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Bobolink (Dolichonyx Oryzivorus)

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Dickcissel

Red-winged Blackbird

Bobolink
Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

Sections

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This species account is dedicated in honor of Wendy Paulson, member of the Cornell Lab of Ornithology's Administrative Board.

The Bobolink is one of the most striking passerines in North America. Males— conspicuous visually, behaviorally, and vocally during the breeding season—look like they are wearing a tuxedo backward, leading some observers to refer to this species as the "skunk blackbird." Male Bobolinks sing a long, bubbly song, often while flying low over their territories in a characteristic, helicopter-like flight. This sight was certainly the inspiration for the insightful, amusing, and onomatopoeic poem "Robert of Lincoln," written by the nineteenth-century American poet William Cullen Bryant.The Bobolink is polygynous and was one of the first species in which multiple paternity (females laying a clutch of eggs sired by more than one male) was documented. In addition, this North American breeder is an extraordinary migrant, traveling to south of the equator each autumn and making a round-trip of approximately 20,000 kilometers. One male known to be at least 10 years old presumably made this trip annually, a total distance equal to traveling 5 times around the earth at the equator! Results from birds tagged with geolocators show that Bobolinks strain our traditional notion of a stationary non-breeding range, as birds make an extended stopover in Venezuela before proceeding south to Bolivia, Paraguay, and Argentina.

Bobolinks have been shot as agricultural pests in the southern United States, trapped and sold
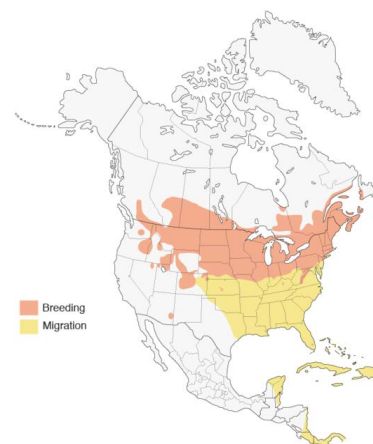
Figure 1. Breeding range of the Bobolink.

Enlarge

See text for details. This species winters in South America (see Fig. 2).

Adult male Bobolink, OH, 14 May.

Enlarge

Male in Alternate plumage is unique among North American songbirds in being entirely black below and lighter above: the front of head, tail, and wings are black, and the scapulars, lower back, rump, and uppertail-coverts are white to pale gray, with a distinctive yellow nape and nuchal collar. The dark feathers may initially be obscured by maize yellow feather fringes when fresh. This fringing wearing off during spring migration.Image via Birdshare: Bryan Hix.

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as pets in Argentina, and collected as food in Jamaica. The species is not as abundant as it was several decades ago, primarily because of changing land-use practices, especially the decline of meadows and hay fields. The Bobolink's tenacity and adaptability, however, should continue to serve it well.
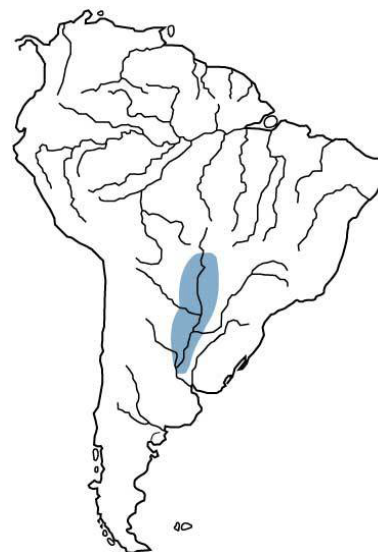
Figure 2. Principal overwintering range of the Bobolink.

Enlarge

The area of highest overwintering densities is east of the Andes in the pampas of southwestern Brazil, Paraguay, and Argentina.

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Adult female Bobolink, Chester Co., PA, 16 June.

Enlarge

Female underparts yellowish buff, streaked dusky or black on sides, flanks, and undertail-coverts; upperparts buffy olive, streaked with black. The broad, buffy median stripe on top of head, bordered on each side with a pronounced brownish or blackish stripe, is distinctive.Image via Birdshare: Kelly Colgan Azar.

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Dickcissel

Red-winged Blackbird

Bobolink
Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

Sections

Appearance

Similar Species

Medium-sized (total length 15.2–20.5 cm; male mass 34–56 g, female mass 29–49 g) icterid of tall grass, hay fields, and meadow habitats. Sexes dichromatic in Alternate plumage but similar in Basic plumage; no significant geographic variation. Distinctive features in all plumages include rigid, sharply pointed rectrices and long hind toenails. Bill short and conical, iris brown. Male in Alternate plumage is unique among North American songbirds in being entirely black below and lighter above: anterior portion of head, tail, and wings black; scapulars, lower back, rump, and uppertail coverts white to pale gray; yellow nape and nuchal collar; glossy black bill. By mid-Aug, before departing breeding range, males molt into Basic plumage, lose bill pigmentation, and resemble females.

Female underparts yellowish buff, streaked dusky or black on sides, flanks, and undertail-

Bobolink, male, Ithaca NY, June

Enlarge

Bobolink, male; photographer Marie Reed

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coverts; upperparts buffy olive, streaked with black. The broad, buffy median stripe on top of head, bordered on each side with a pronounced brownish or blackish stripe, is distinctive. Side of head yellowish olive with prominent black postocular line. Tail and wings brownish dusky with conspicuous yellow-olive edgings. Bill pale, horn-colored. Overall appearance is sparrow-like, but distinguished by larger size, elongated hind claw, and distinctive stiff, pointed rectrices. Immatures resemble females but are generally more yellow.

Detailed Description

Bobolinks have 9 functional primaries, 9 secondaries (including 3 tertials), and 12 rectrices. Little or no geographic variation in appearance (see Systematics: Geographic Variation) or geographic or sex-specific variation in molt strategies reported.

Plumages

Following based primarily on detailed descriptions of Dwight (Dwight 1900c), Ridgway (1902), Oberholser (1974), Cramp and Perrins (Cramp and Perrins 1994b), and Jaramillo and Burke (1999); see Pyle (1997a) and Nocera (2005) for age- and sex-determination criteria. Ages differ slightly and sexes markedly in
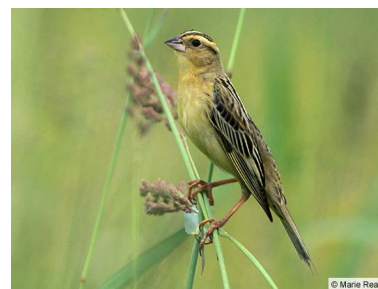
Bobolink, female, Ithaca NY, June   Enlarge

Bobolink, female; photographer Marie Reed

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Figure 6. Annual cycle of the Bobolink, Wisconsin.   Enlarge

Annual cycle of breeding, molt, and migration of the Bobolink near Sauk City, WI. Thick lines indicate peak activity, thin lines off-peak. See text for details.

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plumage. Definitive Plumage typically assumed at Formative (females) or First Alternate (males) plumage, although some males may continue plumage maturation through Definitive Alternate Pluma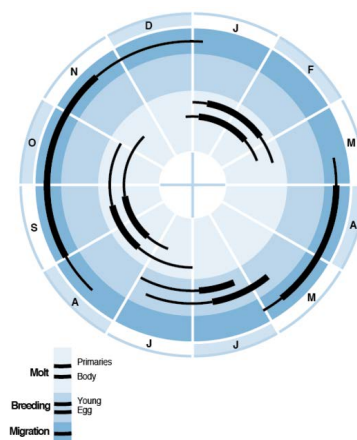ges (Nocera 2005). Dwight ([Dwight 1900c](#)) includes photographs depicting natural size, pattern, and wear of principal Bobolink feathers, including natal down; Dwight counted 3,235 contour feathers from a male in Alternate plumage, excluding down feathers and filoplumes.

Natal Down

Present Jun–Jul, in the nest. Hatchlings nearly naked except for sparse, buff natal down associated primarily with capital and spinal tracts.

Juvenile (First Basic) Plumage

Present Jul–Sep. Head with buff median crown stripe, superciliary line, dusky postocular stripe, and deep buff nuchal band. Upperparts dull brownish black, the feathers with buff fringing. Upperwing coverts dull brownish black, edged in buff and tipped with grayish white. Primaries, secondaries and rectrices brown with tin pale buff edges, becoming thicker proximally among inner secondaries and tertials; feathers narrower and more pointed at tip than in Definitive Basic Plumage (Fig. 320 in Pyle 1997a). Underparts rich buff, paler on chin and faintly flecked on sides of throat and center breast with clove brown; flanks without streaks as in later plumages; underwing coverts whitish, fringed gray. Juvenile body feathers (especially undertail coverts) filamentous due to lower barb density than feathers of later plumages.

Adult male Bobolink, OH, 14 May. [Enlarge](#)

Male in Alternate plumage is unique among North American songbirds in being entirely black below and lighter above: the front of head, tail, and wings are black, and the scapulars, lower back, rump, and uppertail-coverts are white to pale gray, with a distinctive yellow nape and nuchal collar. The dark feathers may initially be obscured by maize yellow feather fringes when fresh. This fringing wearing off during spring migration.Image via [Birdshare](#): [Bryan Hix](#).

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Adult male Bobolink, Turner Valley, AB, 20 June. [Enlarge](#)

Note rigid, sharply pointed rectrices, which are distinctive in all plumages. Male in Alternate plumage has scapulars, lower back, rump, and uppertail-coverts white to pale gray, with a yellow nape and nuchal collar.Image via [Birdshare: Ron Kube](#).

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Male Bobolink in breeding (alternate) plumage.

Enlarge

, May 13, 2006; photographer Gerrit Vyn

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Formative Plumage

"First Basic" or "Basic I" plumage of Humphrey and Parkes (1959) and later authors; see revision by Howell et al. (2003). Present primarily Sep–Mar. Similar to Juvenile Plumage, but body feathers more durable, upperparts darker and underparts richer yellow, washed ochre or maize yellow, palest on chin and belly. Sides of breast, flanks, and undertail coverts conspicuously streaked with dull black, veiled by overlapping pale feather edges when fresh.

In both sexes Formative Plumage averages brighter than Juvenile Plumage and slightly duller than Definitive Basic Plumage. Formative Plumage most reliably distinguished from Definitive Basic Plumage by primary coverts duller and browner with thinner and paler buff edging, contrasting with newer formative greater coverts; retained juvenile outer primaries and rectrices thinner, more pointed, browner, and relatively more worn; molt limits occasionally occur among greater coverts or tertials (Pyle 1997a; see Preformative Molt). Occasional birds, especially those in Nov–Mar on winter grounds, may also show one or more outer primaries and up to four inner secondaries replaced, contrastingly broad and fresh (see Preformative Molt).

Adult male Bobolink in flight, Rollins Savanna, Lake Co., IL, 19 May.

Enlarge

Male Bobolinks sing a long, bubbly song, often while flying low over their territories in a characteristic, helicopter-like flight.Image via Birdshare: JanetandPhil.

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Adult male Bobolink. Victoria, MN. June   Enlarge

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Jun 03, 2007; photographer Amber Burnette

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First And Definitive Alternate Plumages

Present primarily Mar–Aug.

Male. Frontal portion of head, proximal scapulars, most upperwing coverts, and entirety of underparts black, the feathers initially obscured by maize yellow feather fringes when fresh, this fringing wearing off during spring migration (usually by early May) resulting in jet black appearance to these areas; thin fringing on belly, flanks, and undertail coverts persist the longest. Posterior portion of head and nape rich buff forming conspicuous nuchal collar. Lateral scapulars white; upper back streaked black and rich buff; central back plumbeous blending to white lower back through uppertail coverts, the feathers often tipped olive-buff to olive-gray. Tertials, proximal upperwing greater coverts, remiges, and rectrices black fringed or edged with wood brown to olive-gray when fresh, the outermost primary (p9) edged white, the two adjacent primaries edged maize yellow, and the outer 4–6 primaries (among p4–p9) becoming grayer near the tip. Underwing coverts blackish to slate.

With increasing age, buff nuchal collar on males gets smaller (8–12% decrease in area per year) while extent of black on forehead increases (1–4% increase in area per year; NGP). Nocera (2005) used a discriminant function analysis to suggest that males with the distance from the base of the culmen to the anterior edge of the nuchal collar < 14.6 mm can be assumed in First Alternate Plumage, whereas those with this

Male Bobolink molting, NJ, 11 September.   Enlarge

By mid-Aug, before departing breeding range, males molt into Basic plumage and lose bill pigmentation; resemble females.Image via Birdshare: Khurram Khan.

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Adult female   Enlarge

distance > 25.5 mm can be assumed in Definitive Alternate Plumage; however, most males have measures in between these values. This difference suggests that the black frontal area may function more as a social-dominance signal than the width of the nuchal collar (Noceda 2005). Otherwise, little or no criteria are known to separate First from Definitive Alternate Plumages in either sex (Pyle 1997a).

Female. Similar to Juvenile and Formative Plumages, but buff appears slightly paler. Females in Alternate Plumage can occasionally acquire male-like feathering or plumage (Pyle 1997a). NGP observed a female in Vermont during the 2006 breeding season that showed typical female-like alternate plumage and which produced eggs and fledged young. In 2007, the female returned to same area with predominately male-like Alternate Plumage (including black wing and body feathers, buff nuchal collar, and white scapulars and rump), and laid and incubated five eggs for 21 d before abandoning the nest (Perlut 2008). Male-like plumages in females is often related to estrogen deficiencies in older birds (Pyle 1997a), and the loss of fertility in the Vermont female may have been due a damaged ovary, increasing androgen production and reducing estrogen production (Perlut 2008).

Definitive Basic Plumage

Present primarily Sep–Feb. Definitive Similar to Juvenile and Formative Plumages but usually lighter on chin and mid belly; feathers of upperparts with richer brown edgings, especially on tertials. Definitive Basic males often show a

Bobolink, Chester Co., PA, 16 June.

Female underparts yellowish buff, streaked dusky or black on sides, flanks, and undertail-coverts; upperparts buffy olive, streaked with black. The broad, buffy median stripe on top of head, bordered on each side with a pronounced brownish or blackish stripe, is distinctive.Image via Birdshare: Kelly Colgan Azar.

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Nonbreeding Bobolink, Kenansville, Osceola, FL, 10 September.   Enlarge

Sexes dichromatic in Alternate plumage but similar in Basic plumageImage via Birdshare: Cleber Ferreira.

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Bobolink nest with eggs and hatchling, Chicopee, MA, 9 June.   Enlarge

Females appear to choose nest location. Nest is always on ground, often at base of large forbs.Image via Birdshare: Mike Allen.

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few yellow-tipped black feathers scattered on breast and chin; otherwise, sexes similar. Definitive Basic Plumage further separated from Formative Plumage by having wing and tail feathers uniform in quality and freshness: tertials, inner secondaries, and outer primaries uniform in wear; primary coverts duskier, showing wider and richer buff edging, not contrasting in feather quality with greater coverts; basic outer primaries and rectrices broader, more truncate, duskier, and relatively fresher (Fig. 320 in Pyle 1997a).

Molts

General

Molt and plumage terminology follows Humphrey and Parkes (1959) as modified by Howell et al. (2003, 2004). Bobolink exhibits a Complex Alternate Strategy (*cf.* Howell et al. 2003, Howell 2010), including complete prebasic molts, a partial (occasionally incomplete) preformative molt, and complete (occasionally incomplete) prealternate molts in both first and definitive cycles (Stone 1896; Dwight 1900c ; Jones 1930a ; Parkes 1952b ; Oberholser 1974; Cramp and Perrins 1994b ; Pyle 1997a, 1997b; Jaramillo and Burke 1999; Renfrew et al. 2011; Figure 6). One of few bird species that can undergo two complete molts per year, which, combined with substantial color change from feather wear (see Alternate Plumages, below), led to early confusion and controversy about the number and extent of molts, relationship of "color change" to molt, and whether Bobolink conformed to ordinary molt processes (Chapman Chapman 1893 , Chapman 1897 ; Dwight 1900c).

Prejuvenal (First Prebasic) Molt

Complete, primarily Jun–Jul in North America, in the nest. Following is from SGM's notes on observations of nestlings in Wisconsin and is supported by TAG's work in New York. On day 3, shafts of primaries and secondaries become visible beneath skin. On day 4, ensheathed wing quills are 3.2–6.0 mm long; ensheathed contour feathers become visible in spinal tract and, late on day 4, in ventral tract. Caudal tract appears as fine filaments. On day 5, wing quills have lengthened to 6.0–12.5 mm, not emerged from sheaths. Contour feathers in spinal and ventral tracts are clearly visible, and filamentous rectrices are about 1.5 mm long. On day 6, wing quills and feathers of ventral and capital tracts emerge from sheaths; remiges 10.0–18.0 mm long, and

rectrices still completely within sheaths, about 6.0 mm in length. On days 7 and 8, all feathers expand beyond their sheaths, with capital tract feathers tending to emerge late in day 8. Body is fully covered by feathers at time of nest departure, on day 10 or 11, but flight feathers are still partly ensheathed; flight is not possible.

Preformative Molt

"First Prebasic" or "Prebasic I" Molt of Humphrey and Parkes (1959) and some later authors; see revision by Howell et al. (2003). Partial to (rarely?) incomplete, primarily Jul–Oct (Figure 6), on or near breeding grounds but may complete at migration stopover sites or on winter grounds. Includes most or all body feathers and upperwing secondary coverts (the outer 1 or 2 greater coverts can be retained in about 10% of birds) and occasionally (in about 5% of birds) 1 or 2 tertials, but typically no primary coverts, primaries, other secondaries, or rectrices (Pyle 1997a, 1997b). Parkes (Parkes 1952b) reported two migrants collected in New York in early Sep that were replacing the outer two primaries (p8–p9) and, in one specimen, up to four inner secondaries and all rectrices had been replaced. It is possible that replacement of outer primaries in "eccentric" sequence (see Pyle 1997a, 1998) may occur more often than has been documented, particularly in Bobolinks that continue preformative molts south of the breeding grounds; few specimens or data are available from first-winter birds prior to the complete prealternate molt. Eccentric molt sequence occurs more frequently in migratory bird species exposed to greater amounts of solar radiation, as is the case for Bobolink, and includes more-exposed feathers of the wing (Pyle 1998). Sequence of outer primary and rectrix molt as in Prealternate Molt in these birds, and sequence among secondaries is likely distal from the tertials.

