COSEWIC
Assessment and Status Report

on the

Bobolink
Dolichonyx oryzivorus

in Canada

THREATENED
2010

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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Bobolink — Photo by Carl Savignac, with permission.

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COSEWIC
Assessment Summary

Assessment Summary – April 2010

Common name
Bobolink

Scientific name
Dolichonyx oryzivorus

Status
Threatened

Reason for designation
Over 25% of the global population of this grassland bird species breeds in Canada, which is the northern portion of its range. The species has suffered severe population declines since the late 1960s and the declines have continued over the last 10 years, particularly in the core of its range in Eastern Canada. The species is threatened by incidental mortality from agricultural operations, habitat loss and fragmentation, pesticide exposure and bird control at wintering roosts.

Occurrence
British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

Status history
Designated Threatened in April 2010.

COSEWIC
Executive Summary

Bobolink
Dolichonyx oryzivorus

Species information

The Bobolink is a medium-sized passerine. Males are black below and lighter above, while females are light beige streaked with brown and could be mistaken for some species of sparrow. The Bobolink has a conical bill, rigid, sharply pointed tail feathers and long hind toenails. Male plumage outside the breeding season and juvenile plumage are similar to that of the female. No subspecies of the Bobolink are currently recognized.

Distribution

The breeding range of the Bobolink in North America includes the southern part of all Canadian provinces from British Columbia to Newfoundland and Labrador and south to the northwestern, north-central and northeastern U.S. The species is not present in the Yukon, Northwest Territories and Nunavut. The Bobolink winters in southern South America, east of the Andes in Bolivia, Brazil, Paraguay and Argentina.

Habitat

The Bobolink originally nested in the tall-grass prairie of the mid-western U.S. and south central Canada. Most of this prairie was converted to agricultural land over a century ago, and at the same time the forests of eastern North America were cleared to hayfields and meadows that provided habitat for the birds. Since the conversion of the prairie to cropland and the clearing of the eastern forests, the Bobolink has nested in forage crops (e.g., hayfields and pastures dominated by a variety of species, such as clover, Timothy, Kentucky Bluegrass, and broadleaved plants). The Bobolink also occurs in various grassland habitats including wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, remnants of uncultivated virgin prairie (tall-grass prairie), no-till cropland, small-grain fields, restored surface mining sites and irrigated fields in arid regions. It is generally not abundant in short-grass prairie, Alfalfa fields, or in row crop monocultures (e.g., corn, soybean, wheat), although its use of Alfalfa may vary with region.

Biology

The Bobolink is a semi-colonial species that is often polygamous, depending on the region and habitat conditions. The first adults arrive from their wintering grounds in mid-May. Upon arrival on the breeding grounds, the males establish their territories, performing courtship flights and songs. Females construct the nests, which are always built on the ground, usually at the base of large forbs. Each clutch typically contains 3-7 eggs. The nestlings are fed by both parents for 10-11 days and fledglings are fed for at least one week. The Bobolink has an average life span of five years.

Population sizes and trends

In Canada, the Bobolink population is estimated at between 1.8 and 2.2 million breeding birds. North American Breeding Bird Survey (BBS) data for the period 1968 to 2008 indicate a significant decline of 5.2% per year in Canada or a loss of 88% of the population during the last 40 years. Over the most recent 10-year period (1998 to 2008), the BBS data show a significant decline of 4.6% per year, which corresponds to a population decline of 38% over this period.

Limiting factors and threats

The main causes of the decline in Bobolink populations have been identified as: 1) incidental mortality from agricultural operations such as haying that destroy nests and kill adults, 2) habitat loss caused by the conversion of forage crops to intensive grain crops and other row crops, 3) habitat fragmentation, which promotes higher rates of predation on nests located near edges and 4) pesticide use on breeding and wintering grounds, which may cause both direct and indirect mortality.

Special significance of the species

Given its generally high abundance in forage crops and the large quantity of insect pests on which it feeds, the Bobolink may be beneficial to agriculture on the breeding grounds.

Existing protection or other status designations

In Canada, the Bobolink, its nest and eggs are protected under the *Migratory Birds Convention Act, 1994*. It is ranked as globally secure (G5) by NatureServe (2009).

