite in the next year. Birds with non-returning mates appeared to take advantage of the first available mating opportunity instead of waiting for the return of their previous partners. *Received 4 February 2008. Accepted 11 July 2008.*

An individual bird that forms a seasonal pair bond has two choices if it survives to return to its breeding site; either reunite with its partner from the previous year or seek a new mate (Black 1996). Each strategy has specific advantages and disadvantages. Reunion or mate change are often not options in species where survival is low and pair members frequently do not return to the breeding site (Choudhury 1995).

We investigated rates of seasonal return after migration, and patterns of pair formation

in Baltimore (*Icterus galbula*) and Orchard (*I. spurius*) orioles. Both species are temperate-breeding, migratory birds which are considered socially monogamous (Ollason and Dunnet 1978, Rising and Flood 1998, Jaramillo and Burke 1999). The maximum observed life spans for Baltimore and Orchard orioles are 11 and 9 years, respectively (Rising and Flood 1998, Jaramillo and Burke 1999). Previous studies have addressed the issue of monogamy and extra-pair mating in orioles (Edinger 1988, Richardson and Burke 1999), but few data have been published on post-migration return rates and pair fates of oriole species. Our objectives were to: (1) examine return rates after seasonal migration, and (2) identify which pair fate is most common (reunion, mate change or loss of mate due to non-return).

METHODS

We captured 53 Baltimore Orioles (26 pairs) and 78 Orchard Orioles (39 pairs) using mist nets and marked them with three band combinations (1 aluminum band and 2 color bands). Pairs were observed at three study sites in Maryland, USA during the breeding seasons of 2002–2005. These sites were designated Croom (89 ha), Monocacy (24 ha), and University of Maryland, Baltimore County (UMBC, 24 ha). Baltimore Orioles were absent from the Croom site and data for this

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TABLE 1. Baltimore and Orchard oriole return rates, Maryland 2002–2005.

Species/Parameter	2002	2003	2004	2005	Average
Baltimore Oriole					
Newly arrived	14	9	8	22	
Returned	NA	6	5	5	
Did not return	NA	8	10	8	
Total present	14	15	13	27 ^a	
Return rate, %	NA	43 (6/14)	33 (5/15)	38 (5/13)	38 (16/42)
Orchard Oriole					
Newly arrived	16	27	15	20	
Returned	NA	4	9 ^b	12 ^b	
Did not return	NA	12	23 ^b	15 ^b	
Total present	16	31	24	32 ^a	
Return rate, %	NA	25 (4/16)	29 (9/31)	50 (12/24)	35 (25/71)

^a Increased sample size due to intensive work at the Monocacy field site.

^b [# birds returned from a previous year + # not returned] does not equal total birds present from the previous year because some birds were absent for a year or more before returning.

species were only available at the Monocacy and UMBC sites.

We conducted thorough searches of each study site 6 days a week to identify individuals from previous years, and recorded the location and whether the individual was seen with another bird. Nests ($n = 30$) for Baltimore and Orchard ($n = 43$) orioles were located by conducting daily nest searches at the beginning of the breeding season. Most nests were found during the building stage by observing and following a female carrying building material. Pairs were confirmed when a male was seen interacting with a nest-building female (e.g., copulating with female, landing repeatedly on or close to nest, feeding female on nest). We monitored and confirmed pairing status throughout the nesting cycle, especially noting provisioning visits made by males. Data for each species were pooled from all three study sites.

We defined return rate as the percentage of banded birds observed the following year. Baltimore and Orchard oriole pairs were divided into three main categories to investigate pair fate: reunited pairs, lost pairs, and pairs that changed mates. These terms describe the fate of a pair in the next season after they have paired for one season. A lost pair occurred when at least one member of a previous pair failed to return to the study site. Lone returners were individuals that returned while their mate did not.

Two additional categories were defined to

encompass the remainder of the pairs observed: first pairs and mixed pairs. Placement in these categories was based on each pair member's experience on the study site. A pair that formed between two newly banded birds was considered a first pair, whereas a pair that formed between a newly banded bird and a banded/experienced bird was considered a mixed pair. An experienced bird was a bird that had previous pairing experience on the study site. A newly banded bird was a bird with no previous experience on the study site. Pairs present in 2002 were not placed into categories because all birds in the first year of the study were newly banded. A proportion of the birds we designated newly banded may have obtained breeding experience at a different site and arrived at one of our sites via breeding dispersal.

RESULTS

Return Rates and Pair bonds.—The majority of pairs that formed during one breeding season had no opportunity to reunite in the next season because one or both pair members did not return. The return rate was 38% for Baltimore Orioles and 35% for Orchard Orioles (Table 1). Pair bond duration for both species averaged about one season. Only two pairs (Orchard = 1, Baltimore = 1) during our 4-year study remained paired for more than one season. Baltimore Orioles averaged 0.87 (SD = 0.98) mates per study period (4 years), while Orchard Orioles averaged 0.92 (SD =

TABLE 2. Frequency of mate change and reunion for all Baltimore and Orchard oriole pairs, and for pairs with both mates returning.