First And Definitive Prealternate Molts

Complete (rarely incomplete), primarily Jan–Mar (Figure 6), on the non-breeding grounds but may occasionally complete during northbound migration or on summer grounds. In South America, molt of primaries begins late Dec or the first week of Jan, continues into the first week of Mar, and appears to be shorter in duration in Argentina (44 ± 7.3 d, n = 43) compared to Bolivia (57 ± 3.5 d, n = 193) (Renfrew et al. 2011). Duration of feather replacement in individual birds not studied. First and Definitive Prealternate Molts similar in timing, as far as known.

Molt sequence appears similar to that of prebasic molts in passerines. Primaries are replaced distally (p1 to p9), secondaries are replaced proximally from s1 and, likely, proximally and distally from the central or innermost tertial (s8 or s9) as typical of

passerines, and rectrices are replaced distally (r1 to r6) on each side of tail (Jones 1930a , Renfrew et al. 2011); sequence of rectrix molt differs from that of other icterids, often r6 to r1 (Parkes 1972). Initiation of upperwing lesser coverts can begin with replacement of p1, tertial molt coincides with p4 followed by simultaneous molt of greater coverts, and secondaries and median coverts began molt when p5–p6 are replaced. Commencement of rectrix and alular molt corresponded with molt of the outer primaries; Jones (Jones 1930a) noted central pair of rectrices replaced same time as p6, and molt then proceeded rapidly. Contour feather molt occurred late Jan–early Mar. Replacement of feathers on the head, underparts, and upperparts usually begins shortly after the inner primaries, and finishes shortly after all primaries completed. Generally, molt begins with central feathers of dorsal and scapulohumeral tracts and quickly spreads forward and backward in these tracts and thence laterally (Jones 1930a). Commencement of scapular molt corresponds with molt of the outer primaries.

Occasional birds may retain some middle secondaries (among s4–s6) during prealternate molts (Pyle 1997a, 1997b), although none of 332 birds captured in Vermont showed retained secondary feathers (NGP in Renfrew et al. 2011). Age determination may be possible on these birds if the secondaries can be distinguished between juvenile (perhaps narrower and more worn) and basic (perhaps broader and less worn) feathers (see also Nocera 2005).

Definitive Prebasic Molt

Complete, primarily Jul–Oct (Figure 6), on or near breeding grounds, although study needed on the relationship between breeding territories and molting grounds; in Bobolink molt may suspend and complete on migration or winter grounds (Pyle 1997a, 1997b). Sequence very likely similar to that described under Prealternate Molts (above).

Bare Parts

Bill And Gape

In Juvenile, bill clay colored with duller brown tip. In adult female, culmen and tip of upper mandible dark walnut brown or horn brown with slate-black tip; remainder of upper mandible reddish horn to pale flesh-gray; lower mandible drab ecru, pinkish white, or pale horn; gape whitish or flesh pink. In adult male, mandible bill seal brown to reddish and maxilla whitish gray to flesh-brown in Sep–Feb, changing to glossy black to bluish black with plumbeous base in Mar–Aug; gape black (Ridgway 1902,

Oberholser 1974, Cramp and Perrins 1994b).

Iris

Vandyke brown, prout brown, or blackish brown (Ridgway 1902, Oberholser 1974,
Cramp and Perrins 1994b).

Legs And Feet

In Juvenile, feet Vandyke brown. In adult female, legs and feet fawn or flesh colored; in
adult male, legs and feet drab brown in Sep–Feb, changing to brownish black Mar–Aug
(Ridgway 1902, Oberholser 1974, Cramp and Perrins 1994b).

Measurements

Adults

Males up to 20% larger than females for all parameters including mass. No significant
geographic variation. Representative measurements are given below.

Nestlings

Male nestlings weigh more than female nestlings (Perlut et al. 2014).

Linear Measurements

Adult males in New York state: wing chord 97.4 ± 2.8 mm (n = 301; Bollinger and Gavin
1989); tail length 68.4 ± 2.47 (range 64.0–74.5, n = 38; SGM); bill length 14.3 ± 0.65
(13.0–16.8, n = 38; SGM); tarsus length 26.1 ± 1.06 (24.0–29.0, n = 38; SGM).

In Vermont: wing chord 96.4 ± 2.4 mm (84–103, n = 724; NGP); bill length 10.7 ± 0.5
(9.6–12.6, n = 547; NGP); bill width 6.3 ± 0.4 (4.7–7.9, n = 536; NGP); bill depth 7.5 ±
0.3 (6.1–8.5, n = 535; NGP); tarsus length 26.8 ± 0.8 (23.9–29.2, n = 563; NGP).

In Argentina: wing chord 96.0 ± 3.5 (85–100, n = 23; RBR); tarsus length 30.2 ± 1.2
(28.1–34.0, n = 23; RBR).

Width of testis given in Hamner and Stocking 1970 .

Adult females: wing chord 87.5 ± 2.6 (n = 261; Bollinger and Gavin 1989); tail length
60.9 ± 2.47 (55.0–65.5, n = 23; SGM); bill length 13.4 ± 0.47 (12.7–14.4, n = 23; SGM);

tarsus length 25.2 ± 0.70 (24.0–26.0, *n* = 23; SGM).

In Vermont: wing chord 87.1 ± 2.4 mm (76–98; *n* = 705; NGP); bill length 9.9 ± 0.4 (8.1–11.4, *n* = 644; NGP); bill width 5.9 ± 0.4 (4.5–7.5, *n* = 640; NGP); bill depth 7.0 ± 0.4 (5.6–8.3, *n* = 641; NGP); tarsus length 25.5 ± 0.9 (22.4–28.0, *n* = 648; NGP).

In Argentina: wing chord 86.4 ± 3.0 (79.5–92, *n* = 22; RBR); tarsus length 28.3 ± 0.8 (26.6–29.6, *n* = 22; RBR).

Mass

Body mass of birds in breeding and migratory status differs markedly. Males: breeding, New York, mean = 33.9 ± 2.1 g (*n* = 142; TAG); Vermont breeding, mean = 33.0 ± 2.1 g (24.9–44.3, *n* = 743; NGP); migrating = 51.7 g (44.4–56.3, *n* = 14; Meanley 1967); wintering, Bolivia and Argentina, mean = 32.3 ± 2.4 (23.5–38.1, *n* = 235; RBR). Females breeding: New York, mean = 29.2 ± 2.1 g (*n* = 130; TAG); Vermont breeding, mean = 28.7 ± 2.3g (22.9–38.2, *n* = 692; NGP); migrating = 39.9 ± 5.0 (*n* = 7; Graber and Graber 1962); wintering, Bolivia and Argentina, mean = 26.8 ± 1.9 (22.9–33.2, *n* = 157; RBR). Cramp and Perrins (Cramp and Perrins 1994b) provide additional weights, from various locations during migratory period.

Systematics

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Red-winged Blackbird

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Dolichonyx oryzivorus

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Family: ICTERIDAE

Sections

Systematics

Geographic Variation

Adult males in Alternate plumage may average slightly paler in the western part of the breeding range (i.e., the Rocky Mts. and westward)—see Subspecies, below—and there is a shallow east-to-west cline in increasing body size across the species' breeding range.

Subspecies

No subspecies, following Chapman (1893) and Ridgway (1902). Hence, *D. o. albinucha* Ridgway, 1873, ascribed to western populations in which the adult male reputedly had a nape whiter (less yellow), is a junior synonym of *D. oryzivorus* (Linnaeus, 1758). The names *Icterus agripennis* Bonaparte, 1825, and *Psarocolius caudacutus* Wagler, 1827, also are junior synonyms.

Related Species

Icteridae, the New World blackbirds, is a key family in the radiation of oscine passerines with nine primaries (Klicka et al. 2007). The monotypic genus *Dolichonyx* is member of the meadowlark (*Sturnella*) clade, one of five lineages in the family (Johnson and Lanyon 1999, Lanyon and Omland 1999), the others being 1) grackles (*Quiscalus*) and

allies (including *Agelaius* and *Molothrus*), 2) oropendolas and caciques (primarily *Psarocolius* and *Cacicus*), 3) *Icterus* orioles, and 4) the Yellow-billed Cacique (*Amblycercus holosericeus*).

Appearance   Distribution, Migration and Habitat

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Sections

Distribution, Migration and Habitat

Distribution in the Americas

eBird data provide detailed looks at the range of this species throughout the years: eBird Year-round Range and Point Map for Bobolink.

Breeding Range

Figure 1. Breeds in U.S. and Canada from British Columbia and Alberta in west to w. Newfoundland in east (Cadman et al. 1987 , Semenchuk 1992 , Cyr and Larivee 1995a), and as far south as West Virginia (Bucklew and Hall 1994) in east and Colorado in the western part of its range; found generally between 50°N and 39°N. Seen as far north as Pt. Barrow, Alaska, but not known to nest in that state (Kessel and Gibson 1978). Breeds more or less continuously throughout this range wherever suitable habitat exists; distribution is patchy in western and southern portions of breeding range. Isolated breeding populations are found in central Washington, ne. Nevada, n. Utah, e. Arizona,
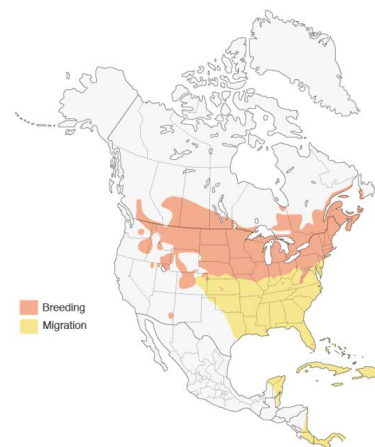

Figure 1. Breeding range of the Bobolink.

Enlarge

See text for details. This species winters in South America (see Fig. 2).
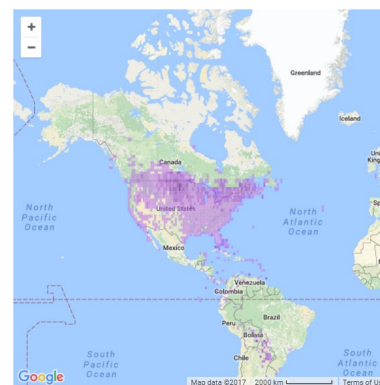
Kansas, n.-central Kentucky (American Ornithologists' Union 1983). Probably a small breeding population in w. North Carolina (Potter et al. 1980).

Overwintering Range

Figure 2; Neotropical Birds Range Map. Overwintering range defined here as where birds undergo Prealternate molt, generally mid-Jan. to mid-Mar. (Renfrew et al. 2011). In s. South America east of Andes, primarily in e. Bolivia, Paraguay, ne. Argentina to northern Buenos Aires, and smaller numbers in nw. Argentina (Pearson 1980 , American Ornithologists' Union 1983 , Pettingill 1983 , Ridgely and Tudor 1989 , Canevari et al. 1991 , Sick 1993 , Di Giacomo et al. 2005, Renfrew et al. 2013). Often reported as overwintering in sw. Brazil, but records appear to be from Nov, Mar and Apr during migration (e.g., von Pelzen 1871, Allen 1891, Naumburg and Cherrie 1930). There are a few records along the coast of Peru (R. S. Ridgely pers. comm.), and as far south as n. Chile (e.g., Howell 1975). See migration section for non-breeding distribution in South America outside of principle overwintering grounds.

**eBird range map
for Bobolink in
North America**

Enlarge

Generated from eBird observations (Year-Round, 1900-2016)

Explore more on eBird
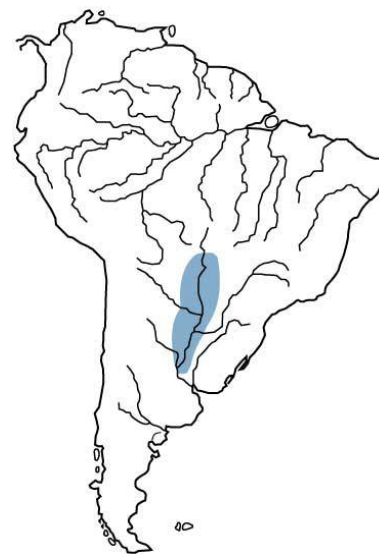
**Figure 2. Principal
overwintering
range of the Bobolink.**

Enlarge

The area of highest overwintering densities is east of the Andes in the pampas of southwestern Brazil, Paraguay, and Argentina.

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Distribution Outside the Americas

As of 1990, 14 fall (Sep-Oct) records from British Isles; one spring record from Gibraltar, Spain (Cramp and Perrins 1994b). Observed or collected in autumn in France (Dubois and 1989). Also recorded in Norway and Italy (Cramp and Perrins 1994b).

Nature of Migration

[Figure 2](). Makes round-trip, transequatorial migration of ca. 20,000 km between breeding and overwintering grounds—one of longest annual migrations of any New World passerine. Populations across the breeding range generally converge and mix on the migration and overwintering grounds, and exhibit no coarse-scale migratory connectivity.

Based on geolocator data, southbound migration includes a multi-week stop in the Llanos grasslands of Venezuela or Colombia, followed by another stop in the lowlands of e. Bolivia, where some birds remain for the rest of the overwinter period; others individuals continue to Paraguay, or more often, ne. Argentina. Migrates in groups that appear to be mostly single-sex in spring, mixed sex-age groups in fall. For example, five banded males comprised the first group to arrive at a study site in Tompkins Co., New York, in 1983 (TAG). For birds with geolocators, southbound migration to molting grounds lasts 3–4 months, and northbound migration takes 5–6 weeks (Renfrew et al. 2013).

Timing and Routes of Migration

Some birds depart breeding areas late Jul–early Aug, apparently congregating in freshwater or coastal marshes where Prebasic molt is completed. However, some males may begin staging as early as the first few days of July; males in Vermont begin molting as early as 28 June (NGP). Western populations generally fly east in fall before following traditional route south (Bagg and Eliot 1937, Renfrew et al. 2013). They may spend several weeks in this habitat before moving south and east. Others stay on breeding sites into mid-Aug (SGM); large flocks observed in marshes near Lake Erie, Michigan, in early Sep (J. Woods pers. comm.).

Baird et al. ([Baird et al. 1905]()) stated that "about the middle of August they appear in almost innumerable flocks among the marshes of the Delaware River" and Chapman (1890) cites flocks in wild rice marshes in the vicinity of New York City with many remaining until October. In the late nineteenth century, Bobolinks appeared in rice fields of South Carolina in late Aug, then passed through West Indies in Oct ([Baird et al. 1905]()). Historically appeared in rice fields 15–21 Aug in the Southeast (e.g., South Carolina, Georgia) and remained for several weeks (Chapman 1890). As late as 1950-51, Bobolinks observed in Arkansas rice fields from Sept–Oct (range Aug 16–Oct 24), with peak occurring Sept 15 (Meanley and Neff 1953). Migration generally proceeds southward through Florida, and across Caribbean, with stopovers in Cuba, Jamaica,

Hispaniola, and Puerto Rico before flying to South American mainland. Geolocator data show some eastern birds flying south from coast between Connecticut and the Delmarva Peninsula, non-stop to Venezuela or Columbia (NGP). Early in the twentieth century, flight over Caribbean from Jamaica was called the "bobolink route" (Allen 1932) because Bobolinks were the most numerous bird using this corridor. Pettingill (Pettingill 1983) cited observations of David Wingate, who saw hundreds, which he believed were nonstop migrants, in late Sep–early Oct flying over Bermuda.

After crossing the Caribbean, birds with geolocators (n = 18) spent 4–6 wks. in the Llanos grasslands of w. Venezuela and e. Colombia (Renfrew et al. 2013, RBR). The species was a common visitor in Sept and Oct in lowlands and shores of northernmost Colombia (11 Sept–14 Oct; Clyde and Carriker 1922). Birds from Oregon, Nebraska, Ontario, and Vermont with geolocators arrived farther east in nw. Venezuela (3–19 Oct; *n* = 18; Renfrew et al. 2013, RBR). Leave the Llanos in early to mid-Nov, crossing the Amazon Basin in 1-2 d to n. Bolivia (RBR). Remain in Beni or Santa Cruz departments of Bolivia for 3 d to 8 wks for the remainder of winter, when they complete their Prealternate molt; some remain in that same area, while others move farther east and south in Bolivia or to Paraguay; most move to ne. Argentina, primarily Formosa, Santa Fe, and Entre Rios provinces, also Chaco and Corrientes, and to nw. Argentina on the eastern edge of Andes in Salta and Jujuy (Pettingill 1983 , Di Giacomo et al. 2005, Blanco and López-Lanús 2008, Renfrew et al. 2013, RBR). Generally on overwintering/molting grounds mid-Dec to mid-Jan until mid-Mar.

Small numbers regularly reported from Galapagos I. in Oct–Dec (Leveque et al. 1966, Pettingill 1983), presumably from western breeding populations, although exact origins are unknown.

Spring migration begins in late Mar and early Apr when birds reported to be moving north (Chapman 1890, Renfrew et al. 2013) through Bolivia, w. Brazil (including the Pantanal), to e. Colombia along e. edge of the Andes, or w. Venezuela; birds with geolocators traveled this route early Apr to early May, with stops lasting up to 2 wks. Leave n. Venezuela from between Gulf of Venezuela and Caracas to continue northwest through Hispaniola, Cuba, Jamaica, Bahamas, and/or Bermuda to Florida, Alabama, Georgia, or the Carolinas (Chapman 1890, Renfrew et al. 2013, RBR). Capable of making transoceanic flights of 1,200 km or more in one day. Appears in Louisiana and Texas, presumably using less common route from Yucatán Peninsula in Apr (Bent 1958).

During migration also recorded from Mexico, Guatemala, Belize, Honduras, Costa Rica, Panama, Trinidad and Tobago (three sight records), and Lesser Antilles to the east of primary migration routes (Rappole et al. 1983 , Wetmore et al. 1984 , Stiles and Skutch 1989 , ffrench 1991a). Migration through Central America appears to be uncommon; e.g., 18 birds with geolocators all used Caribbean route.