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2010)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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SPECIES INFORMATION

Name and classification

The common name of *Dolichonyx oryzivorus Linnaeus* (1758) is Bobolink in English and '*Goglu des prés*' in French. The taxonomy of the Bobolink is as follows:

Class:	Aves
Order:	Passeriformes
Family:	Icteridae
Genus:	*Dolichonyx*
Species:	*Dolichonyx oryzivorus*

Morphological description

The Bobolink is a medium-sized passerine (total length: 16.5 - 20.2 cm; Godfrey, 1986) with a body mass ranging from 33.9 ± 2.1 g (n = 142 breeding males) to 51.7 g (n = 14 migrating males; Martin and Gavin, 1995). The sexes are dimorphic only in alternate (breeding) plumage (Martin and Gavin, 1995). The Bobolink has a short, conical bill and a dark brown iris. Males in alternate plumage have a black bill, head (crown, cheek, malar stripe and throat), front parts (breast, sides, flanks, belly, lower belly, undertail-coverts), wing underparts and tail (Figure 1). Males have a white to light grey rump, scapulars and uppertail-coverts and a buff nuchal collar. Females have a light pink bill and generally buff plumage on the front, head, eye stripe, nuchal collar and rump, and a dark brown crown, stripe, wings and tail. The scapulars of the female are beige streaked with dark brown. A number of fine brown streaks are visible on the sides of the female. Before migration, the males moult into basic plumage and resemble the females in virtually every respect. The male's bill loses its black pigmentation and turns buff (Martin and Gavin, 1995). Juveniles resemble females, but are more yellow and have no streaks on the flanks. Distinctive features in all plumages of both sexes include rigid, sharply pointed rectrices and long hind toenails (Martin and Gavin, 1995).

The alternate plumage in the male is unmistakable in the field. However, the female, as well as the male in basic plumage, can resemble sparrows of the genus *Ammodramus*. They can be distinguished from these species, however, by their larger size, the presence of a long hind toenail, pale malar patches, plain nuchal collar and pointed wings (Martin and Gavin, 1995).

Figure 1. Adult male Bobolink in breeding plumage. (Photo by Carl Savignac, with permission.)

Genetic description

Studies have been conducted on extra-pair fertilizations in Bobolinks (Bollinger and Gavin, 1991). Bobolinks have also been included in genetic studies examining New World oscine bird relationships (Klicka *et al*., 2000) and the DNA barcodes of North American birds (Kerr *et al*., 2007).

Designatable units

No subspecies have been recognized for the Bobolink (American Ornithologists' Union, 1998) and there are no other distinctions that warrant assessment below the species level. This report deals with a single designatable unit.

DISTRIBUTION

Global range

Before European settlement of North America, the centre of the Bobolink's range was associated with the tall-grass prairie of the Mississippi Valley in the United States. In Canada it was probably rare, but its range expanded with the arrival of Europeans and the conversion of forests to forage crops such as hay fields (Brewer *et al*., 1991; Martin and Gavin, 1995; Van Damme, 1999).

The current breeding range of the Bobolink in North America includes the southern part of the Canadian provinces from British Columbia to Quebec and Newfoundland and Labrador and all of the Maritimes south to the northwestern, north-central and northeastern U.S. The species breeds contiguously throughout this range (Figure 2; Martin and Gavin, 1995), although the distribution of the species in the southern and western U.S. states is generally patchy (Martin and Gavin, 1995).

The wintering range of the Bobolink is known to include eastern Bolivia and southwestern Brazil in the north and Paraguay and northeastern Argentina in the south (Pettingill, 1983; Ridgely and Tudor, 1989; American Ornithologists' Union, 1998; Di Giacomo *et al*., 2005). The species likely winters in small numbers west of the Andes on the coast of Peru (Howell, 1975). In several South American countries, the size of the wintering ground likely varies as a function of the acreages planted to rice and is probably expanding (Renfrew and Saavedra, 2007).