Year ^a	All pairs	Mate change due to partner's death or disappearance, %	Both mates returned (Pairs)	% Change	% Reunite
Baltimore Oriole					
2002	3	33 (1/3)	2	100 (2/2)	0 (0/2)
2003	3	67 (2/3)	1	100 (1/1)	0 (0/1)
2004	4	75 (3/4)	1	0 (0/1)	100 (1/1)
Overall	10	60 (6/10)	4	75 (3/4)	25 (1/4)
Orchard Oriole					
2002	5	100 (5/5)	0	0 (0/0)	0 (0/0)
2003	11	100 (11/11)	0	0 (0/0)	0 (0/0)
2004	7	71 (5/7)	2	50 (1/2)	50 (1/2)
Overall	23	91 (21/23)	2	50 (1/2)	50 (1/2)

^a Pairs present in 2005 were excluded from this analysis because fates of these pairs in the next year (2006) were not known.

0.83) mates. The individual with the highest number of mates, a male Baltimore Oriole, had a different mate each breeding season for 4 years.

Mechanism of Pair Formation.—Baltimore Oriole pairs between 2002 and 2004 became lost pairs in the next year more often than they reunited or changed mates (pairs were lost 60% of the time, reunited 10% of the time, and changed mates 30% of the time, when all pairs are considered). The same was true for Orchard Orioles (pairs were lost 91% of the time, reunited 4% of the time, and changed mates 4% of the time, when all pairs are considered). More mixed pairs ($n = 16$) were present than first pairs ($n = 6$) for Baltimore Orioles between 2003 and 2005. The same was true for Orchard Orioles ($n = 16$ mixed pairs, $n = 13$ first pairs).

The pattern of pair formation that was most often observed involved pairing of a lone returner with another available bird. The lone returner either paired with a newly banded bird or with an experienced bird. We observed no situations in which a lone returner disrupted a pair that had formed that same season, and no situations in which a lone returner did not pair. Lone returners most frequently paired with newly banded birds (80% of the time). When lone returners paired with experienced birds (20% of the time), the experienced birds were most often available because they were lone returners as well, although one experienced bird was available to pair with a lone returner because he did not pair with his pre-

vious mate (which was present on the study site).

Mate Change in Orioles.—Both Baltimore and Orchard orioles most often changed mates due to the death or disappearance of their partner (Table 2). Six of 10 Baltimore Oriole pairs changed mates in the next year due to their partner's death or disappearance. Twenty-one of 23 Orchard Oriole pairs changed mates in the next year due to their partner's death or disappearance. Three of four Baltimore Oriole pairs in which both partners returned in the next year changed mates and one pair reunited. One of two Orchard Oriole pairs with both partners returning in the next year changed mates and one pair reunited.

DISCUSSION

Baltimore and Orchard orioles had low rates of return to the study site and had a low tendency to reunite. It was more likely for a pair bond to dissolve in the next season, after pairing for one season, due to non-return of one or both pair members than it was for a pair to reunite or change mates. The remaining (lone returner) mate was more prone to pair with a newly banded bird than to not pair at all or to pair with an experienced bird.

Reunion occurred infrequently, as should be expected given the low probability that both previous mates will return. There is a 14% chance that both members of a previous Baltimore Oriole pair will return and a 12% chance that both members of a previous Orchard Oriole pair will return. Both members

of previous Baltimore Oriole pairs actually returned more often than expected from return rates (29% of the time) while both members of previous Orchard Oriole pairs returned less often than expected from return rates (8% of the time).

The patterns observed in these two oriole species closely parallel the mating systems of other temperate-breeding migratory birds that have low return rates. For example, the American Redstart (*Setophaga ruticilla*) is a long-distance migratory bird with a return rate of ~50% (Sherry and Holmes 1992, Sherry and Holmes 1997), and a similar pairing strategy in that pair bonds are maintained only during the breeding season (Sherry and Holmes 1997). A similar pattern has also been reported for Great Reed Warblers (*Acrocephalus arundinaceus*), which have an annual return rate of ~55% (Hansson et al. 2002) and a low tendency to reunite (Bensch and Hasselquist 1991). A conflicting pattern is shown in the Black-throated Blue Warbler (*Dendroica caerulescens*). This species has a low return rate (between 36 and 39%), yet ~80% of pairs reunite between seasons (Holmes et al. 2005). The mating system of the Eastern Kingbird (*Tyrannus tyrannus*) has a different pattern in that both return rate (69% for males, 54% for females) and reunion rate (85%) are relatively high (Murphy 1996). Little is known about other orioles, but tropical orioles, such as the Altamira Oriole (*Icterus gularis*), maintain pair bonds year-round and are thought to maintain pair bonds for life (Brush and Pleasants 2005). This pattern in a non-migratory, tropical oriole species suggests that migration affects how likely a pair is to maintain pair bonds between breeding seasons.

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