Reported to reach South Carolina by mid-Apr (Sprunt 1970), although males with geolocators arrived in first half of May, and some individuals continued to pass through that state until late May. Two males with geolocators associated with breeding grounds northwest of Toronto were in n. Florida during the first week of May, and then proceeded north along Appalachian Mountains, and between Lake Erie and Lake Ontario (RBR). A Nebraska male with a geolocator stopped in Bahamas for 6 d and on 14 May flew northwest across the Gulf of Mexico directly to Alabama in 1 d, continuing to Kansas 2 d later, then arriving at breeding site 4 d later (RBR). A Vermont male with a geolocator spent 3 d in Bahamas, flew directly to ne. Florida on 12 May, was located in the Chesapeake Bay area 15-20 May, then flew directly to breeding grounds in Vermont. Another Vermont male spent only 1 d in Bahamas, flew directly to South Carolina, moved inland and northward along the coast, arriving on breeding grounds by 12 May (RBR).

Males arrive in breeding areas during the first week of May in New York (TAG) and s. Wisconsin (Martin 1971b); in mid-May in Oregon (Wittenberger 1976) and n. Michigan (Pettingill 1983). Females begin arriving about 1 wk after first males appear. Four males with geolocators left wintering grounds within 5 d of each other (Renfrew et al. 2013), and two males in a different geolocator study left within 1 d of each other (RBR), suggesting that males may initiate northbound migration fairly synchronously within a given year. Female arrival is more diffuse, with 0–3 new females/d until late May at a New York study site (TAG).

Migratory Behavior

Appears to have an integrated system for migratory orientation that involves stellar and magnetic cues (Beason Beason 1987 , Beason 1989a). Iron oxide, probably magnetite, is present in sheaths of tissues that surround olfactory nerve and bulb, as well as in bristles that project into nasal cavity (Beason and Nichols 1984). Cells in trigeminal nerve system respond to experimental changes in the magnetic field small enough to

detect changes in the earth's magnetic field (Semm and Beason 1990). When magnetic field was reversed in a planetarium with seasonally appropriate, but stationary, star patterns, Bobolinks captured in late summer changed orientation accordingly after 1–5 d under the new magnetic regime (Beason 1989b). Bobolinks may use the earth's magnetic field as primary cue for orientation, but they rely on location of stars once this initial magnetic cue is set in their "inclination compass" (Beason 1989b).

Control and Physiology of Migration

As transequatorial migrants, Bobolinks present an interesting problem with respect to endocrinological triggering and control of breeding. All individuals experience a spring and summer in southern hemisphere and a spring and summer in northern hemisphere; they breed only in the latter. In most species, decreasing day length after breeding season is thought to trigger a sexual refractory period of several months followed by gonadal recrudescence in preparation for the next reproductive period. How, then, do Bobolinks respond to movement from the shortening days of late summer–early fall in the north to the lengthening days of the austral spring?

Daily injections of testosterone propionate in females and sexually inactive males resulted in dark pigmentation of the beak, which is horn-colored outside the breeding season in both sexes (Engels 1959). In later experiments, Engels (Engels 1961 , Engels 1962 , Engels 1964 , Engels 1969) used this morphological trait as an indication of testicular activity (also correlated with testes weight) to determine effect of day length on male reproductive condition. Decrease in day length experienced in fall in s. U.S. (i.e., approximately 12.75 h) was enough to initiate a photorefractory period in Bobolinks as is typical of temperate-zone migrants such as *Junco* and *Zonotrichia* (Engels Engels 1959 , Engels 1962). However, after exposure to day lengths of 12.5 or 12.75 h for several weeks, males exposed to 14-h day lengths in captivity terminated refractoriness and exhibited testicular recrudescence. Therefore, Bobolinks terminate the refractory period and regain breeding readiness at day lengths normally encountered on their wintering range in the Pantanal.

Two interesting ideas emerge from Engels's work relative to the Bobolink's distribution: (1) southward distribution in the southern hemisphere is limited to those latitudes that do not attain 15.5 h of daylight, or else birds would probably come into reproductive readiness; and (2) there appears to be no reason why Bobolinks must go south of the equator to facultatively end photorefractoriness and initiate gonadal recrudescence.

This prompts the question why such an extensive migration is undertaken, and how it evolved, although the species' habitat affinities may be fundamental (see below).

Bobolinks experience significant weight gain in fall, owing entirely to deposition of dry fat (Gifford and Odum 1965). Mass of male fall migrants caught in Florida increased from mean of 38 g in early Sep to 50 g in early Oct; females increased from a mean of 32 to 40 g during same period (Gifford and Odum 1965). For comparison, males during breeding season in May–Jun 1984 in upstate New York have mean weight of 33.9 ± 2.1 g (n = 142), females 29.2 ± 2.1 g (n = 130) (TAG).

Habitat in Breeding Range

Originally nested in tall-grass or mixed-grass prairie of midwestern U.S. and s.-central Canada (Bent 1958). Most of this area came under intensive agriculture more than a century ago, but by that time the vast deciduous forests of the e. U.S. had been cleared, providing habitat in hay fields and meadows. Bobolinks continue to use and may prefer fields in e. U.S. comprised of a mixture of grasses and broad-leaved forbs (e.g., red clover [*Trifolium pratense*], dandelion [*Taraxacum officinale*]). Specifically, density is significantly greater in fields in w.-central New York with relatively low amounts of total vegetative cover, low alfalfa (*Medicago sativa*) cover, and low total legume cover but with high litter cover and high grass-to-legume ratios relative to other nearby fields (Bollinger 1988b , Bollinger and Gavin 1992). These vegetative characteristics occur in hay fields in New York that are ≥8 yr old (time since last plowing and reseeding; Bollinger and Gavin 1992). These "old" hay fields contain significantly higher densities of Bobolinks than hay fields <8 yr old, or than any of 3 other types of fields or pastures sampled. In the north-central U.S., Bobolink densities were greater in monocultures of warm-season grasses (switchgrass [*Panicum virgatum*]) than cool-season plantings (Bakker and Higgins 2009).

Several landscape factors have been shown to influence habitat use patterns of Bobolinks. In Vermont, Bobolinks were strongly associated with landscapes with high proportions of non-forested habitats within 2,500 m of point-count locations (Shustack et al. 2010) with similar results in Wisconsin (Ribic et al. 2009). In Canadian prairies, Bobolink abundance in planted grassland increased when these parcels were surrounded by native grassland (Davis et al. 2013). At the patch level, the species can show strong area sensitivity, with probability of occurrence only reaching 20% in fields in Maine greater than 100 ha (Vickery et al. 1994), and area sensitivity mediated by the

proportion of forest in the Midwest landscape (Thogmartin et al. 2006). Edge avoidance (Renfrew et al. 2005, Perkins et al. 2013) and patch openness have been suggested as causal mechanisms for area sensitivity (Keyel et al. 2012, 2013). Large fields have greater Bobolink densities than small fields; fields ≥30 ha support more than twice the number of males per 100 m of transect than fields ≤10 ha (Bollinger and Gavin 1992).

Also breeds in habitats similar to grass-sedge fields along river bottomland habitat in Wisconsin (Martin 1971b) and in irrigated meadows in arid climate of e. Oregon (Wittenberger 1976), and in reclaimed strip mines in the Midwest (Ingold 2002). Bobolink density decreased in the first year following prescribed fire, but increased and stabilized 2 to 3 years post-fire (Grant et al. 2010); densities are also decreased in grazed sites (Kim et al. 2008). Settlement cues in Bobolinks have been shown to be strongly affected by social information gathered post-breeding during the previous year (Nocera et al. 2006).

Habitat in Migration

Mixed-sex and -age flocks begin forming in late Jun. In some locations flocks leave nesting hay fields and meadows by late Jul, but in others, flocks remain until late Aug. Some birds seek shelter of freshwater marshes (Pettingill 1983) and coastal areas to complete Prebasic molt before migration.

During southbound migration, historically fed on wild rice (*Zizania palustris*) along shores and marshes associated with large rivers (e.g., Pennsylvania, New Jersey, New York City, along Delaware River) and on cultivated rice in southern states, also in corn, small grains, and hay fields. In Cuba, Jamaica and the Dominican Republic, fed on rice, corn, introduced Guinea grass (*Panicum maximum*; Swainson and Richardson 1831, Nuttall 1832, Brewer 1840, Baird et al. 1875, Chapman 1890, Wetmore and Swales 1931). Fed in Arkansas rice fields Sept–Oct (Meanley and Neff 1953). Wild rice currently not available in the U.S. during southbound migration, and habitat use and timing of movements probably differ somewhat from historical records. Feed in agricultural fields in Venezuela in Oct (G. Basili, pers. comm.); more study needed on habitat use during their stopover in the Llanos. Present in ne. Bolivia as early as mid-Nov (Renfrew et al. 2013); specific diet before rice becomes available in early Jan not well known, but crop seed generally not available and likely feeds wherever grass seed is abundant. Feeds in small, more dispersed flocks in natural grasslands in Formosa, Argentina Nov–Dec (Di Giacomo et al. 2005).

During northbound migration, feeds along riverways in Pantanal on seeds of emergent vegetation in Mar–Apr (RBR). Feed in rice fields in Colombia, where Bobolinks are considered a pest (C. Ruiz, pers. comm.) and Cuba (E. Iñigo-Elias, pers. comm.) in Apr and early May. Historically, habitat in U.S. similar to southbound, including small grains, wild rice, natural grasses, and forbs.

Habitat in the Winter Range

Overwinter defined here as 3–4 month period during which Bobolinks remain within a radius of 300 km or less and undergo Prealternate molt. Inhabit open grassland systems, loosely following major waterways and major wetland systems primarily in e-central and se. Bolivia, Paraguay, and ne. Argentina (see Distribution). Found in wet lowlands and drier uplands, feeding on grass, forb, and shrub seed in ranchlands, ungrazed grasslands, marshes, and in crops. Largest flocks found in rice production regions, where they are considered a pest in inundated rice paddies (Renfrew and Saavedra 2007, Blanco and Lopez-Lanus 2008); see Conservation and Management). Occur less frequently in other crops such as sorghum, soybean, sunflower, and corn, where they eat insects and/or seeds. Also feed near crops in grasses and shrubs along field margins, on dykes, and in fallow fields.

Historical Changes to the Distribution

Commonly believed that breeding range expanded west from Great Plains with advent of irrigation and cultivation (Chapman 1890c , Allen 1932), just as species must have become more common in east after clearing of deciduous forest. Hamilton (Hamilton III 1962a), however, believed disjunct western populations are relicts from an earlier period of wetter climate, as evidenced by their localized distributions. In ne. Argentina, southern edge of winter range with occurrences in fewer locations in 1990-2002 compared to 1903-1989 (Di Giacomo et al. 2005).

Fossil History

Found from Holocene in Iowa and Pleistocene in Florida (Brodkorb 1978). Not mentioned by Olson (Olson 1985d) in his monograph on fossil birds.

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Dickcissel

Red-winged Blackbird

Bobolink
Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

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Main Foods Taken

Breeding season: weed seeds, a variety of larval and adult insects, spiders, and snails. Migration and winter periods: wild and domesticated rice, sorghum, oats, other small grains, corn, tassels, weed seeds, occasional insects. Young are fed almost exclusively invertebrates.

Microhabitat For Foraging

Breeding season: gleans insects, and spiders from mid-growth and bases of forbs, grasses, and sedges. Exploits seeds at tops of herbaceous plants interspersed within expanses of grasses or sedges. Preferred foraging height is 6–15 cm above ground (Wiens 1969). Occasionally forages for invertebrates in trees and shrubs adjacent to or within nesting vicinities (SGM). Migration and winter: concentrates on pliable seed of rice, sorghum, oats, and other grains and on weed seeds in and adjacent to cultivated fields and marshes (Burleigh 1958, Meanley and Neff 1953 , Renfrew and Saavedra 2007, López-Lanús et al. 2008). As during breeding season, insects taken opportunistically on leaves and twigs of shrubs in day roosts.

Food Capture And Consumption

Feeds primarily as it walks slowly on ground (< 1 m/min; Cody 1968, Wiens 1969) or as it ascends into lower levels of vegetation. Uses foraging pecks that are slow and

deliberate (Wiens 1969). When foraging on seeds, often perches near top of vegetation and carefully, deliberately, extracts and ingests seed bodies. Has been observed jumping from ground to grasp mature seeds of dandelion and other plants too limber to permit stable perching (SGM, RBR). Generally swallows seeds or prey items whole; often wipes bill on perch or nearby vegetation after eating milky grains or insects. In winter, searches for insects under leaves of soybean and sunflowers (Renfrew 2007, López-Lanús et al. 2008, RBR). Adults on the breeding grounds frequently have muddy lower mandible—unknown what prey are found while digging in mud/dirt (NGP). Bouts of foraging occur throughout daylight period. During migration, while building fat reserves for long overwater flight, has been observed feeding in rice fields after dark on bright nights (McAtee 1919b). During breeding period, a solitary forager. In post-fledging groups on nesting fields and during migration and winter, forms flocks and is highly social in feeding behavior. Sentinels sit atop plants while the rest of the flock feeds lower in the canopy (RBR).

Diet

Major Food Items And Quantitative Analysis

During breeding season, principal foods of adult and independent young include adult and larval insects and weed and grain seeds. Contents of 291 stomachs from n. U.S. localities comprised 57.1% invertebrate materials and 42.9% seeds and other vegetative parts by volume (see medialink).

Feeding opportunism seems to prevail during non-breeding season, and flocks are larger where food is more concentrated. During staging and migration, diet is mainly granivorous. Historic records report feeding in wild and cultivated rice in se. U.S., Cuba, and Jamaica, and in natural and cultivated grasses (incl. wheat, barley, oats), sedges, and forbs (Nuttall 1832, Brewer 1840, Baird et al. 1875, Gentry 1876, Wheaton 1882, Chapman 1890, Bewster 1906). As migrants move southward they increase feeding rate and rapidly deposit fat and become obese as they prepare for overwater flight to South America (Odum et al. 1961). Thirty stomachs from migrants collected in Arkansas in Sep and early Oct contained 97.3% vegetation and 2.7% invertebrates by volume (Table 1) No quantitative data are available for areas south of the U.S.

In agricultural areas of Bolivia, Argentina, Paraguay, generally in loose proximity to major waterways, crop grains (especially rice, also sorghum and corn tassels) consumed

by large flocks Jan–Mar. Rice eaten when seed is available in soft form, 7–14 d before harvest, specific varieties preferred. Seed from natural and exotic grasses and sedges also consumed along field edges and rivers, on ranchlands, in natural and fallow fields, and in wetlands (Pettingill 1983, Di Giacomo et al. 2005, Renfrew and Saavedra 2007, López-Lanús et al. 2008). Stomach contents (n = 5) and fecal analysis indicate insects eaten while feeding in rice, and only insects consumed in soybean fields (Renfrew 2007, RBR). In sorghum fields in Argentina, observed eating more insects than seed (López-Lanús et al. 2008). Occasionally eat large quantities of insects in celery, cotton, and sunflowers (Howell 1932, Baird et al. 1985, López-Lanús et al. 2008). During 5-6 weeks of winter molt late Jan–early Mar, roughly 25% of diet consisted of C $_3$ plants (presumably mostly rice) based on stable isotopes analysis of feathers (R. Renfrew, in prep.).

Food during northbound migration in U.S. historically included seeds of wheat, barley, oats, weeds, grasses (Nuttall 1832, Brewer 1840, Chapman 1890), insects also taken (Gentry 1876, Howell 1932). Presently, rice consumed in Colombia (C. Ruiz, pers. comm.) and Cuba (E. Iñigo-Elias, pers. comm.).

Food Selection and Storage

No evidence of food storage.

Nutrition and Energetics

Summary from Gifford and Odum (Gifford and Odum 1965). Nutritional and energy requirements vary dramatically between breeding and migratory periods. Prior to rapid migratory weight gain, average food ingestion represents 25.1 kcal/male/d and 23.1 kcal/female/d. In late Sep–early Oct, rapid increase in weight builds fat reserves. Males average wet weight gains of 12.2 g (33% above average premigration weight); females gain 8.2 g (26%). These changes are accompanied by a 38% average increase in food intake in both sexes. Corresponding energy requirements during interval of marked fat deposition represent 34.6 kcal/male/d and 31.9 kcal/female/d. Energetic requirements and caloric intake in grasslands versus rice during winter, especially in the weeks prior to northward migration, need study.

Metabolism and Temperature Regulation

Efficiency of food assimilation on Purina Game Bird Startena mash ranged from 57 to 63%, with little intersexual difference and no changes between summer and migratory periods. Estimated catabolic (respiration) rates varied from 1.9 kcal/g nonfat dry weight/d to 2.2 kcal/g/d. Peak catabolized energy occurred during period of increased muscular activity associated with maximum migratory restlessness (Gifford and Odum 1965). No information available on temperature regulation.

Drinking, Pellet-Casting and Defecation

Water consumption in females held in captivity ranged from 14 ml/d (summer period) to 28 ml/d (maximum obesity); for males, corresponding uptakes were 15 and 35 ml/d. Researchers speculated that increased water usage associated with higher weight was required for temperature regulation as fat accumulation increased insulative properties (Gifford and Odum 1965). Bobolinks do not produce pellets. No information available on defecation.

Distribution, Migration and Habitat

Sounds and Vocal Behavior

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Dickcissel   Red-winged Blackbird

Bobolink
Dolichonyx oryzivorus

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Acknowledgments

Sounds and Vocal Behavior

Sound selections for Bobolink can be found in the Audio Gallery, or see the full catalog of Bobolink sound at Macaulay Library.

Vocalizations

Song

Vocal Array

Songs are long and complex, given only by males (Figures 3a-d). Bent (Bent 1958) described song as "a bubbling delirium of ecstatic music." Male has two song types, each composed of 25-50 figures (notes); figure order is highly stereotyped (Avery and Oring 1977 , Bakker et al. 1983). Figures often contain frequency overtones and are occasionally paired (e.g., Figure 3b). Song length averages 3.5 s, range 0.5-11.0 s; frequency range 1.15-7.45 kHz, excluding overtones (Bakker et al. 1983).