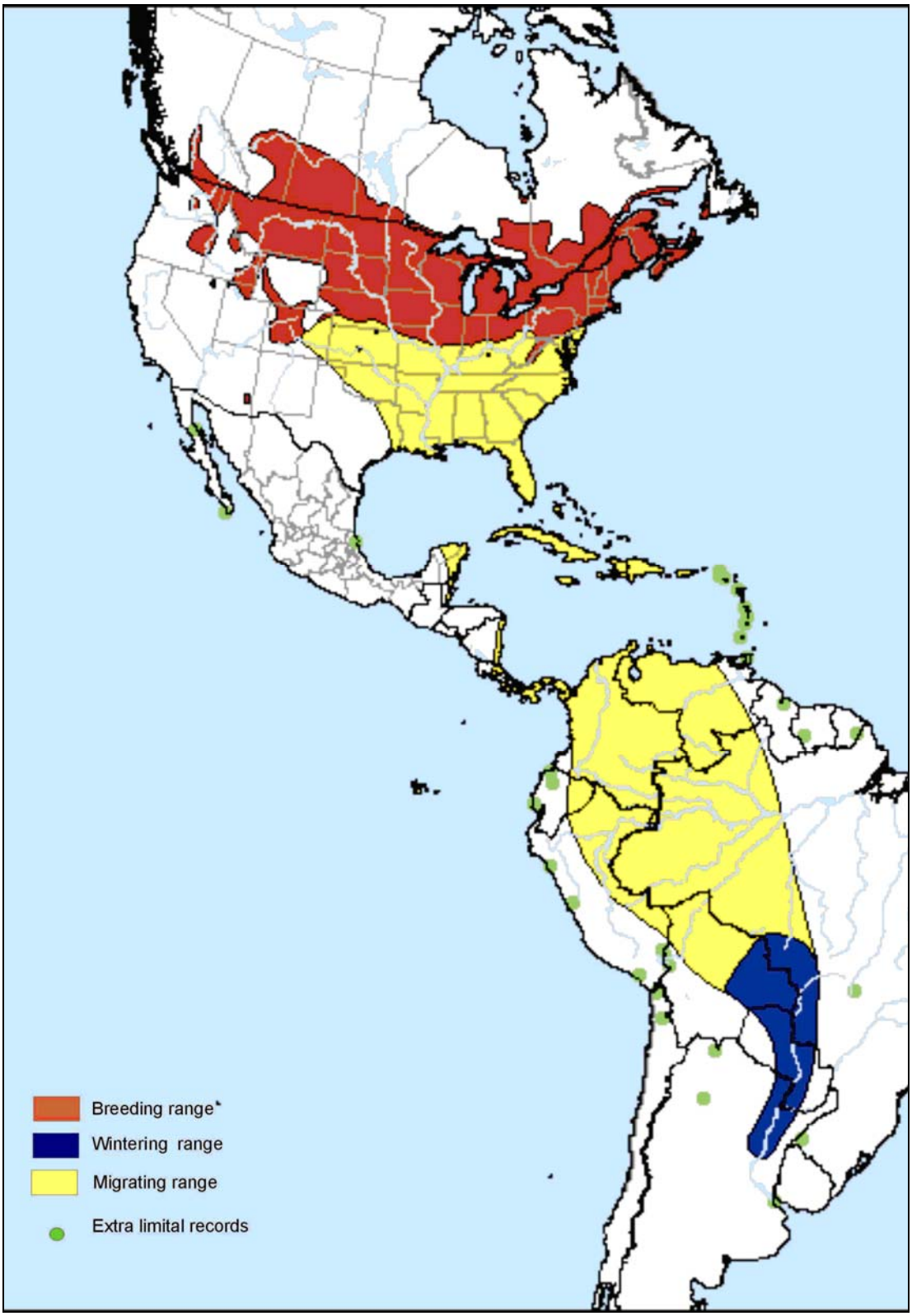

Figure 2. Global range of the Bobolink (from Ridgely *et al*., 2005).