Adult male Bobolink, OH, 14 May.   Enlarge

Male in Alternate plumage is unique among North American songbirds in being entirely black below and lighter above: the front of head, tail, and wings are black, and the scapulars, lower back, rump, and uppertail-coverts are white to pale gray, with a distinctive yellow nape and nuchal collar. The dark feathers may initially be obscured by maize yellow feather fringes when fresh. This fringing wearing off during spring migration.Image via Birdshare: Bryan Hix.

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Repertoire Organization And Delivery

Figures are organized into phrases (figure sequences), and phrases are sequenced in a nonrandom order to constitute the two song types in repertoire (Avery and Oring 1977 , Bakker et al. 1983). Most males present their two songs in a random order during a singing bout (Woods 1994b). Song types frequently are not sung in entirety; may be as short as a single figure (Wittenberger 1983 , Capp and Searcy 1991b , Woods 1994b). Song types (or fragments) may be strung together without interruption to form a compound song; in compound song, the introduction precedes only the first song (Bakker et al. 1983). Songs are given while birds are perched or in flight. Structure and order of figures does not differ between flight and perched songs (Avery and Oring 1977), but most flight songs are compound (Bakker et al. 1983).

In some populations, the two songs in repertoire have precise relationship in which the B song type is a subset of figures in the A song type; A and B songs also typically have different introductions (Wittenberger 1983 , Capp and Searcy 1991b). In other populations, the two songs do not show the A/B relationship (Woods 1994b ; also see Figures 3A and 3B). In these cases, no consistent pattern exists in number of figures shared between songs in repertoire; sometimes no figures are shared. The different patterns of repertoire organization appear to be interspersed on a continent-wide scale, but additional investigation is needed.

Geographic Variation
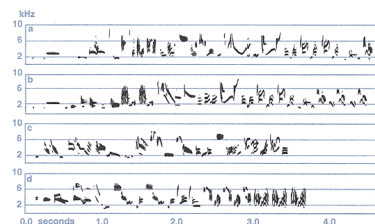
Figure 3. Bobolink songs and calls.   Enlarge

(A and B): 2 songs (from a single male) comprising the Pelleston dialect (near Pelleston, MI); (C) 1 song from a dialect near the Pelleston dialect; (D) 1 song from a male singing nonlocal songs. All from Woods 1994.

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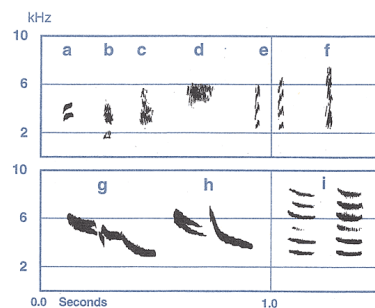
Figure 4. Call notes.   Enlarge

Bobolink call notes. See text for descriptions of calls. Recording locations: a–d, f, i, 3 km SE Pellston Emmet Co., MI; e and g, 14 km ENE Pellston, MI; h, 16 km WNW Pellston, MI. c, f, and i were recorded from females; the remaining notes were from males.

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Males in a population typically share their repertoire of two song types (Avery and Oring 1977 , Woods 1994b). In a n. Michigan population, nine song dialects are found in a 90-km2 area; dialects correspond to large, disjunct patches of hay fields (average dialect area = 5,650 ± 4,530 ha; estimated average population = 1,460 ± 920 males; Woods 1994b). Several dialects show evidence of geographic subdivision. A few figures usually are shared between nearby dialects (mean = 12.5 ± 8.3%, *n* = 9 dialects; Woods 1994b).

Within each dialect area, 25% of males sing individualistic songs (Woods 1994b). In both Michigan and North Dakota, some males with nonlocal songs have songs typical of a nearby dialect, suggesting they are immigrants from other dialects (Avery and Oring 1977 , Woods 1994b). Males with local dialect songs have greater reproductive success than males with unshared songs (Woods 1994b). Song-sharing males arrive on breeding grounds earlier in spring, are more likely to have territories in unmowed hay fields, and maintain their territories for longer periods compared with males singing unshared songs. Increased probability of breeding dispersal following nest failure (Fajardo et al. 2009) likely impedes strong dialect formation (AMS).

Development

Observation of song sharing suggests that song is learned; not confirmed experimentally. Scott (Scott 1904) raised two nestlings (4-5 d of age) in isolation and reported that their adult songs did not resemble those of wild Bobolinks. However, independent juveniles taken from postbreeding flocks, in the absence of or with minimal exposure to adult song, developed songs like those from the dialect area in which they had been captured (Woods 1994b). In one case a juvenile developed songs of a nearby dialect, suggesting he had dispersed before capture.

Caged juveniles occasionally give subsong in fall (Wittenberger 1983). During spring song development, captive males pass through subsong, plastic song, and crystallized song stages typical of song development in other oscines (Woods 1994b). In spring, rare yearlings have high-pitched, distorted, or garbled songs that may resemble subsong (Wittenberger 1983).

No Bobolinks observed to switch song types within years (Woods 1994b). Not known if males with unshared song types change songs between years. Males singing local dialect songs occasionally make minor changes in songs between years; in rare cases, males make major changes in their versions of local dialect songs (Woods 1994b).

Average number of phrases (syllables) per song increases with age, whereas interval between syllables tends to decrease (Mather 1989).

Phenology

Observed singing partial song on wintering grounds in Jan, Feb, and Mar at day and night roosts, not studied in detail (RBR). In spring migration, song is reported from birds in Central America and s. U.S. (Lowery 1974 , Ridgely and Gwynne 1989). Singing occurs throughout breeding season, but levels decrease following territory establishment and courtship; decrease further once males begin feeding nestlings (Appendix 1 Few songs are given after young fledge, and none is heard in postbreeding flocks (Avery and Oring 1977 , Wittenberger 1983 , Woods 1994b).

Daily Pattern Of Singing

Early in mating period, song begins about 1 h before dawn. Singing is sporadic and intermixed with preening for first 15 min (Wittenberger 1983), then becomes more continuous; after about midmorning, it becomes sporadic again, although some singing may be heard until sunset. Later in breeding season, daily pattern is similar but at reduced song frequency (Capp 1992). On wintering grounds, partial song at day and night roosts. At night roosts, arrive within an hour of dusk and sing until dusk (RBR).

Places Of Singing

During breeding, sing in flight and from perches. Favored perches are usually highest points in territory, including fences, overhead wires, trees, and taller emergent vegetation. Sometimes birds sing while foraging low in vegetation, and they may choose low song perches in cold or windy weather. No difference in use of A or B songs based on location in territory (Capp 1992). Flight songs are at heights of 2-40 m; may last up to 1 min. During courtship, 10% of day is spent in flight-song displays (Mather and Robertson 1992); flight songs may be given at average rate of almost 1/min (Appendix 1 On wintering grounds, no flight songs; partial songs from perches when not feeding (RBR).

Social Context And Presumed Function Of Singing

Song occurs in several different contexts (Wittenberger 1983). Males sing at migration stopovers and on wintering grounds when perched, function not studied. Earliest spring arrivals sing in small flocks prior to establishing territories. Singing occurs from perches in territories, either alone or in countersinging with another male. Also occurs during Parallel Walk boundary disputes (see Behavior: agonistic behavior) and during

intrasexual chases. Males sing toward females during courtship from perches, during circle-flight displays, and during courtship chases. Males may also sing following mounting and in response to human approach to a recently paired female. They sing in flight in response to sightings of aerial predators. Thus, song occurs in both male-male and male-female contexts and apparently functions in territory defense, mate attraction, and courtship. These functions not confirmed experimentally.

Male display duration may serve as an honest signal of male quality. Mean song-flight display duration is positively correlated with male body condition and number of young a male fledges. Wing-clipped males had shorter display durations and acquired fewer mates than unclipped males (Mather and Robertson 1992).

Research results conflict regarding contexts in which A and B song types are used. Wittenberger (Wittenberger 1983) suggested that B songs signal a higher level of aggressiveness than A songs and are more frequently used in intrasexual interactions, whereas A songs are used more frequently in intersexual situations. Using very different methods, Capp and Searcy (Capp and Searcy 1991b) and Capp (Capp 1992) concluded that A and B songs did not differ in function or message. Results also conflict regarding context and significance of song fragmentation. Wittenberger (Wittenberger 1983) believed that long songs were more common in situations of intense intrasexual interaction and suggested that long songs signaled higher levels of aggression, whereas Capp and Searcy (Capp and Searcy 1991b , b) concluded that short songs were associated with increased aggression and that number of notes per song might reliably signal likelihood of attack.

When countersinging with a playback tape, males tend not to match songs (Capp 1992 , Woods 1994b). Because Bobolinks have a two-song repertoire, this pattern of response may be functionally equivalent to song matching (Capp 1992). Males are able to discriminate between playback of songs from nonlocal dialects and unfamiliar songs from their own dialect (Woods 1994b). Strength of response to nonlocal versus unfamiliar local songs appears to depend on an individual male's recent experience with nonlocal songs. Males respond weakly to playback of nonlocal songs when inexperienced with them, whereas experienced males respond more strongly to nonlocal songs than to local dialect songs (Woods 1994b). Individual, neighbor, and species recognition abilities have not been investigated.

Calls

Nine different call notes identified (summarized from Martin 1967). Except for *Pink* note, none of these calls is known to occur outside the breeding season. See Figure 4 for sonograms of typical call notes.

Pink. Figure 4a. Given by juveniles and adults in flocks, around breeding areas and during migration. Also given on wintering grounds, especially in flight, presumably as a contact call (Sick 1993 , RBR). May be used to maintain contact between birds migrating at night (Hamilton III 1962c).

Chunk. Given during prenesting and incubation stages by disturbed males (Figure 4b) every 3-4 s as intruder (e.g., human) advances. Disturbed females produce similar note (Figure 4c), possibly higher in pitch.

Buzz. Males give rasping *buzz* as they alight after a circle-flight display to female (Figure 4d); the *buzz* follows immediately after a song delivered during the display. *Buzzes* can be repeated, usually not > 3 times, and are of variable length (0.15-0.9 s, *n* = 4; J. Woods unpubl. data).

Tcheck. During male-male chases, pursuer may rarely give a series of *tcheck* notes (Figure 4e) in a rapid staccato fashion. Notes are not always evenly spaced and may vary in number.

Tchenk. After young have hatched, perched both sexes give a *tchenk* note in conjunction with wing- and tail-flicking, in response to intruders near nests or fledglings; this replaces *chunk* note given earlier in breeding cycle.

Whine. Given by female when soliciting copulation from male. A series of 6-10 high-pitched notes descending in pitch over the course of the sequence. Only given when fertile. Occasionally multiple females will whine simultaneously.

None available in Macaulay library, but can be seen at https://www.youtube.com/watch?v=8TXIrXiyW6o at 2:23 in video

Quipt. After young hatch, perched or flying females give *quipt* notes (Figure 4f) in response to intruders.

See-yew. In flight, males give clear, descending *see-yew* note (Figures 4g and 4h) in response to intruders near nests or fledglings, usually while hovering 3-5 m over intruder. This note may replace introduction at beginning of songs; is also found

between song types in compound songs. Note varies geographically, typically between song dialects (J. Woods unpubl. data) and may not actually be a call note; when given with no song following, may represent extreme case of song fragmentation.

Zeep. Females emit a series of quiet *zeep* notes (Figure 4i) during prenesting stage or while engaged in conflicts with other females; number of notes varies. Notes given in intrasexual conflicts may be slightly higher pitched.

Begging Call. Begging fledglings give sound resembling that produced by strumming a stretched rubber band. Humans generally have difficulty locating fledglings giving this note.

Nonvocal Sounds

Male Bobolinks make exaggerated wing flaps during flight displays when singing above the female and when landing on an exposed perch, frequently given immediately at the end of a song.

Diet and Foraging   Behavior

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Dickcissel

Red-winged Blackbird

Bobolink

Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

Sections

Behavior

Locomotion

Walking, Hopping, Climbing, Etc

Normally walks, occasionally runs on ground.

Flight

Type of male flight varies depending on context. In silent flight, usually involving a direct flight path, wings are brought substantially above and below horizontal, appearing to almost touch at highest point. Series of fast flaps alternating with short glides. Song flight usually follows a more circular path. Entire form of wingbeat becomes altered at moment song commences: beaten in a hovering fashion, wings pointed downward; wings barely attain horizontal position at peak height, and extend almost to mid-ventrum at low point. Wingbeats are more rapid than in silent flight (Martin 1967). In song flight, head is usually up and tail down, exposing white on rump. White plumage on shoulders is fluffed out and visible. No accentuated feather

Adult male Bobolink in flight, Rollins Savanna, Lake Co., IL, 19 May.   **Enlarge**

Male Bobolinks sing a long, bubbly song, often while flying low over their territories in a characteristic, helicopter-like flight.Image via Birdshare: JanetandPhil.

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positions occur in silent flight (Withrow 1980). Female flight similar to silent flight of male but normally swift, low, and inconspicuous. No information on flight speed.

Fig. 5. Precopulatory Crouch Display.

Male Bobolink directing Precopulatory Crouch Display toward a female. Drawing by J. Zickefoose.

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Self-Maintenance

Preening, Head-Scratching, Stretching, Bathing, Anting, Etc

Head-scratches, stretches, and preens frequently. Scratches head by lifting foot over wing. Stretches by simultaneously extending leg and wing on same side; also by extending both legs and neck. Preening routines appear similar to those of other songbirds, concentrating on upper breast, wing, tail, and belly, with shaking and fluffing movements interspersed. Often wipes bill on vegetation or hard perch, especially after feeding. Ivor (Ivor 1945) and Nice (Nice 1945) reported typical anting behavior, and Ramsden (Ramsden 1914) found live mollusks among Bobolink feathers, perhaps ant substitutes. Kingsbury (Kingsbury 1933) noted bathing in early afternoon, followed by a period of feather fluffing and preening.

Sleeping, Roosting, Sunbathing

Little information. Sleeps on ground during breeding season, female on nest until young fledge. In rice production areas on wintering grounds, flocks of 100 to several thousand roost in the afternoon in tall grasses, reeds, and shrubs along ditches and roadsides or in wetlands, where birds preen and vocalize, and occasionally feed opportunistically. Some day roosts also used as night roosts. Day flocks gather at night into large roosts in inundated rice or wetlands, usually with standing water, where they sleep perched on the plants (Renfrew and Saavedra 2007, López-Lanús et al. 2007).

Daily Time Budget

Daily patterns of behavior and times devoted to each vary markedly as breeding season progresses. Time allocation by males to various behaviors and categories of activities during five stages of reproductive period is summarized in Appendix 1.Details, based on 93 h of systematically recorded time budgets, are given in Martin 1971b . No detailed information on time budgets during nonbreeding period. In rice production regions on overwintering grounds, flocks leave night roosts within 1 h of dawn and during a period of approximately 30-60 min, in distinct flocks of hundreds or thousands. Forage throughout morning in rice fields, alternate bouts of foraging with roosting in afternoon. Fly into nighttime roosts within 1 h of dusk for approximately 30–60 min (Renfrew and Saavedra 2007, López-Lanús et al. 2008).

Agonistic Behavior

Physical Interactions

Strong competition for territories between arriving males, involving song, ritualized display, fighting, and male-male chases (Martin 1967). Early in season, males in Wisconsin averaged 11.9 perched and 2.4 flight songs, and > 20 discrete agonistic behaviors per 5-min period (Appendix 1. Aerial Chases are common; most frequent and intense during first week of territorial defense. Lasting from 30 s to > 1 min, these high-speed chases involve much song. Pursuer follows within 1–5 m, occasionally swooping and striking at fleeing male. Martin (Martin 1967) and Withrow (Withrow 1980) provide elaboration.

Most aggressive physical male-male encounter is Aerial Contest (Flutter Flight of Withrow 1980), originating on ground at territorial boundary; two males rise vertically, facing with outstretched feet, flapping wings, and maintaining distance of < 10–15 cm. Both thrust and clutch at the other's feet and continuously strike at one another with bills. Sometimes interlock feet at high point of flight and fall to ground, grasping and striking one another while thrashing wildly about for up to 7 s. No vocalization given.

Communicative Interactions

Males commonly give several specialized displays during establishment and defense of territories. See Martin 1967 for amplification. Song-spread functions in territorial advertisement and as a mild threat; performed from perches and ground, accompanied by full song, wings extended outward as head is bowed and white feather tracts and nape feathers are raised. Song-flight functions in territorial advertisement, threat, and

female attraction. The last function is treated by Mather and Robertson (Mather and Robertson 1992), who demonstrated that males engaging in shorter Song-flight displays attracted fewer mates. See Locomotion, above, for description. Parallel Walk is composed of a series of ground displays given as two males slowly walk and hop (15 cm–1 m apart) parallel to one another along their common territory border. Parallel Walks can continue in bouts of up to 1–3 h duration, and integrate several discrete display components, including Bill-flipping, Display-preening, Thrust-flights, Back-presentation, Direct-run, Head-flagging, Nodding, Aerial Contests, and high-intensity Song-spread. After interruption, birds quickly return and continue Parallel Walk activities. May continue intermittently over a 2–3 day period. Thereafter, replaced by localized Face-off series, possessing all elements of Parallel Walk except the "boundary patrolling" component. Frequency of Face-offs declines gradually; rare by the time a male's primary female commences incubation.