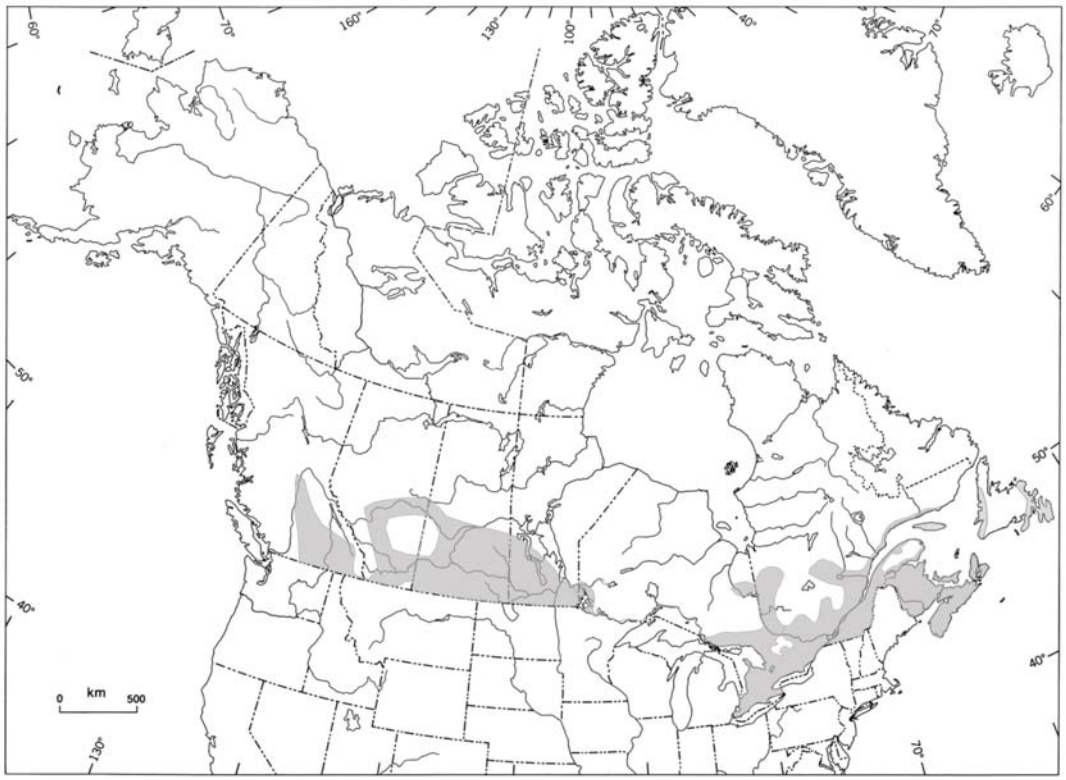

Figure 3. Canadian breeding range of the Bobolink (based on http://birdmap.bsc-eoc.org/maps/birdmap/viewer.htm; Godfrey, 1986; Banville and Gauthier, 1995; Cyr and Larivée, 1995; Campbell *et al*., 2001; Manitoba Avian Research Committee (MARC), 2003; Cadman *et al*., 2007; Federation of Alberta Naturalists (FAN), 2007; P. Taylor, pers. comm., 2008; Newfoundland Department of Environment and Conservation, unpubl. data, 2008; Bird Studies Canada (BSC), (2008, 2009); Saskatchewan Ministry of Environment, 2009).

Canadian range

In Canada, the breeding range of the Bobolink includes the Cariboo, and the Thompson-Nicola, Creston and Okanagan valleys of British Columbia (Godfrey 1986; Campbell *et al*., 2001), central and southern Alberta (from Beaverhill Lake to the border regions) (FAN, 2007), where it appears to be sporadic (absent from the foothills of the Rockies), central and southern Saskatchewan (from Prince Albert National Park to the border regions), southern Manitoba (from Swan Lake to the United States border) (MARC, 2003; P. Taylor, pers. comm., 2008), central and southern Ontario (Kenora in the northwest and Lake Abitibi in the northeast to the border regions) (Cadman *et al*., 2007), southern Quebec (Lake Abitibi, Lac-Saint-Jean, North Shore region, Gaspé Peninsula and Magdalen Islands, in the north, Ottawa Valley, the St. Lawrence Valley in the south) (Banville and Gauthier, 1995), throughout New Brunswick, Prince Edward Island and Nova Scotia (Erskine, 1992; BSC, 2008), and southwestern and southeastern Newfoundland (Godfrey, 1986; Newfoundland Department of Environment and Conservation, unpubl. data).

Currently, approximately 28% of the global breeding population and 33% of the global breeding range of the Bobolink occurs in Canada (P. Blancher, pers. comm., 2009). The extent of occurrence in Canada is 3.73 million km^2 using a minimum convex polygon based on the range map shown in Figure 3. The Index of Area of Occupancy (IAO) can not be estimated with precision; however, based on the number of breeding pairs, it would exceed the minimum threshold of 2,000 km^2.

HABITAT

Habitat requirements

Macrohabitat

The Bobolink nests primarily in forage crops (e.g., hayfields and pastures; Bollinger and Gavin, 1992; Martin and Gavin, 1995; Jobin *et al*., 1996) dominated by a variety of species, such as clover (*Trifolium spp.*), Timothy (*Phleum pratense*), tall grasses (e.g., Kentucky Bluegrass, *Poa pratensis*), and broadleaved plants (Dale *et al*., 1997; Van Damme, 1999; Frei *et al*., submitted). Hayfields and associated pastures are its preferred habitat due to the plant cover present at the start of the nesting season (Nocera *et al*., 2007); such cover is generally absent from grain fields. The Bobolink also occurs in wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, remnants of uncultivated virgin prairie (tall-grass prairie), no-till cropland, small-grain fields, reed beds and irrigated fields in arid regions (Martin, 1971; Martin and Gavin, 1995; Van Damme, 1999; Dechant *et al*., 2001). The Bobolink is also known to use sites that have been restored to grassland habitat (Ingold, 2002; Fletcher and Koford, 2003). The Bobolink is not abundant in the short-grass prairie of Saskatchewan and Alberta (FAN, 2007; Saskatchewan Ministry of Environment, 2009). Throughout its range Alfalfa (*Medicago sativa*) monocultures are variably occupied (Bollinger and Gavin, 1992; Bollinger, 1995; Martin and Gavin, 1995; Corace *et al*., 2009). It does not generally occupy fields of row crops, such as corn, soybean and wheat (Sample, 1989; Jobin *et al*., 1996), pastures in valleys with high shrub density or intensively grazed pastures (Martin and Gavin, 1995; Renfrew and Ribic, 2002).