Spacing

Territoriality

Territorial boundaries are easily determined by observing agonistic interactions. Multipurpose territory (courtship, mating, foraging, rearing young) of Hinde (Hinde 1956) modified Type A, established soon after male arrival. Two patterns of territorial development are evident: compression of original large territories in more suitable areas of meadow from pressure of newly arriving males, and expansion of occupancy of meadow by annexation of peripheral areas. A pattern of contiguous, nonoverlapping territories results. Mean size of territories in Wisconsin ranged from 0.70 ± 0.008 ha (n = 78) in primary habitat (Martin 1971b) to 2.0 ha (n = 8) in lower-quality habitat (Wiens 1969); in New York, mean size 0.49 ha (n = > 250; Bollinger 1988b); in Oregon, 0.74 ha (n = 66) in good habitat to 1.45 ha (n = 93) in drier areas (Wittenberger 1978a). In Washington, the area (12,881 ± 1,346 m^2) and perimeter (428 ± 32 m) of polygynous territories were larger than the area (9,594 ± 817 m2) and perimeter (346 ± 18 m) of monogamous territories, although the differences were not significant (Moskwik and O'Connell 2006). In Iowa, average territory size was similar among edge types (agriculture: 0.34 ± 0.05 ha; road: 0.34 ± 0.05 ha; woodland: 0.35 ± 0.05 ha). However, the relationship between territory size and edge type was influenced by distance to edge. Territory size increased near roads, decreased near woodlands, and showed no difference near agricultural edges (Fletcher and Koford 2003).

Once females arrive, males rarely leave territories except to chase away neighboring intruders or drifting (nonterritorial) males. Territory is vigorously defended until male begins feeding nestlings, when territorial maintenance abruptly ends. At this time, drifting males quickly establish territories on better-quality habitats; they are often successful in attracting females that lost original nests on other fields to mowing (SGM).

Unlike females of some other polygynous icterids, female Bobolinks show little aggressiveness toward one another and do not defend an area within the male's territory against intrusion by conspecific females. Simultaneously active nests of two females on same territory have been found as close together as 5 m (TAG). Occasional aggressive attack-chases occur between females (SGM), but these tend to be exceptional.

Overwinter territoriality, interspecific territoriality, and dominance hierarchies not noted.

Fertile females utter characteristic peeping "whine" to get males' attention. Whines are often followed by dramatic aerial chases (see Physical Interactions). Early in the breeding season, females will occasionally "whine" when others do. Only fertile females "whine" (NGP).

Song on the breeding grounds positively influences settlement patterns of juvenile birds in subsequent years. Moreover, song heard the previous year can exert a 'carry-over attraction' effect on conspecifics the following year (Nocera et al. 2006).

Individual Distance

Highly gregarious during nonbreeding period. Individuals commonly within 25 cm of one another feeding and roosting, with individuals sometimes displacing others on perches, especially when settling at nighttime roosts (RBR).

On breeding grounds, Nocera et al. (2009) assessed whether resources or conspecific presence most influenced Bobolink settlement patterns. Core territories were clustered around resources, and these territory holders were older than in the periphery. Peripheral territories were likewise clustered but did not always co-occur with the best available resources, suggesting that social information may not always direct them to the best sites available.

Sexual Behavior

Mating System And Sex Ratio

Strongly polygynous; successful males hold simultaneous pair bonds with multiple females. Extent of polygyny varies geographically, apparently depending on quality of habitat conditions. Of 62 males defending territories in Wisconsin, 36 were polygynous (24 pairing with 2 females, 11 pairing with 3 females, and 1 pairing with 4 females), 12 males were socially monogamous, and 14 males failed to pair (Martin 1971b). In Oregon, polygynous males rarely paired with >2 mates (Wittenberger 1980b , b). In New York, only 7 of 53 males attracted > 1 female (Wootton et al. 1986). Martin (Martin 1971b , Martin 1974c) demonstrated that polygyny and vegetative structure were correlated, whereas Wittenberger (Wittenberger 1980b) viewed polygyny to be strongly influenced by food abundance in territories. In Washington, 45% (13 of 29) of males were socially monogamous, and territories of monogamous pairs had higher caterpillar density (Moskwik and O'Connell 2006). During a four-year study in Wisconsin, sex ratio of adult Bobolinks did not differ from unity (Martin 1971b). Wittenberger (Wittenberger 1978a) described a sex ratio that was slightly skewed in favor of females.

Pair Bond

Forms quickly after female arrival (see Breeding: phenology). When single or multiple females pass overhead, males give conspicuous, short aerial song displays. When unpaired female alights in or close to male's territory, male initiates repetitive, stereotyped advertising-courtship sequence: includes a low, hovering, circle-flight, brief song, and abrupt drop to low perch or ground. During drop, male gives 1–3 rasping *buzz* notes as he dangles legs and holds wings in strong dihedral. Wings are often retained in elevated position for several seconds after alighting. If female remains, male repeats sequence up to 5 times/min for intervals of 30–40 min. Female typically is passive, although occasionally she initiates sexual chase by flying over male while giving series of *zeep* or "whine" notes. Chases are tortuous (up to 8 males, NGP) and sometimes prolonged, lasting up to 4–6 min, with female flight rapid and elusive. Neighboring males often join chase, which ends with female darting to heavy ground cover within mate's territory. Agonistic behaviors directed toward other males, and high song rate characteristic of pre-pairing period, decline with onset of courtship (Appendix 1

Pair bond continues until juveniles attain independence. In instances where nest is destroyed by predators or inclement weather, pair may renest together, or female may

choose a new mate or leave field and presumably renest elsewhere. In Wisconsin and New York, females with vascularized brood patches typically arrive on primary research meadows coincident with mowing of other hay fields in region. These form pair bonds and construct replacement nests. In cases where both male and female survive, they sometimes re-pair upon their return in May to their nesting meadow.

Courtship And Copulation

Courtship lasts 2.5–3 d before copulation commences, and involves Precopulatory Crouch Displays, some accompanied by partial song, tail fanning, and accentuated wing spread (Figure 5). Martin (Martin 1967) provides detailed description of crouch, copulation, and postcopulatory behaviors, including female solicitation and reception postures and vocalizations. Actual mounting occurs throughout day; major concentrations of prolonged copulations (15–20 consecutive mounts) are characteristic between 0700 and 0900 h and again in late afternoon. Copulation contact is brief, usually < 1 s, as male rapidly flutters wings and lowers cloaca and tail. Normally occurs within 40 m of nest, which is under construction during early stages of copulation. Female often carries nesting material in bill at time of copulation. Mounting usually occurs directly following male flight from perch or nearby ground position. Flights from ground are preceded by slow, walking variation of Crouch Display, in which male approaches in stiff, fairly upright posture with greatly arched wings and erect body plumage; tail is lowered, spread, and dragged on ground; partial song sometimes accompanies display and immediately following copulation. Dismounting is always by flight. Between mounts, male typically orients back toward female with prominent erection of nape and scapular feathers, wings slightly spread, and tail lowered and fanned. Male gives partial song and often turns head toward female during display. Copulation bouts are given through second and often into third day of laying.

Fertile females are chased by males (up to 8 at a time; NGP) in dramatic aerial stunts. A single male able to or allowed to catch up to female and corals her to the ground.

Extra-Pair Copulations

Based on allozyme analysis of blood samples, extra-pair copulations (EPCs) often result in extra-pair fertilizations (EPFs) (Gavin and Bollinger 1985); multiple paternity occurs when > 1 male sires young hatched from same clutch. In an analysis of 191 pair-bonded adults and 840 nestlings, a minimum of 36 nestlings (4.3%) exhibited genotypes that excluded attending male as genetic father; 14.6% is best estimate of nestlings sired by EPCs and 38% of all nests contained ≥1 nestling resulting from EPFs.

Highest percentage of EPFs occurred when older females pair-bonded with younger males (Bollinger and Gavin 1991).

Social and Interspecific Behavior

Degree Of Sociality

Strongly territorial during early period on breeding fields, but social and highly gregarious during remainder of year. Interfamily flocks begin forming within 6 d after first young fledge. Flock size increases, in some locations to several hundred birds. Normally, members of flock depart nesting field simultaneously, joining with other flocks into aggregations of at least 25,000–30,000 birds (McAtee 1919b). Winter flocks range from several dozen individuals, especially in grasslands, to thousands of individuals in daytime foraging flocks in crops, up to hundreds of thousands at some night roosts (López-Lanús et al. 2007, Renfrew and Saaavedra 2007).

Play

Unknown in species.

Nonpredatory Interspecific Interactions

Territorial males are aggressive toward most co-nesting bird species. Dive and swoop at other birds from air or perch, and chase from several to > 100 m. Occasionally attack flying individuals. Excluding male Red-winged Blackbirds (*Agelaius phoeniceus*), which dominated Bobolinks in 24 of 33 encounters, and Eastern Meadowlarks (*Sturnella magna*), which dominated in 4 of 5 aggressive interactions, other species were subordinate in 74 of 75 interspecific exchanges (Martin 1967 , SGM). Bobolinks dominated all 66 interspecific encounters reported by Wiens (Wiens 1969) in an area without Red-winged Blackbirds. Red-winged Blackbirds appear particularly aggressive toward Bobolinks; early in breeding season, Bobolink males chase all Dickcissels (*Spiza americana*), but by midseason, Dickcissels become the aggressors (Karr 1964). Sometimes flock with other icterids in winter (López-Lanús et al. 2007, Renfrew and Saaavedra 2007).

Predation

Kinds Of Predators And Manner Of Predation

Cooper's Hawks (*Accipiter cooperii*) known to take adults (Meag 1959), and Ring-billed Gulls (*Larus delawarensis*) observed taking fledglings (Bollinger 1988b). Eggs and nestlings taken by garter snakes (*Thamnophis sirtalis*; Gabrielson 1922a , SGM) and milk snakes (*Lampropeltis triangulum*; TAG); cats, dogs, and skunks (SGM); Short-eared Owls (*Asio flammeus*; Wittenberger 1978a , SGM); Sandhill Cranes (*Grus canadensis*; Wittenberger 1978a); yellow-bellied racers (*Coluber constrictor flaviventris*; Wittenberger 1978a); Northern Harriers (*Circus cyaneus*; Meag 1959); American Crows (*Corvus brachyrhynchos*; Kingsbury 1933 , Bollinger et al. 1990a); and Ring-billed Gulls (Bollinger et al. 1990a). Karr (Karr 1964) and Martin (Martin 1967) reported mouse (*Peromyscus* sp.) predation on eggs and nestlings. Bat Falcon (*Falco rufigularis*), Aplomado Falcon (*F. femoralis*), and Peregrine Falcon (*F. peregrinus*) observed hunting Bobolinks on overwintering grounds (RBR).

Response To Predators

Bobolinks respond to flying accipiters and Northern Harriers by characteristic, high-altitude circling song flight; often involves most territorial male Bobolinks on a meadow (SGM, TAG). Disturbed adults emit several call notes (see Vocalization: calls) in response to predators and intruders near nest or young. Both sexes perform diversionary behavior when disturbed at nest by human or predator; typically involves a short hop-flight from nest, then skimming along above vegetation for 1–2 m and plummeting with outspread wings into vegetation, then running in weaving, "rodent-like" fashion for several meters, lurching from side to side and alternately outstretching and sometimes dragging right and left wings. If pursued, may proceed while displaying for > 100 m before flying off. Male behavior is more elaborate and conspicuous, often accompanied by song and followed by repetitive tchenk notes; female moves off nest in silence (SGM). Nero (Nero 1959a) provides another detailed description.

Males will jump on the back of snakes during or immediately after predation events. Perlut observed a male repeatedly (over eight times) jumping on a milk snake that had a 4 day old nestling in its mouth and was 15 m from the nest.

On overwintering grounds, foraging and roosting flocks are typically very vocal, and respond to arrival of a raptor by simultaneously ceasing all vocalizations. Do not fly when a raptor is present (RBR).

Note: Unreferenced descriptions are from SGM's unpublished field notes or from Martin (Martin 1967).

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Menu

Dickcissel   Red-winged Blackbird

Bobolink
Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

Sections

Breeding

Phenology

Pair Formation

See Figure 6. In three well-studied populations, bulk of males that establish initial territories normally arrive on breeding grounds 1–5 May in New York (TAG); 13–22 May in Oregon (Wittenberger 1978a); and 10–13 May in Wisconsin (Martin 1971b). Older males generally precede yearlings by several days. Females normally begin arriving 4–8 days after initial group of territorial males. Earliest returning females also tend to be oldest (Martin Martin 1971b , Martin 1974c , Wittenberger 1978a).

Females returning to same breeding meadow often settle with a male within hours of returning, occasionally re-pairing with male of previous year. Females lacking familiarity with location generally move about the meadow for up to 2 days before pairing, which becomes
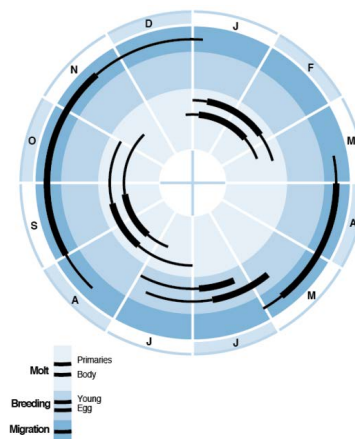

Figure 6. Annual cycle of the Bobolink, Wisconsin.   Enlarge

Annual cycle of breeding, molt, and migration of the Bobolink near Sauk City, WI. Thick lines indicate peak activity, thin lines off-peak. See text for details.

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evident when female closely associates with and follows a male within territory as he performs courtship sequence (SGM). Early in courtship phases, male devotes complete courtship attention to female. After second day of courtship, and always by first day of copulation period, male attempts to attract unpaired females. Polygynous males often pair with a second mate 3–8 days after initial pairing occurs. Pair formation within a population is typically highly synchronous, with most males that are successful in becoming paired attracting their first females within a few days of one another (SGM, TAG). However, dispersal and subsequent renesting triggered by hay harvesting can lead to significant asynchrony in agriculturally dominated landscapes (Perlut et al. 2006).

Nest-Building

Over a 6-yr period in Wisconsin, earliest nest-construction initiation dates were 18 May (four years), 19 (one year), and 24 May (one year). Nest construction completed in 1–2 d (SGM, TAG). In Oregon, pair-formation and nest-building phenology tend to be 6–10 d later than in Wisconsin. Food abundance may influence timing of nesting events in Oregon (Wittenberger 1978a). The timing and intensity of hayland management in the previous year may influence the timing of nesting in Vermont (Perlut et al. 2006).
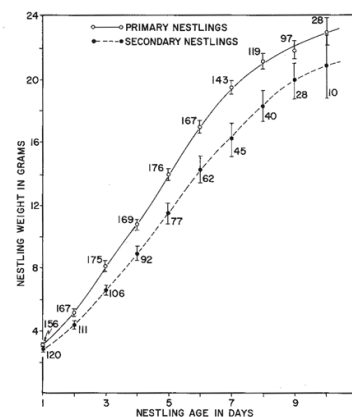
Figure 7. Weight gain of Bobolink nestlings.   Enlarge

Weight gain of primary (from nest of first female of a male) and secondary (from nests of subsequent females of a male) Bobolink nestlings according to age. The number beside each plotted value represents the sample size for that age; vertical bar indicates 99% confidence limits for the mean values. Age 1 represents chicks that emerged within the 24-h period before weighing (Martin 1974).

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Bobolink nest, Wisconsin.   Enlarge

Collected Oconto Co.; Wisconsin. 10 Jun 1947. Ruler is in cm.; photographer Rene Corado

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First Brood Per Season

One egg laid/day, starting within 1–2 d of nest completion (SGM, TAG). First egg dates for a 6-yr study in Wisconsin ranged between 20–26 May (median = 20 May); over 13 yr in Vermont first egg dates ranged from 13–25 May (median = 20 May). Average incubation period was approximately 12 d, 9 hr in Wisconsin, and 11 d, 8 hr in Nebraska (D. Kim unpubl. data) and 10 d, 7 hr in Vermont (n = 157, NGP). Extreme dates for eggs in nest in Wisconsin were 20 May and 22 Jul. Last young left nests in Vermont between 11–30 July (NGP). If undisturbed, young leave nest 10–11 d after hatching. Extreme dates for young in nest in Wisconsin were 3 Jun and 2 Aug (SGM).

Second Brood Per Season

One brood per season is norm. In Vermont, only 7.2% of females renested after their first nest either fledged or failed (58 of 798); two individuals nested three times (NGP). Clutch size smaller in second attempt (1st clutch: 4.92 ± 1.11 SD; 2nd clutch 4.23 ± 1.03 SD; NGP). Renesting was slightly more common by females breeding in hayfields than pastures (Perlut and Strong 2011). One observation of second brood in Wisconsin (SGM). In one year, 30% of females in 1 of 10 New York fields (studied over several years) built second nests and laid second clutches even though first brood fledged. Initiation date for first clutches of double-brooded females ranged from 21 to 24 May; for second clutches, from 24 Jun to 1 Jul (Gavin 1984). In New York and Wisconsin, some color-banded females experiencing repetitive nest failures laid two replacement clutches. Presence of eggs after 20 Jun and nestlings after 1 Jul probably represent renesting. Females that renest tend to move away from wooded edges in their second nest (Bollinger and

Bobolink clutch, Iowa.   Enlarge

Collected Shawondasee, Dubuque Co., Iowa. 28 May 1906. Ruler is in cm.; photographer Rene Corado

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Bobolink nest with eggs and hatchling, Chicopee, MA, 9 June.   Enlarge

Females appear to choose nest location. Nest is always on ground, often at base of large forbs.Image via Birdshare: Mike Allen.

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Gavin 2004).

Nest Site

Females appear to choose nest location. Nest is always on ground, often at base of large forbs such as meadow rue (*Thalictrum dasycarpum*), golden alexander (*Zizia aurea*), and clover (*Trifolium* sp.). Of 127 nests in Wisconsin, 83.5% were beneath major forbs, 11% in sedge growth containing smaller forbs, 3.1% beneath woody overstory, and 2.4% arched over by litter. None was located where grass afforded the major concealment, despite wide coverage (63.8%) of grass over the entire nesting meadow. Total vertical vegetative density adjacent to nest sites was higher than over the meadow as a whole; percent of open skylight in nest vicinities was significantly less than average ground-level shade for entire field (Martin 1971b). In Vermont, 759 of 863 nests (88%) included grass immediately around the nest cup.