Microhabitat

The Bobolink is generally sensitive to vegetation structure and composition in its habitat (Wiens, 1969; Wittenberger, 1980; Bollinger and Gavin, 1989; 1992; Nocera *et al*., 2007). Bobolink abundance and density are positively associated with a moderate litter depth (Wiens, 1969; Herkert, 1994; Schneider, 1998; Renfrew and Ribic, 2002; Johnson *et al*., 2004; Warren and Anderson, 2005; Frei *et al*., submitted), high lateral litter cover and high grass-to-legume ratios (Bollinger, 1988a; Bollinger and Gavin, 1989; Patterson and Best, 1996; Fritcher *et al*., 2004), an abundance of small shrubs as perches (Schneider, 1998) and a high percent of forb cover (Frei *et al*., submitted). These characteristics are often found in old ($\geq$ 8 years) forage crops (Bollinger, 1988a; Bollinger and Gavin, 1989; Fritcher *et al*., 2004). The Bobolink avoids nesting in habitats

dominated by overly dense shrub vegetation (Bollinger, 1988a; Bollinger and Gavin, 1992) and with an overly deep litter layer (> 1-2 cm, Wiens, 1969; Heckert, 1994; Renfrew and Ribic, 2002; Johnson *et al*., 2004; Warren and Anderson, 2005) and a high percentage of bare soil (Schneider, 1998; Warren and Anderson, 2005).

The Bobolink is sensitive to habitat size (Fletcher and Koford, 2003; Murphy, 2003; Bollinger and Gavin, 2004; Horn and Koford, 2006; Renfrew and Ribic, 2008; K. Mozel, pers. comm., 2008). Reproductive success is reportedly lower in small habitat fragments (Kuehl and Clark, 2002; Winter *et al*., 2004). In addition, the Bobolink responds negatively to the presence of edges separating its habitat, and particularly forest edges (Helzer and Jelinski, 1999; Fletcher, 2003). Fletcher and Koford (2003) reported that Bobolink density and the likelihood of occurrence increase as a function of distance from forest edges. The Bobolink is not highly sensitive to edges adjacent to old fields or pastures, however (Bollinger and Gavin, 2004). The studies are contradictory with regard to the sensitivity of the Bobolink to road edges (Fletcher and Koford, 2003; Bollinger and Gavin, 2004).

During fall migration to South America, the Bobolink is found primarily in rice fields, small-grain fields and aquatic grassbeds bordering freshwater and saltwater marshes (Pettingill, 1983; Sick, 1993). On the wintering grounds, the Bobolink primarily occupies the pampas (temperate grasslands of South America), but also marshes, riverbanks and rice fields (Sick, 1993; Martin and Gavin, 1995; Di Giacomo *et al*., 2005; Lopez-Lanus *et al*., 2007).

Habitat trends

Since European settlement, tall-grass prairie, the natural habitat of the Bobolink in North America, has declined by 88–99% due to conversion to cropland (Samson and Knopf, 1994; Askins, 1999). The Bobolink shifted to forage cropland following the conversion of the forests of eastern North America that took place around 1800. Presumably this is because the structure is similar to that of its natural habitat (Graber and Graber, 1963; Herkert, 1991). In North America, declines of the surrogate habitat began in the 1940's, as agriculture intensified (Rodenhouse *et al*., 1995; Murphy, 2003). In the northeastern United States, for example, the area of cropland planted with forage crops declined from 12.6 to 7.1 million hectares from 1940 to 1986 (Martin and Gavin, 1995). During the same period, the area planted with mainly Alfalfa, which is not as highly favoured by Bobolinks, increased from 20 to 60% (Bollinger and Gavin, 1992). In addition, between 1964 and 1987, 35% of the total area of hay and pasture crops (4,200,000 acres) in Illinois, Iowa and Indiana was converted to row crops (primarily soybean; Podulka *et al*., 2004). In the state of Illinois alone, the area of forage crops declined by 50% from 1960 to 1989 (Herkert, 1991). Furthermore, over the last several decades in several regions of northern North America, there has been substantial re-growth of forests in abandoned farmlands; the average overall forest cover in these areas including eastern Ontario is expected to level out at approximately 40% (Askins, 1993; OMNR, 1997).

In Canada, the habitat trend is believed to be similar to that in the United States. For example, in the St. Lawrence Lowlands, the number of dairy farms, which included extensive areas of grassland, fell by half from 1971 to 1988 due to farm abandonment, industrialization and urbanization (Jobin *et al*., 1996). The total area planted to corn, soybeans and wheat has increased by 23% since 1960 because of new policies favoring grain production for livestock (Jobin *et al*., 1996; Bélanger and Grenier, 2002; Jobin *et al*., 2007). According to Latendresse *et al*. (2008), this pattern of land use change in the St. Lawrence Lowlands began at least as far back as 1950.

Elsewhere in Canada, there has been a clear reduction in forage crops in favour of annual crops, which are considered low quality habitat for Bobolinks (Ontario: Cadman *et al*., 2007; Maritimes: BSC, 2008). In British Columbia, the decline in available grassland habitat in the south Okanagan Valley for example is believed to be caused by increased urban development, conversion of hay lands and rangeland to orchards, vineyards and other crops (Van Damme, 1999; Campbell *et al*., 2001).

Few studies exist on the habitat trends on the wintering grounds in South America. However, the area of native prairie is known to have declined throughout South America due to conversion to agriculture and urban areas (Di Giacomo *et al*., 2005; Renfrew and Saavedra, 2007). This decline in natural habitat may, however, be offset by the significant increase in rice fields in several countries (Vickery *et al*., 2003; Renfrew and Saavedra, 2007).

Habitat protection/ownership

In Canada, most anthropogenic habitat acceptable for breeding is located on private agricultural land (Natural Resources Canada, 2005). Habitat protection is accomplished primarily through voluntary conservation programs, such as the North American Waterfowl Management Plan (Prairie Habitat Joint Venture, 1989). Private conservation groups, such as Ducks Unlimited Canada and the Nature Conservancy of Canada indirectly protect Bobolink habitat on private land in Canada. Finally, under the Permanent Cover Program (PCP, Agriculture and Agri-Food Canada, 2008), which ran from 1989 to 1992, close to 522,000 ha of unproductive grassland was restored. Bobolinks were not, however, found in higher frequencies in PCP land than nearby cropland (McMaster and Davis, 2001), suggesting that this converted land may provide only limited suitable habitat for this species.

Little information is currently available on the quantity of available habitat and the level of habitat protection on public lands in Canada. Some habitat occurs in federal protected areas, such as national parks (e.g., Forillon National Park in Quebec and Grasslands National Park in Saskatchewan; P. Nantel, unpubl. data, 2008), migratory bird sanctuaries and national wildlife areas (S. Blaney, pers. comm. 2008), although these areas represent less than 8% of the total area of Canada (Natural Resources Canada, 2005). According to Parks Canada's database, the Bobolink is present (including incidental observations) in 25 protected areas managed by Parks Canada

(P. Nantel, unpubl. data, 2008). The species would also occur in numerous provincial parks and provincially protected areas across its range.

BIOLOGY

Reproduction

The Bobolink is a semi-colonial species, employing a mixed reproductive strategy (monogamous and polygamous), depending on region and habitat conditions (Martin, 1971; Wittenberger, 1978; Wootton *et al*., 1986; Moskwik and O'Connell, 2006). Monogamous females generally have higher reproductive success than polygamous females, whereas polygamous males have greater reproductive success than monogamous males (Moskwik and O'Connell, 2006).

In the spring, the adults return from migration starting in late April for regions further south (Martin and Gavin, 1995) and starting in May to early June for all regions further north, such as Canada (Banville and Gauthier, 1995; Campbell *et al*., 2001; FAN, 2007). Females arrive approximately one week after the males (Martin and Gavin, 1995).