Ribic et al. (2009) reviewed the area sensitivity and distance to edge literature, and found that both the effects of patch area and distance to edge on nest placement were variable. In Vermont, mean distance to edge in hayfields and pastures was 94.5 ± 56.5 m for Bobolinks (*n* = 652), where Bobolinks nested significantly less than expected within 50 m of the edge. They used portions of fields near hedgerows less than expected, but used wetland, forest, agricultural, road, and developed edges in proportion to availability (Perkins et al. 2013). Nest placement was also positively associated with the degree of habitat openness (Keyel et al. 2013). Nest density was lower than expected within 25 m of the edge in New York, where edge avoidance extended to 100 m (Bollinger and Gavin 2004). There, Bobolinks also avoided road edges, but did not avoid edges with old fields or pastures. In Iowa, Bobolink density was lower near woodland edges as compared to road and agricultural edges (Fletcher and Koford 2003). Furthermore, edge avoidance increased in grassland fragments with multiple edges (Fletcher 2005). Numerous other studies have found a positive relationship between Bobolink nest density and distance to edge (Bollinger 1995, Johnson and Igl 2001, Renfrew and Ribic 2002, Skinner 2004), while Davis et al. (2006) found the relationship to be variable.

Nest

Construction Process

Female gathers material and constructs nest without male assistance, typically over 1–2 d. Additional lining material is sometimes placed in nest after first and second eggs are laid. Construction activity often is intensive, occurring throughout day. Females bring 5–10 individual grass, forb, or sedge pieces in each carry, gathered at distances ≤ 80 m from nest site both within male's territory and from territories defended by other males. Nests discovered early in construction by observers are often immediately abandoned (SGM, TAG).

Structure And Composition Matter

Construction is initiated when female plucks all vegetation directly under nest site, exposing bare earth and creating slight depression or deepening an existing one. Nest is composed of two distinct parts, an exterior wall formed of coarse, dead grass leaves and weed stems, occasionally interwoven with living vegetation, and an interior lining of very fine grasses or sedges. Lining covers bare ground, forming floor, and extends upward to top of walls. Exterior walls are constructed first. Exterior shell averaged 540 grass and forb pieces (range 419–760, n = 3); lining averaged 657 stems (314–860, n = 3) (SGM). Nest typically is open above, but in areas where forbs are sparse and litter is deep, some nests are fashioned beneath heavy litter overhang. In one Wisconsin location, 30% of 27 nests were arched by litter (Martin 1971b). Joyner (Joyner 1978) reported on 10 nests in Ontario, all possessing canopies of dead grasses. In Vermont, only 14 of 1,025 (0.01%) nests had a covering, and the openings' orientation for these few nests was inconsistent (NGP).

Dimensions

Mean inside diameter 9.1 cm (range 6.1–11.0, n = 15), inside depth 3.2 cm (1.8–4.4, n = 15) (SGM).

Microclimate

Nests are often placed beneath grass and forbaceous growth, which provides shading and temperature modulation. Percent open skylight at ground level in immediate vicinity of 127 nests in a Wisconsin hayfield was 14%, compared with average value of 34% at ground level over entire field (Martin 1971b).

Maintenance Or Reuse Of Nests, Nonbreeding Nests

After nest completion, no further maintenance reported. Bobolinks are not typically double brooded; in instances of second clutches (Gavin 1984), birds construct new nests. Replacement clutches following predation or flooding of first nest are laid in

newly built nest. No evidence exists for use of nonbreeding nests.

Eggs

Shape

Oval to short oval. Eggs of individual females are relatively constant in shape within and between clutches, but interfemale variation in shape exists (SGM). Egg-shape index (egg length divided by egg breadth): 1.35 ± 0.037 SD (n = 30; Picman 1989).

Size

Following mean measurements from Western Foundation of Vertebrate Zoology are from a sample of 20 clutches; averages and extremes are based on clutch means. Number of eggs measured = 93. Mean length 21.7 mm (range 20.47–23.41), mean breadth 16.20 mm (15.14–17.27). Mean length and breadth of 35 eggs from 7 clutches in Vermont was 21.63 mm ± 0.15 SD and 15.97 mm ± 0.08 SD, respectively (N. Zalik unpubl data). Egg volume: 2.697 cc ± 0.231 (n = 30; Picman 1989).

Mass

Egg mass for 175 eggs from 37 nests in Québec and eastern Ontario showed a mean mass of 2.69 g ± 0.05 SD (range 1.6–3.5 g). Egg mass did not differ with clutch size or initiation date (Frei et al. 2010). Mean mass of 35 eggs from 7 clutches in Vermont was 2.68 g ± 0.04 SD (N. Zalik unpubl data). Mean mass of 5 eggs reported as 6.7 g by Meyer (Meyer 1916).

Color

From Bendire 1895 . Ground color varies from bluish gray to pearl gray to pale reddish brown or pale cinnamon rufous. Irregularly blotched and spotted with different shades of claret brown, chocolate, and lavender markings, intermingled with each other and varying in size and intensity. In some eggs, ground color is almost hidden by large blotches; in most, darker markings are primarily confined to larger end of egg. Almost every clutch is differently marked; thus, difficult to provide an "average" description.

Surface Texture

Smooth, fairly glossy.

Eggshell Thickness

From 17 eggs collected in 1987 by Picman (Picman 1989): 0.09 mm ± 0.003 SD.

Clutch Size

Number of eggs deposited per clutch in Wisconsin: mean 5.1 ± 0.84 SD, range 3–7, *n* = 214 clutches (SGM), Vermont: 4.7 ± 0.99 SD, range 2–7, *n* = 965 clutches (NGP).

Egg-Laying

One egg deposited/day, normally between 0600 and 0700 h. First eggs laid within 1–2 d of nest completion. Female seldom visits nest (other than to lay) during deposition period, although she may bring additional lining material to nest during first and second day of egg-laying (Martin 1971b). No behavioral or genetic evidence of intraspecific egg parasitism (Gavin and Bollinger 1985 , Bollinger and Gavin 1991).

Incubation

Onset Of Broodiness And Incubation In Relation To Laying

Incubation by female only; begins with laying of penultimate egg (Martin 1974c).

Incubation Patch

Develops only in female as ventrum defeathers and develops vascularization around the time egg deposition begins. Remains vascularized through nestling period (SGM).

Incubation Period

As measured from laying of last egg to hatching of this egg, varies from 11 d 20 h to 13 d 7 h, averaging approximately 12 d 9 h (Martin 1971b).

Parental Behavior

Late in incubation stage, male visits nest periodically; does not feed mate. He shows anticipatory food-bringing in last day of incubation.

In Wisconsin, daytime attentive bouts by females averaged 19.8 min, or 70.2% of active period (range 2.5–80 min, *n* = 130 bouts on nest); inattentive times averaged 8.3 min, or 29.8% of active period (2.5–28.7, *n* = 132 bouts off nest). Eighteen measurements of night incubation period averaged 9 h 53 min (range 8 h 41 min–11 h 51 min), with female coming to nest near dusk (range 1943–2117 h) and initially leaving nest in morning between 0528 and 0734 h (SGM).

Hardiness Of Eggs

No information available.

Hatching

Preliminary Events And Vocalizations

No information on nestling vocalizations prior to and during emergence. Eggs are pipped from inside, usually split around middle, occasionally around wider end. Egg tooth is clearly visible during pipping.

Shell-Breaking And Emergence

In Ontario, 80% of nests showed hatching asynchrony where one chick hatched later than its brood-mates (Frei et al. 2010). Young push two eggshell halves in opposite directions. All but last-laid egg hatch synchronously, usually within a period of 2–5 h. Final hatchling emerges approximately 20–30 h after first. Unhatched eggs are left in nest (SGM).

Parental Assistance And Disposal Of Eggshells

Parents do not assist in emergence. Eggshells quickly disappear from nest after each young hatches; evidence that female eats shells (SGM).

Young Birds

Condition At Hatching

Nearly naked except for sparse, buff natal down associated primarily with capital and spinal tracts. Eyes closed. Lie on bottom of nest; movement feeble. In response to noise, emerging young observed to gape while still partially in shell. Capable of strong but silent gaping response within minutes of hatching, lifting head and stretching neck slightly. Average mass at or within a few hours of hatching 3.03 g (range 1.70–3.96, n = 276; SGM). Linear measurements not available.

Growth And Development

Nestling growth may differ between years. Wing length, tarsus length, and mass (n = 166) for 2 to 10 day nestlings showed that birds fledged below adult size and mass, achieving 87.7 ± 2.3%, 67.6 ± 1.5%, and 55.1 ± 0.4% of breeding adult tarsus length, mass, and wing length (± SE), respectively (Frei et al. 2010).

Following is from SGM's notes on observations of nestlings in Wisconsin and is supported by TAG's work in New York. Mass increases rapidly until approximately 8 d after hatching, then more slowly; young achieve average of 22.5 g (range 17.6–26.9, *n* = 38) by day 10. Figure 7 illustrates differential masses by age for primary (fed by two adults) and secondary (fed by female only) nestlings (Martin 1974c). No linear measurement data available. Eye-slits begin opening on day 4, eyes fully open by the end of day 6.

Juvenile plumage initially visible on day 3 as primaries and secondaries show as bluish lines beneath skin. On day 4, ensheathed wing quills are 3.2–6.0 mm long; ensheathed contour feathers become visible in spinal tract and, late on day 4, in ventral tract. Caudal tract appears as fine filaments. On day 5, wing quills have lengthened to 6.0–12.5 mm, not emerged from sheaths. Contour feathers in spinal and ventral tracts are clearly visible, and filamentous rectrices are about 1.5 mm long. On day 6, wing quills and feathers of ventral and capital tracts emerge from sheaths; remiges 10.0–18.0 mm long, and rectrices still completely within sheaths, about 6.0 mm in length. On days 7 and 8, all feathers expand beyond their sheaths, with capital tract feathers tending to emerge late in day 8. Juvenile coloration pattern is apparent by this point.

Body is fully covered by feathers at time of nest departure, but flight feathers are still partly ensheathed; flight is not possible. Until day 8, nestlings give low, quiet buzzes in conjunction with gaping when disturbed or when adults appear at nest rim. Thereafter, reaction to disturbance changes to a crouch or sometimes to escape by rapid running and jumping. Running capability develops by day 7. By this time, birds frequently engage in preening and stretching, are quite active, and if hungry, enthusiastically respond to attending parents. Adults consistently brood through day 4 of nestling period; temperature regulation probably commences about this time. Prior to final nest vacancy, 9–10 day old birds occasionally leave nest cup, squat within 0.5 m of nest for periods, then return to nest. Entire brood may leave for brief periods. Begging Call characteristic of fledglings is not given during these temporary bouts away from nest.

Parental Care

Brooding

Hatchlings in primary nests (those of first female paired with a male) are brooded by both adults; male begins alternating with female as soon as first chick emerges. In

Wisconsin, nestlings in secondary nests (those of second and subsequent females paired with a polygamous male) normally are attended only by female. Brooding rhythm is similar to that described for incubation attentiveness. On hot afternoons parents shade nestlings by crouching over them. About 4 d after hatching, brooding frequency declines markedly and male ceases. Female occasionally broods through day 7 or 8 and at night until final exodus of fledglings (Martin 1971b).

Over a 4-yr period of observations at primary nests in Oregon, the two adults cumulatively spent between 43 and 50 min/h brooding and feeding 2-d-old nestlings; nest attendance dropped to between 4 and 15 min/h for 10-d-old young. Males and females adjust time jointly apportioned to brooding and feeding primary nestlings, based on prevailing weather conditions and food availability (Wittenberger 1982).

Feeding

Both parents feed young in primary nests; at secondary nests, degree of male assistance differs geographically. In New York (Wootton et al. 1986) and Oregon (Wittenberger Wittenberger 1980a , Wittenberger 1982), polygynous males routinely feed at primary and secondary nests. In Wisconsin (Martin Martin 1971b , Martin 1974c), polygynous males concentrate on feeding their primary nestlings but show flexible, adaptive behavior by turning some or all attention to secondary nestlings when insufficient food is delivered by female.

Feeding begins within 1 h after first nestling hatches; continues until fledglings become independent. Food is fed directly from parent's bill to nestlings' mouths when they beg and gape. Peak feeding periods occur early in morning and just before dark (Wittenberger 1982). Rate at which young receive food increases linearly with nestling age. Based on 174 h of feeding schedule data, in Wisconsin approximately 2.6 food deliveries/h to each nestling aged 1–2 d; feeding rate increased to about 4.3 deliveries/h to nestling aged 9–10 d (Martin 1974c). Feeding rates in Oregon showed similar increases according to nestling age. Primary nestlings aged 7–10 d received 69–132 mg food/h, with approximately 50% delivered by each parent (Wittenberger 1982). In Vermont, feeding of nestlings at 6 d was female-biased (72% of feedings); Little et al. 2009). Nestlings are fed exclusively invertebrates. medialink summarizes food items brought to older nestlings in Oregon for a representative year. Food brought to Wisconsin nestlings is similar in composition and proportion to that in Oregon (SGM). Based on ligature samples of 124 prey items from 54 nestlings in 38 nests, 75% of the prey brought to nestlings consisted of leaf hoppers, crickets, Lepidoptera larvae,

mayflies, and spiders (McAtee 1919b , AMS). Holometabolous larvae, crickets, and mayflies were the largest prey items fed to nestlings (AMS).

Nest Sanitation

Nestlings defecate immediately after being fed; they rotate in nest, expose posterior, and extrude discrete, well-contained fecal sac which adult snatches as it emerges from the cloaca (videotape of S. Antonini). Adults swallow sacs of small nestlings. After 4–5 d, small sacs are still eaten, but many are carried and dropped in flight, typically > 15 m from nest. Parent normally removes dead nestlings. Nest sanitation continues until final departure by fledglings, resulting in clean, vacated nest cups (SGM). Nestling parasites and invertebrate nest associates not reported.

Parental Carrying Of Young

Never observed.

Cooperative Breeding

Helpers

At four nests in New York, more than two adult Bobolinks fed nestlings (Beason and Trout 1984 , Bollinger et al. 1986). Two instances of this phenomenon involving multiple adults in Wisconsin (Martin 1971b). Electrophoretic analyses of adults and nestlings at nest in New York indicated possibility that both feeding males may have sired nestlings or that one male may have been previous year's offspring of one or both of other adults (Bollinger et al. 1986). SGM recorded feeding schedule data at nest with young fed by two Bobolinks and a female Eastern Meadowlark that had lost her brood to predator.

Results Of Helping

Help of additional feeding male at a New York nest may have increased fledging success (Bollinger et al. 1986).

Brood Parasitism

Identity Of The Parasitic Species

Two subspecies of Brown-headed Cowbird (*Molothrus ater ater* and *M. ater artemisiae*) are reported (Friedmann and Kiff 1985).

Frequency Of Occurrence, Seasonal Or Geographic Variation

Intensity of brood parasitism apparently varies geographically. In e. breeding range parasitism rates are low. In New York, 0 of 422 nests were parasitized (TAG), in Ontario 8 of 136 nests (5.9%) parasitized (Peck and James 1987), and in Vermont 1 of 1,025 nests parasitized (NGP). In the Midwest, rates are low to moderate. In Illinois one study found 0 of 57 nests parasitized (E. Bollinger, pers. comm.), and only 1 of 62 nests parasitized in another study (J. Herkert pers. comm.), and in Wisconsin < 5% to 20% parasitized (SGM). Farther west, parasitism rates are higher. In North Dakota, 42 of 108 (39%) nests were brood parasitized (Kerns et al. 2009), and in Nebraska 430 of 839 (51%) nests parasitized over five nonconsecutive years (range 44–69% among years; D. Kim pers. comm.). In Minnesota, 6 of 14 nests within 45 m of wooded edges and 10 of 33 nests farther from edges contained Brown-headed Cowbird eggs (Johnson and Temple 1990).

Timing Of Laying In Relation To Host's Laying

In Wisconsin, Brown-headed Cowbird's laying tends to be synchronized with that of host (SGM).

Response To Parasitic Mother, Eggs, Or Nestlings

Based on SGM's observations. Both male and female Bobolinks routinely attack or chase Brown-headed Cowbirds entering territory. No evidence that Bobolinks distinguish or remove cowbird eggs from nest, or that they abandon nests containing cowbird eggs. Cowbird eggs are incubated with host eggs; normally hatch within 1 d of hosts' eggs. Bobolinks give cowbird nestlings and fledglings the same parental attention they give their own young.

Effects Of Parasitism On Host

In Minnesota, fewer Bobolink young fledged from parasitized than nonparasitized nests (Johnson and Temple 1990). Population-level effects over entire range are probably minor because of relatively low incidence of parasitism.

Success Of Parasite With This Host

Apparently successful. In Wisconsin, fledging rates of parasite and host are similar. Adult Bobolinks noted attending almost-independent cowbird fledglings. One banded nestling cowbird was mist-netted the following May on its natal field as an adult male (SGM).

Fledgling Stage

Undisturbed young leave nest on day 10 or 11. Entire brood usually departs within 1–6 h of first fledgling. Runts remaining in nest normally starve, as parents give priority response to calls of fledglings. At nests disturbed by humans or predators, some young leave as early as day 8, most on day 9. Vacate nest by walking, running, or jumping over vegetation tangles, any time during daylight hours. Parents do not encourage or provoke them. Within 2–3 min of leaving nest, fledglings commence loud, characteristic contact note that continues for > 20 d. They scatter by walking or running almost immediately after leaving nest. Move as much as 70 m in first day out of nest. Adults divide labor of feeding, each parent concentrating on specific fledglings (Martin Martin 1967 , Martin 1971b , Wittenberger 1980a).

Young depart nest unable to fly, with all contour feathers emerged from sheaths but flight feathers partially encased. Until flight capability develops, birds generally remain in thick vegetation, relying on cryptic coloration for concealment. At approximately day 13, they make short flights; by day 16, they are capable of sustained flight > 200 m and pursue one adult after another in flight, emitting repetitive Begging Calls (Martin Martin 1967 , Martin 1971b). Little data on growth between leaving nest and independence.