Upon arrival on the breeding grounds, males establish their territory through courtship flights and songs (Wittenburger, 1978). After approximately 10 days following pair formation, egg-laying begins, and the eggs are laid one per day (Wittenberger, 1978; Weir, 1989; Martin and Gavin, 1995). Typically, only one brood is produced each year, but a second and third clutch may be laid if the previous nest is destroyed (Martin and Gavin, 1995). Females construct the nests, which are always built on the ground, usually at the base of large forbs (Martin and Gavin, 1995). The clutch size ranges from four in British Columbia (range between 2-6 eggs; Campbell *et al*., 2001) to five in Ontario (range: 2-7 eggs; Peck and James, 1987). The eggs are incubated by the female and incubation begins with the laying of the penultimate egg; and lasts on average 12 days (Martin and Gavin, 1995).

In the St. Lawrence Valley of Quebec, the mean number of hatchlings per nest is 4.3 ± 0.2 (n = 36 nests; Lavallée, 1998). Hatching success (at least one egg hatched) in the St. Lawrence Valley varies from 62% to 85% (Lavallée, 1998; Frei *et al*., submitted). Nestlings are fed by both parents for an average of 10-11 days and fledglings are fed for at least one week (Martin and Gavin, 1995). Polygamous males generally feed at only one nest, often the primary nest (Martin, 1974; Wittenberger, 1982). In the U.S. midwest, two fledglings are produced on average (Winter *et al*., 2004). Fledging success ranges from 42% to 57% in New York State (Martin, 1971) and from 56% to 77% in southern Quebec (Lavallée, 1998; Frei *et al*., submitted).

The generation time is estimated at two to three years, taking into account the species' age at first breeding (one year; Martin and Gavin 1995) and maximum life span (nine years; Bollinger, 1988b). The average lifespan is five years (Martin and Gavin, 1995).

Survival

The apparent survival rate of adults in New England ranges from 0.52-0.70 for males and 0.19-0.55 for females; these rates are considered relatively low (Perlut *et al*., 2008). On average, adults using late-hayed fields have a 25% higher survival rate than those using early-hayed and grazed fields (Perlut *et al*., 2008). Daily survival rate is apparently lower during incubation than during rearing stages (Scheiman *et al*., 2007).

Return rate of adults to breeding sites varies among studies. Wittenberger (1978) found that the annual return rate to breeding sites was 63% for males and 34% for females. Bollinger and Gavin (1989) found return rates of 70% for males and 44% for females – both of which should be considered minimal survival rates as some birds may have gone elsewhere to breed. The annual return rate of male Bobolinks to nesting sites in the central United States is 48.2%, which is relatively high, whereas that of females is low (4.6%; Fletcher *et al*., 2006). Another study in the U.S. midwest found a return rate of 21% for males (n = 30/143 males; Scheiman *et al*., 2007). In that study, the adult male survival rate ranged from 0.57 to 0.90.

Movements/dispersal

The round-trip distance travelled during migration for Bobolinks is approximately 20,000 km, one of the longest annual migrations of any North American passerine (Hamilton, 1962; Ridgely and Tudor, 1989; Martin and Gavin, 1995). Fall migration begins in mid- to late July, with adults and immatures forming loose flocks close to the breeding grounds (Hamilton, 1962) before heading for coastal habitats on the east coast, between New Jersey and Florida (Campbell *et al*., 2001). Groups of migrating birds are of single-sex in the spring, but of mixed sex and age composition in the fall (Martin and Gavin, 1995). Migrating groups, sometimes totalling 30,000 birds (Martin and Gavin, 1995), leave the coast in mid-September, crossing the Caribbean to reach their wintering grounds in South America. Once on their wintering grounds, the flocks are gregarious and move over large distances depending on the availability of food (e.g., rice fields; Renfrew and Saavedra, 2007).

Immature birds of both sexes initially captured on their natal sites were recaptured in subsequent years at distances of between 19 and 742 km from the original capture sites (Brewer *et al*., 2000). In a fragmented agricultural landscape in west-central Indiana, adult Bobolinks that were colour-banded and then resighted moved a maximum 14.2 km from their former breeding sites (Scheiman *et al*., 2007).

Diet and foraging behaviour

During the breeding period, the Bobolink feeds on insects (57%) and plant matter (43%; Martin and Gavin, 1995). The main insect groups comprising its diet during this time are lepidopterans (larvae and adults), orthopterans and coleopterans (Wittenberger, 1978; 1982; Lavallée, 1998). Nestlings are fed exclusively on insects (lepidopterans and orthopterans; Martin and Gavin, 1995).