Immature Stage

By time of independence, young are approximate size of adult female (SGM, TAG). Six birds were caught between 21 and 31 days after banding (on day 6-7); capture dates ranged from 7 July to 14 July. All six individuals could fly; average mass was 30.1 g (min = 24.2, max = 33.3; NGP). Because of synchronism in onset of nesting by primary females, young of many nests fledge within a 3- to 4-d interval. Within 6 d after first young leave nests, fledglings and associated adults from several nests join in flock; remain in group until birds depart breeding meadow and possibly longer. Flock increases in size as additional immatures and adults from other nests join. Flock is mobile, gradually moving as a unit over entire meadow. Within flock, adults continue feeding their own young, for up to at least 28 d after birds leave nest (Martin 1971b). Immatures observed foraging for and picking at food as early as 26 d after hatching (SGM). Research needed on post-fledging survival.

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Cornell Birds of North America Online
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Menu

Dickcissel

Red-winged Blackbird

Bobolink

Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

Sections

Demography and Populations

Measures of Breeding Activity

Age At First Breeding; Intervals Between Breeding

Capable of breeding in second year, based on breeding behavior of banded 1-yr-old males and females (TAG, SGM). 1-yr olds presumably attempt to breed with same frequency of all other age classes (NGP). Bobolinks apparently breed every year, or attempt to do so.

Clutch

Clutch size data from Bobolinks nesting in upstate New York and Wisconsin are quite similar. Clutch size ranges from 1 to 7, with a mode of 5. New York (n = 422 nests): average = 4.99, (TAG). Wisconsin (n = 214): average = 5.1 (Martin 1974c , SGM), Vermont (n = 989 nests): average = 4.7. Mean clutch size of renests after nest failure was 4.20 (n = 86) compared to 4.95 (n = 79) on undisturbed sites in an investigation of alternative hay harvest cycles (Perlut et al. 2011).

Annual And Lifetime Reproductive Success

Nest success varies broadly across regions and habitat types from 3.5% to 48% (Table 1).

First clutches have higher fledging success than attempted renests: 213 of 379 first clutches (56.2%) and 16 of 41 second clutches (39.0%) fledged ≥1 young in New York

(TAG). Of 422 total nest attempts, 230 fledged young, for a mean of 2.29 young/clutch. For the 213 successful first clutches, mean number of young fledged was 4.27 (±1.35 SD).

In Vermont: 360 of 817 first clutches (55.9%), 33 of 61 second clutches (44.1%), and 1 of 3 (33.3%) third clutches fledged ≥1 young (NGP). Of 881 total nest attempts, 486 fledged young, for a mean of 2.15 young/clutch. Of 457 successful first clutches, mean number of young fledged was 3.91 (±2.13 SD).

Annual reproductive success in New York was 2.55 (967 young fledged by 379 females). Corresponding number in Wisconsin where flooding destroyed many nests in 2 of 5 yr was 2.13 (219 young fledged by 103 females). Number for Wisconsin nests unaffected by flooding was 2.69 (215 young fledged by 80 females) (Martin 1971b). Annual reproductive success varied in Vermont based on the timing and intensity of hayfield and pasture management (range: 0.04 ± 0.04 to 2.8 ± 0.22; Perlut et al. 2008a). Number of females that fledged ≥ 1 young (230) divided by the total number of females (379) equaled 0.61 in New York (TAG).

Number Of Broods Normally Reared Per Season

Females occasionally renest if first nest is destroyed; nests destroyed by hay harvest often lead to within-season breeding dispersal, complicating estimates of renesting frequency. Rarely, females in New York, Vermont and Wisconsin attempt a third nest during the same breeding season (TAG, SGM, NGP). Generally single-brooded, although 6 of 20 resident females initiated a second brood after successfully fledging young from their first nest at one site in New York in 1982; none of these second broods fledged (Gavin 1984). In Vermont, 10 females renested after successfully fledging young from their first nest site; six of 10 successfully fledged their second nest (NGP). For females whose nest failed due to hay harvest (cut prior to 11 June), a radio-telemetry study revealed that ca. 25% of dispersing females renested, and of those who renested, ca. 25% successfully fledged young (AMS, NGP).

Proportion Of Total Females That Rear At Least One Brood To Nest-Leaving

See above.

Life Span and Survivorship

First-Year

Survival of fledglings and natal fidelity may be very low in New York; of 337 nestlings banded on day 7 at sites that were netted the following year, only six (1.8%) were subsequently captured at those breeding sites (TAG). Bollinger (Bollinger 1988a) recaptured a female, banded as a nestling, that was 8 yr old; TAG recaptured a female and a male originally banded as adults that were ≥ 9 yr old and ≥ 7 yr old, respectively.

In Vermont, of the nestlings banded in 2002-2011, 83 were recaptured (12.5%). Annual apparent survival estimates for first-year birds were most strongly impacted by nestling mass and fledge date, where heavier nestlings hatched earlier in the summer had higher apparent survival. Across ten yearly estimates, first-year birds averaged 0.412 (range 0.322–0.577; NGP, AMS). Perlut recaptured a male, banded as a nestling, that was 9 yr old, and another male, banded as an adult, that was at least 10 yr old.

Adult

Wittenberger (Wittenberger 1978a) reported that a mean of 56.9% of adult males and 61.1% of females returned to his study area the following year; Martin (Martin 1974c) found that 62.8% of males and 33.9% of females returned to his site the following year; at a high-quality site, Bollinger and Gavin (Bollinger and Gavin 1989) noted return rates of 70% for males and 44% for females. (Gavin and Bollinger 1988).

In Vermont, annual apparent survival for both males and females differed among fields with managed in varying intensities; for males, it ranged from 0.52 on the most intensively managed fields to 0.70 on the least-intensively managed fields. For females, it ranged from 0.19 on the most intensively managed fields to 0.55 on the least-intensively managed fields (Perlut et al. 2008b). However, other life-history factors, particularly the number of nest attempts, nest success and the total number of young fledged per year, are all positively associated with annual apparent survival—more so than intensity of grassland management. Across ten yearly estimates, it averaged 0.51 (range 0.37-0.80) for males and 0.41 for females (range 0.28-0.72). The detection probability varied from 0.58-0.67 based on the off-plot resight effort but was similar between sexes (NGP, AMS).

Disease and Body Parasites

Diseases

Bobolinks are known to carry several species of *Plasmodium* blood parasites (Levin et

al. 2013), reportedly of both North and South American origin (I. Levin unpubl. data).

Body Parasites

Few data. In New York, several adults were captured with attached ticks (*Ixodes muris*; TAG). Adults and nestlings commonly harbor fleas (Siphonoptera) and occasionally lice (Mallophaga).

Causes of Mortality

Exposure

Loss of nestlings during cold, rainy weather or hailstorms can be substantial (Martin 1971b , Wittenberger 1980b , TAG). Flooding of lowland meadows and sedge fields in Wisconsin caused serious embryo and nestling mortality in 2 of 7 yr of study (SGM). Flooding caused up to 28% of nests in hayfields to fail in Vermont (Perlut et al. 2006).

Predation

See Behavior: predation.

Hayland Mowing

In regions with significant intensively management hayland, the timing of mowing can cause significant nest failure. In Vermont, in fields mowed by 11 June and again 35 days days later, 95% of nests failed to management; in fields mowed between 21 June and 11 July, 54% of nests failed (Perlut et al. 2006).

Grazing

In rotationally grazed systems in Vermont, predation and trampling by cows accounted for 32% of nest failures. Both nest success (6–44%) and annual productivity (0.43–2.83; *n* = 76) varied annually (Perlut and Strong 2011).

Shooting And Trapping

Shot in rice fields during non-breeding season, though overall mortality likely low. Trapped on overwintering grounds and during spring migration for pet trade. See Conservation and Management: Effects Of Human Activity.

Pesticides

Exposed to organophosphates at lethal and sublethal levels on non-breeding grounds. See Conservation and Management: Effects Of Human Activity.

Competition With Other Species

Red-winged Blackbirds occasionally displace Bobolinks from perches (see Behavior: social and interspecific behavior), and Bobolinks seem to avoid nesting too close to active Red-winged Blackbird nests; no mortality is known to result from these interactions (TAG).

Range

Initial Dispersal From Natal Site

Flocks of all sexes and ages begin forming in late Jun; remain in breeding vicinity until late Jul to mid-Aug. Soon thereafter, flock disappears from breeding fields, apparently as a cohesive unit.

Fidelity To Breeding Site And Winter Home Range

Adults of both sexes show high fidelity to breeding sites, tending to return to same vicinity year after year (Martin 1971b , Wittenberger 1978a); see Life Span and Survivorship, above. Previous reproductive success appears to be a principal factor influencing fidelity, particularly for females (Gavin and Bollinger 1988); site quality also appears to play an important role (Bollinger and Gavin 1989). Overwintering sites visited by flocks over multiple years, including rice fields visited consistently for 50 years according to farmers (Renfrew and Saavedra 2007). One male with two years of geolocator data stopped and overwintered in same areas in both years (Renfrew et al. 2013), more information needed on individual fidelity to overwintering sites.

Dispersal From Breeding Site Or Colony

In Vermont, mean breeding dispersal distances for Bobolinks were 370 m (median = 119 m); ~85% of adults returned to the field they bred in previously. Dispersal distance was not different between sexes; however, successful reproductive success was associated with decreased probability of dispersal. Mean natal dispersal distance 975 m (max = 8,424 m), with ~30% returning to the natal field (Fajardo et al. 2009). Maximum natal dispersal distance in Vermont was 8.4 km (Fajardo et al. 2009).

Home Range

During breeding season, home ranges of males and females encompass area of several male territories (TAG), an area of use that becomes larger when nestlings fledge. Spatial

extent of movements within multi-week stopovers (the Llanos and Bolivia), and on overwintering grounds (Bolivia, Paraguay, and Argentina) are generally within 500 km based on light-level geolocator data (RBR). Technological advancements expected to provide refined estimates.

Population Status

Numbers

Mean densities (males/km^2) 33 ± 24 (*n* = 12) for mixed-grass prairie; 26 ± 19 (*n* = 9) for tall-grass prairie (Breeding Bird Census, 1966-1989); and 91 ± 70 (*n* = 81) for New York hay fields. Highest-quality hay fields in New York supported mean of 120 ± 81 (*n* = 45; Bollinger and Gavin 1992).

Trends

Of 17 physiographic regions reporting Bobolinks, Breeding Bird Survey data for 1966–2013 indicated 10 regions showing a significant decline and only one region with a significant increase (Sauer et al. 2014). For the period 1966-2013, the species showed an annual survey-wide decline of -2.04% per year, and a significant -1.0% decline in the U.S. and a -3.65% decline in Canada. For the period 2003-2013, annual declines were not as steep, but still statistically significant (e.g., -1.19%, -0.74%, and -2.42% for survey-wide, U.S., and Canada, respectively).

Population Regulation

Predation on eggs and nestlings and nest exposure to adverse weather and flooding are probably the most significant mortality factors in natural habitats. From 1982 to 1985 in New York, 48 of 72 unsuccessful nests were lost to predation, usually during incubation. Land-use changes, however, are most important in affecting overall abundance on regional and continental scales. From 1940 to 1986 in 18 northeastern states, area in hay fields declined from 12.6 to 7.1 million ha. During same period, hay fields planted to alfalfa and alfalfa mixtures, a vegetation type not normally used by Bobolinks, increased from 20 to 60% (Bollinger and Gavin 1992). Also, hay fields now are cut 2–3 wk earlier than they were in 1940s and 1950s, with mowing coinciding with peak nesting period. Bollinger (Bollinger 1988b) and Perlut et al. (2006) address relationship between timing of hay-cropping and nestling mortality. In agricultural regions of Vermont, population dynamics influenced by low productivity and apparent

survival on intensively managed hayland more so than juvenile survival, habitat preference, or overall adult survival (Perlut et al. 2008). Alternatively, in restored grasslands in Iowa, populations were most sensitive to changes in annual adult survival, whereas sensitivity to brood parasitism and renesting was low (Fletcher et al. 2006).

Breeding   Conservation and Management

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Effects of Human Activity

Shooting And Trapping

On overwintering grounds in Argentina and Bolivia, species is considered a pest in rice crops. Based on interviews with farmers, one of the main control measures is scare tactics such as shooting and firecrackers. During late winter in Argentina and perhaps elsewhere, males are trapped and sold in local pet trade (Pettingill 1983 , Sick 1993 , Di Giacomo et al. 2005). Trapped with nets in rice production regions of Colombia during spring migration in April and May (C. Ruiz, pers. comm.). Several thousand trapped and traded each year in Cuba in Apr and May for both domestic and international markets (E. Iñigo-Elias, pers. comm.) .

Pesticides and Other Contaminants

On breeding grounds, studies on the relative risk of pesticides and habitat-related factors are equivocal and based on correlations. Lethal risk of pesticides more highly correlated with 1980–2003 grassland bird population declines in the U.S. than changes in habitat availability (Mineau and Whiteside 2013). However, another analysis for same period found that habitat availability (e.g., CRP, pasture) and agricultural intensification had a greater effect on grassland bird trends than did lethal insecticide risk (Hill et al. 2014). Analyses of population trends in northeastern states for 1966–2007 showed a strong influence of habitat loss rather than pesticides (Perlut 2014).

Bobolinks intentionally poisoned with pesticides in rice fields on overwintering grounds to control seed predation. In Bolivia, rice farmers indicate that intentional poisoning using pesticides in late 1900's caused high mortality; this practice still commonly used in Argentina (Renfrew and Saavedra 2007, Blanco et al. 2008). Indirect exposure to organophosphates (primarily monocrotophos) applied for insect control in Bolivia results in lethal and sublethal levels of exposure in about 40% of Bobolinks captured in mistnets (RBR). Monocrotophos used in Colombia where Bobolinks stopover along northbound migration to feed in rice (C. Ruiz, pers. comm.). Bobolinks seen flocking with Dickcissels in Venezuela during southbound migratory stopover (G. Basili, pers. comm.), where organophosphates have been used as avicides in crops (Basili and Temple 1999).

On both breeding and overwintering grounds, new neonicotinoid-based products a concern due to potential toxicity to pollinators and birds (Mineau and Palmer 2013). High concentrations in surface water linked to declines in local populations of farmland-breeding passerines (Hallmann et al. 2014), and have negative effects on non-target invertebrates (Easton and Goulson 2013, Van Dijk et al. 2013).

Population-level impacts of exposure to pesticides are unknown, needs study.

Degradation Of Habitat: Breeding And Wintering

See Demography and Populations: population regulation, for changes in breeding habitat. Agricultural intensification in Argentina has resulted in conversion of native grasslands, resulting in a slight northward shift in Bobolink distribution as more birds concentrate in rice-producing regions (Di Giacomo et al. 2005, 2008).

Disturbance At Nest And Roost Sites

In New York, primary disturbance to nesting is hay-cropping; 100% of nests with eggs and young nestlings affected by mowing were abandoned or destroyed, but proportion of young lost declined with age of nestlings (Bollinger et al. 1990a). Mowing causes direct mortality from farming equipment that destroys nests, eggs, and nestlings, plus indirect mortality via increased vulnerability of surviving nests and young to predation and weather after a field is mowed (Perlut et al. 2006). Initial models of the effects of mowing in Canada estimate direct mortality of 321,000 eggs and pre-fledged young that would have survived to fledging if mowing had not occurred (Tews et al. 2013).

Flocks in day and night roosts deterred on overwintering grounds in and around rice fields using smoke, guns, and fireworks, resulting in little or no direct mortality (Renfrew

and Saavedra 2007).

Human/Research Impacts

Females occasionally abandon nests during early incubation if nest is visited; rarely abandon after day 3 of incubation (TAG, SGM). In Nebraska and Vermont, 13 of 24 males and 2 of 16 females returned with geolocators that had been attached using leg-loop harnesses the previous year (Renfrew et al. 2013). In Vermont 2 of 8 females abandoned nests immediately after geolocator deployment (NP).

Management

Conservation Status

Protected under Migratory Bird Treaty Act. Listed as threatened in one state and one province, a Species of Special Concern in eight states, and Special Concern, Sensitive, or Vulnerable in four provinces. High Continental Priority in Upper Great Lakes Plain, Dissected Till Plains, and Northern Tallgrass Prairie Partners in Flight physiographic regions; tier II (High Regional Priority) in Lower Great Lakes Plain, St. Lawrence Plain, Spruce-hardwood Forest, and Northern New England regions. High Priority species in Atlantic Northern Forest Bird Conservation Region (BCR), Priority in Prairie Potholes BCR, Medium Priority in Lower Great Lakes/St. Lawrence BCR, and Regional Concern species in Boreal Hardwood Transition BCR.

Measures Proposed And Taken

For discussion of impacts of haying on this species, see above, Demography and Populations: population regulation; also see Bollinger 1988b and Bollinger and Gavin 1992). Fields should be mowed annually to maintain breeding habitat, but mowing should be delayed until early Jul to minimize impacts on fledglings. Even later mowing would allow fledging of birds in renesting situations. However, in Vermont's agricultural landscape, where dairy farmers must hay early, reproductive success increased to a level similar to fields mowed after the breeding season when farmers advanced the first cut in May and delayed the second cut by 65 days (Perlut et al. 2011). In general, large, coordinated landscape-scale management on working lands is needed to address myriad factors limiting breeding habitat.

Idle fields created through Farm Bill programs such as the Conservation Reserve Program (CRP) have the potential to provide suitable habitat for Bobolinks in areas that

otherwise would be unsuitable cropland. Monoculture grass fields with little forb component, however, are generally not suitable for Bobolink nesting. In addition, fields must be managed in order to maintain suitable vegetation structure for breeding Bobolinks (Johnson 1997); appropriate levels and frequencies of disturbance in the form of burning (reviewed in Dechant et al. 2003), mowing, or grazing is needed to maintain suitable habitat (Bollinger and Gavin 1992, Johnson 1997, Madden et al. 1999). Natural prairies can also be managed by prescribed burning. Burning should be done after the nesting season or at least several weeks prior to arrival of adults in spring.

Monocrotophos banned in Argentina in 1999, temporarily banned in Bolivia 2009–2012 (current legal status unknown). Alternatives promoted in Venezuela in early 2000s, although current status unknown. Replacement of monocrotophos with alternative practices or less toxic pesticides recommended at major Bobolink stopovers in Venezuela, Colombia, and Bolivia.

Protection of grassland Important Bird Areas and maintaining quality grasslands through sustainable ranching practices have been promoted as one means to conserve Bobolink overwintering habitat in Argentina (e.g., Di Giacomo and Parera 2008). Grasslands may be especially important in Bolivia and Argentina in Nov and Dec, before rice is available.

Effectiveness Of Measures

Despite the potential for CRP to provide habitat, Bobolink densities can be lower in CRP compared to hayfields (Ribic et al. 2009). The documented effects of grazing vary among many studies that have evaluated its impacts on Bobolinks. For example, Bobolinks showed a negative response to moderate-heavy grazing in the Northern Plains and North Dakota, but neutral and positive response to moderate grazing in Minnesota and Missouri (Saab et al. 1995). Bobolinks respond positively to moderate grazing in tallgrass habitats but negatively to heavy grazing in shortgrass habitats (Bock et al. 1993). Heavily grazed pastures generally do not support Bobolinks (Renfrew and Ribic 2002). In general, light grazing can be beneficial by limiting shrub growth and litter build-up, while heavy grazing does not result in the vegetation height, density, and litter layer that Bobolinks require. Although burning can be used successfully to maintain habitat for Bobolink, densities may be reduced in the short-term (Herkert et al. 1996).

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Priorities for Future Research

Since the first writing of this account, our knowledge of Bobolink ecology has dramatically expanded, particularly for the non-breeding season. Tracking technology has revealed Bobolink migration patterns and greatly refined migration and overwinter distribution. Research on the overwintering grounds has shed new light on the species' ecology and conservation issues, including habitat, diet, foraging behaviors, conflicts with agricultural producers, and threats. This species remains vulnerable where large flocks concentrate during the non-breeding season, usually in rice production regions. Research on the breeding grounds has determined the impacts of haying dates and other farming practices, including grazing, on local populations, and advanced our understanding of behavior, demographics, and influences of patch and landscape features.

To better focus research and guide management, we ultimately need to determine what limits the population size of Bobolinks. Breeding habitat is assumed to be most limiting, and we need to continue to better understand this part of their annual cycle. In addition, recent gains in our understanding of non-breeding distribution and movements allow for a needed assessment of non-breeding threats, their impacts on survival, and the potential for carry-over effects.

Greatest priority should be focused on estimating survival rates and identifying the factors affecting them. The next challenging but essential task is to determine seasonal survival during post-fledging, migration, and overwintering periods, and to estimate annual survival based on data from more breeding locations.

Migration and overwintering periods: better understand habitat use patterns, and determine what constitutes low versus high quality habitat. Investigate carry-over effects, especially effects of overwinter habitat quality on timing of spring migration and breeding productivity; influence of stopovers on movement to and survival on overwintering grounds.

Breeding: knowledge of dispersal distances between breeding populations, and immigration and emigration rates to help identify source and sink populations and dynamics. Across the breeding range, more precise data on breeding phenology could help inform guidelines on mowing dates. Determine at a regional scale how breeding habitat quality decreases over time under late cutting regimes to inform optimal frequency of management. Determine extent to which birds are able to disperse and nest successfully after displaced by early-season mowing.

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the gracious cooperation of farmers in Bolivia, the Platte River Whooping Crane Maintenance Trust, and the Malheur National Wildlife Refuge. Work to update the BNA account was supported by the Bobolink Foundation.

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Jon McCracken, Doug Johnson, and Dave Sample provided input on conservation priorities. Christine Ribic also provided this input, and researched historical accounts of Bobolink distribution and habitat use.

Priorities for Future Research

About the Author(s)

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About the Author(s)

Stephen G. Martin received an M.S. in zoology (1967) from the University of Wisconsin-Madison for research on the behavioral ecology of the Bobolink. He earned his Ph.D. in zoology (1970) at Oregon State University, where his research involved evaluating the ecological and behavioral correlates of polygyny in Bobolinks. After a brief period teaching at Colorado State University, Martin co-founded an environmental science consulting firm. Until 1990 he was senior vice president of ENSR Consulting and Engineering. His consulting research focuses primarily on the effects of environmental contaminants on birds. Martin is a recipient of the A. Brazier Howell Award of the Cooper Ornithological Society, the Russell O. Blosser Memorial Award of the Technical Association of the Pulp and Paper Industry, and the Solid Waste Management Category Award of the American Paper Institute. Current address: S. G. Martin & Associates, Inc., 7121 N. County Rd. 9, Wellington, CO 80549.

Thomas A. Gavin received degrees from Ohio State University (B.S. 1968), University of Arizona (M.S. 1973), and Oregon State University (Ph.D. 1979). After teaching at Oklahoma State University for a year, he accepted a position in the Department of Natural Resources, Cornell University, where he is currently an associate professor. Upon coming to Cornell in 1980, Gavin switched his research emphasis from large mammals to small birds and began studying Bobolinks in fields near Ithaca. He teaches courses in field biology and conservation biology and is also studying the effects of forest fragmentation on resident forest birds in Costa Rica and genetic variation in Northern Goshawks. Current address: Dept. of Natural Resources, Cornell University, Ithaca, NY 14853.

Rosalind Renfrew obtained a Masters (1999) and PhD (2002) in Wildlife Ecology at the University of Wisconsin - Madison. Her graduate research evaluated the effect of fine-scale and landscape characteristics on grassland bird nest productivity in pastures. She began research on the non-breeding ecology of Bobolinks in 2004. In 2007 she co-founded the Vermont Center for Ecostudies and developed a Grasslands Program that includes research on grassland bird non-breeding ecology, grasslands conservation planning, landowner outreach to improve grassland bird habitat, and partnering with South American organizations to advance full life cycle conservation of grassland birds. Bobolink serves as an umbrella species for much of this work. Current address: Rosalind B. Renfrew, Vermont Center for Ecostudies, 20 Palmer Court, Norwich, VT 05055.

Allan M. Strong received his M.S. in Fisheries and Wildlife Sciences from the University of Missouri-Columbia (1986) and a PhD from Tulane University in Ecology and Evolutionary Biology (1999). He began studying Bobolinks when he took on a faculty position at the University of Vermont (UVM) where he teamed up with Noah Perlut and faculty at UVM and SUNY Plattsburgh. The research focused on the population ecology of Bobolinks and Savannah Sparrows in the dairy-intensive Champlain Valley. The research objective has been to seek management practices that simultaneously maintain populations of grassland birds and economic viability for farmers. The work has led to innovative conservation practices that have been successful in the Champlain Valley and other New England states. Strong is a Fellow of the American Ornithologists' Union and currently serves as the Associate Dean of the Rubenstein School of Environment and Natural Resources at UVM. Current address: Allan M. Strong, Aiken Center, University of Vermont, 81 Carrigan Drive, Burlington, VT 05405.

Noah G. Perlut received his MA in Environmental Conservation Education from New York University (1999) and a PhD from the University of Vermont in Natural Resources with a concentration in Wildlife Biology (2007). Since 2002, he and Allan Strong have studied the ecology and evolution of Bobolinks and Savannah Sparrows breeding in agricultural grasslands of the Champlain Valley of Vermont and New York. The project takes a life-history approach, studying the effects of grassland management across known generations of birds, including their reproduction, survival, dispersal, and migration. Perlut's other projects explore how birds adapt to human habitat modification. Perlut is an Associate Professor in the Department of Environmental Studies at the University of New England. Current address: Noah G. Perlut, Department

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Photos from this Account

Adult female Bobolink. Victoria, MN. June.

The following link is to this contributor's Flickr stream or website. http://www.flickr.com/photos/39187618@N04/, Jun 03, 2007; photographer Amber Burnette

Bobolink, female, Ithaca NY, June

Bobolink, female; photographer Marie Reed

Bobolink, male, Ithaca NY, June

Bobolink, male; photographer Marie Reed

Male Bobolink in breeding (alternate) plumage.

, May 13, 2006; photographer Gerrit Vyn

Bobolink nest, Wisconsin.

Collected Oconto Co.; Wisconsin. 10 Jun 1947. Ruler is in cm.; photographer Rene Corado

Bobolink clutch, Iowa.

Collected Shawondasee, Dubuque Co., Iowa. 28 May 1906. Ruler is in cm.; photographer Rene Corado

Adult male Bobolink. Victoria, MN. June

The following link is to this contributor's Flickr stream or website. http://www.flickr.com/photos/39187618@N04/ , Jun 03, 2007; photographer Amber Burnette

Adult male Bobolink, OH, 14 May.

Male in Alternate plumage is unique among North American songbirds in being entirely black below and lighter above: the front of head, tail, and wings are black, and the scapulars, lower back, rump, and uppertail-coverts are white to pale gray, with a distinctive yellow nape and nuchal collar. The dark feathers may initially be obscured by maize yellow feather fringes when fresh. This fringing wearing off during spring migration.Image via Birdshare: Bryan Hix.

Adult male Bobolink, Turner Valley, AB, 20 June.

Note rigid, sharply pointed rectrices, which are distinctive in all plumages. Male in Alternate plumage has scapulars, lower back, rump, and uppertail-coverts white to pale gray, with a yellow nape and nuchal collar.Image via Birdshare: Ron Kube.

Adult male Bobolink in flight, Rollins Savanna, Lake Co., IL, 19 May.

Male Bobolinks sing a long, bubbly song, often while flying low over their territories in a characteristic, helicopter-like

flight.Image via Birdshare: JanetandPhil.

Male Bobolink molting, NJ, 11 September.

By mid-Aug, before departing breeding range, males molt into Basic plumage and lose bill pigmentation; resemble females.Image via Birdshare: Khurram Khan.

Adult female Bobolink, Chester Co., PA, 16 June.

Female underparts yellowish buff, streaked dusky or black on sides, flanks, and undertail-coverts; upperparts buffy olive, streaked with black. The broad, buffy median stripe on top of head, bordered on each side with a pronounced brownish or blackish stripe, is distinctive.Image via Birdshare: Kelly Colgan Azar.

Nonbreeding Bobolink, Kenansville, Osceola, FL, 10 September.

Sexes dichromatic in Alternate plumage but similar in Basic plumageImage via Birdshare: Cleber Ferreira.

Bobolink nest with eggs and hatchling, Chicopee, MA, 9 June.

Females appear to choose nest location. Nest is always on ground, often at base of large forbs.Image via Birdshare: Mike Allen.

Macaulay Library Photos for Bobolink

Top-rated photos submitted to the Macaulay Library via eBird. Note: BNA editors have not confirmed the species identification for these photos.

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Figures

Figure 1. Breeding range of the Bobolink.

Enlarge

See text for details. This species winters in South America (see Fig. 2).
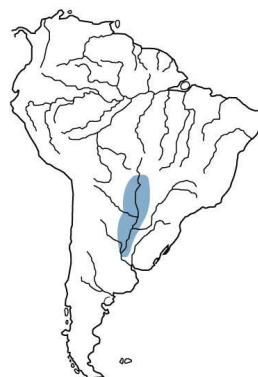
Figure 2. Principal overwintering range of the Bobolink.

Enlarge

The area of highest overwintering densities is east of the Andes in the pampas of southwestern Brazil, Paraguay, and Argentina.

Figure 3. Bobolink songs and calls.

Enlarge

(A and B): 2 songs (from a single male) comprising the Pelleston dialect (near Pelleston, MI); (C) 1 song from a dialect near the Pelleston dialect; (D) 1 song from a male singing nonlocal songs. All from Woods 1994.

**Figure 4.
Call
notes.**

Enlarge

Bobolink call notes. See
text for descriptions of
calls. Recording locations:
a–d, f, i, 3 km SE Pellston
Emmet Co., MI; e and g,
14 km ENE Pellston, MI; h,
16 km WNW Pellston, MI.
c, f, and i were recorded
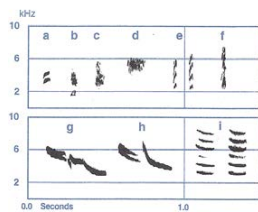from females; the
remaining notes were
from males.

Fig. 5.   Enlarge

**Precopulatory
Crouch Display.**

Male Bobolink directing
Precopulatory Crouch
Display toward a female.
Drawing by J. Zickefoose.
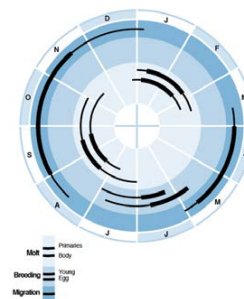
Figure 6.   Enlarge
**Annual
cycle of the
Bobolink, Wisconsin.**

Annual cycle of breeding,
molt, and migration of the
Bobolink near Sauk City,
WI. Thick lines indicate
peak activity, thin lines off-
peak. See text for details.
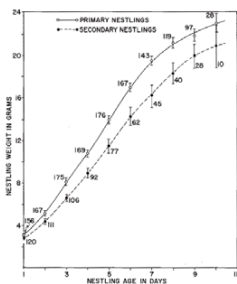
Figure 7.   Enlarge
**Weight
gain of Bobolink
nestlings.**

Weight gain of primary
(from nest of first female
of a male) and secondary
(from nests of subsequent
females of a male)
Bobolink nestlings
according to age. The
number beside each
plotted value represents
the sample size for that
age; vertical bar indicates
99% confidence limits for
the mean values. Age 1
represents chicks that
emerged within the 24-h
period before weighing
(Martin 1974).

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Appendix 1

Appendix. Mean occurrences (1) of male Bobolink activities per 5-minute interval during different stages of the reproductive cycle (Martin 1971).

Stage	Prepairing	Courtship	Copulatory	Egg-laying and incubation	Nestling
No. of 5-min intervals	121	260	301	272	<159
Agonistic Behaviors					
Perched Song(2)	11.9 (0.75) (3)	6.7 (0.46)	4.5 (0.31)	5.5 (0.45)	1.0 (0.02)
Displacement preening	0.7 (0.35)	0.2 (0.06)	0.2 (0.10)	0.4 (0.11)	0.1 (0.05)
Face-off with males	2.5 (0.21)	1.2 (0.17)	0.7 (0.9)	1.4 (0.14)	0.1 (0.08)
Attacks another	0.3 (0.08)	0.2 (0.03)	0.1 (0.02)	0.2 (0.05)	0.1 (0.02)

species					
Total of all agonistic behaviors	20.1 (0.09)	13.6 (0.06)	9.1 (0.04)	11.4 (0.05)	1.5 (0.02)
Intersexual Behaviors					
Circle flights	0.3 (0.04)	1.6 (0.21)	0.3 (0.05)	0.5 (0.07)	0
Courtship notes	1.5 (0.36)	5.1 (0.63)	4.7 (0.54)	3.8 (0.55)	0.4 (0.14)
Buzz vocalization	0.7 (0.09)	1.7 (0.18)	0.5 (0.05)	0.7 (0.08)	0
Copulation	0	0	0.2 (0.05)	0	0
Total of all intersexual behaviors	3.1 (0.02)	12.7 (0.05)	10.9 (0.05)	6.5 (0.03)	0.6 (0.01)
Miscellaneous Behaviors					
Maintenance activities	1.6 (0.04)	1.6 (0.03)	2.1 (0.02)	3.6 (0.06)	1.3 (0.03)
Foraging	9.7 (1.00)	7.3 (0.52)	10.9 (0.59)	8.9 (0.59)	18.2 (1.34)
Total flight	4.5 (0.08)	6.8 (0.08)	4.9 (0.06)	5.2 (0.07)	3.0 (0.05)
Flight song	2.4 (0.06)	4.4 (0.09)	2.1 (0.04)	2.4 (0.05)	0.5 (0.02)

- (1)For discrete activities (song, notes, attack, copulation, etc.), the number of occurrences per 5 min are averaged; for continuous types of activities (foraging, flight, preening, etc.), the total number of 10-sec metronome intervals within which the behavior occurred per 5 min is averaged.
- (2)Perched song is not exclusively agonistic in context. It also functions in territorial advertisement, female advertisement, etc.
- (3)Standard error of mean in parentheses.

Table 1

Types and volume proportions of food consumed by Bobolinks in summer and in early phases of fall migration. Summer diets based on analysis of 291 stomachs from birds collected in n. United States localities (Beal 1900); fall foods based on analysis of 30 stomachs from birds collected in Sep and early Oct in Arkansas (Meanley and Neff 1953).

	Summer	Fall
Invertebrates		
Lepidoptera	13.0%	–
Hymenoptera	7.6%	–
Coleoptera	19.0%	2.7%
Orthoptera	11.5%	–
Other Insects	4.6%	–
Arachnids and Myriapods	1.4%	–
Total Invertebrates	57.1%	2.7%
Vegetable		
Rice	–	76.0%
Oats	8.3%	–
Other Grain	4.1%	–
Weed Seeds	16.2%	–
Paspalum sp.	–	14.3%
Echinochloa colonum	–	2.9%
Panicum sp.	–	2.4%
Setaria lutescens	–	1.2%

Ambrosia sp.	–	0.5%
Polygonum sp.	–	0.1%
Other Vegetable Food	14.3%	–
Total Vegetable	42.9%	97.4%

- [Beal 1900](#)
- [Meanley and Neff 1953](#)

Table 2

Percentage composition of food items delivered to nestlings aged 7-10 days (Wittenberger 1982).

Taxon	Brought by Male	Brought by Female
Lepidoptera and sawfly larvae	58.8%	49.1%
Grasshoppers	18.1%	14.0%
Adult Lepidoptera	2.3%	3.1%
Lepidoptera pupae	0.7%	0.1%
Coleoptera	1.3%	4.4%
Diptera	2.5%	3.1%
Ephemeroptera	5.4%	5.0%
Odonata	1.0%	0.8%
Hemiptera	4.2%	6.2%
Hymenoptera	0.1%	0.1%
Neuroptera	0.1%	0.1%
Arachnida	3.1%	3.7%
Annelida	3.2%	9.9%
Total Number of Food Items	1,492	1,326

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Lab of

Menu

Dickcissel   Red-winged Blackbird

Bobolink
Dolichonyx oryzivorus

Order: PASSERIFORMES
Family: ICTERIDAE

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Sounds and Vocal Behavior

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Acknowledgments

About the Author(s)

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