During migration and on the wintering grounds, the Bobolink's diet consists primarily of plant seeds (Martin and Gavin, 1995). Early in the spring, the diet consists of Common Dandelion (*Taraxacum officinale*) seeds, cinquefoil (*Potentilla* sp.), Yarrow (*Achillea millefolium*), and thistle (*Cirsium* sp.) (Wittenberger, 1978). In winter, the Bobolink feeds on rice (76%; Meanley and Neff, 1953; Pettingill, 1983; Renfrew and Saavedra, 2007), but also on the seeds of California Bulrush (*Schoenoplectus californicus*), native grasses (e.g., *Paspalum intermedium* and *P. rufum*), and Johnson Grass (*Sorghum halepense*) (Di Giacomo *et al*., 2005).

Interspecific interactions

During the breeding period, territorial males are aggressive and will chase away other species of grassland passerines and several species of raptors (Martin and Gavin, 1995). The Bobolink is generally subordinate to the Red-winged Blackbird (*Agelaius phoeniceus;* Joyner, 1978) and Eastern Meadowlark (*Sturnella magna*; Martin and Gavin, 1995).

As a ground nester in open habitats, the Bobolink is vulnerable to predation by a variety of predators, including raptors, reptiles and mammals (Martin and Gavin, 1995; Van Damme, 1999; Campbell *et al*., 2001). In Wisconsin pastures, Bobolink nests are depredated by at least 11 different species, including Raccoons (*Procyon lotor*), ground squirrels (*Spermophilus* spp.) and several species of snakes (*Thamnophis* spp. and *Elaphe* spp.; Renfrew and Ribic, 2003). In southern Quebec, known and potential predators include Northern Harriers (*Circus cyaneus*), Short-eared Owls (*Asio flammeus*), American Crows (*Corvus brachyrhynchos*), Ring-billed Gulls (*Larus delawarensis*; Lavallée, 1998), Raccoons, Striped Skunks (*Mephitis mephitis*) and Red Foxes (*Vulpes vulpes*; Jobin and Picman, 2002). Feral domestic cats (*Felis catus*) are also reported to be a major potential predator of the Bobolink in several parts of North America (Martin and Gavin, 1995; Van Damme, 1999).

In the wet grasslands of Argentina, the Bobolink is associated with other icterids that forage in wetland habitat (Di Giacomo *et al*., 2005). In Bolivia, there is a foraging association between Barn Swallows (*Hirundo rustica*) and Cliff Swallows (*Petrochelidon pyrrhonota*) and the Bobolink, with the two species of swallows foraging on insects flushed by flocks of Bobolinks feeding in soybean fields (Renfrew, 2007).

Home range and territory

Bobolink territories are delineated by aerial displays that are initiated on the ground at territorial boundaries (Martin and Gavin, 1995). Following the hatching period, intruders may sometimes be tolerated given that territorial defence stops at this time (Martin and Gavin, 1995). In Wisconsin, the mean size of territories ranges from 0.70 ± 0.008 ha ($n = 78$) in primary habitat to 2.0 ha ($n = 8$) in lower-quality habitat (Wiens, 1969). Martin (1971) reports territory sizes ranging from 0.45 to 0.69 ha in an agricultural landscape dominated by forage crops in Wisconsin. In New York, territory

size ranges from 0.33 to 0.75 ha (Bollinger and Gavin, 1992). In Oregon, the mean size of territories is 0.74 ha (n = 66) in high quality habitats and 1.45 ha in drier sites (Wittenberger, 1978). In the St. Lawrence Valley, the average territory size is 0.43 ± 0.03 ha (n = 45 pairs; Lavallée, 1998).

In Nova Scotia, Bobolink territories are clustered across suitable habitat (Nocera *et al.*, 2008). In this study, > 2 yr old males resided in clusters of smaller territories (better quality), whereas first year breeders were principally in the peripheral neighbourhoods with large territories.

Behaviour and adaptability

The Bobolink showed considerable ability to adapt to the changes in its habitat following European settlement (Bollinger and Gavin, 1992; Van Damme, 1999; Madden *et al*., 2000). In addition, the Bobolink can adapt to low or moderate livestock grazing, but not intensive grazing (Kantrud and Kologiski, 1982; Temple *et al*., 1999). The Bobolink also responds favourably to prescribed burning carried out regularly in forage crops outside of the nesting season (Bollinger and Gavin, 1992; Herkert, 1994; Madden *et al*., 2000). Generally, it also responds positively to agricultural land retirement and set-aside programs (Renken and Dinsmore, 1987; Patterson and Best, 1996; Lavallée, 1998), natural prairie restoration programs (Volkert, 1992) and mine site restoration (Ingold, 2002).

The Bobolink does not adapt well to hay cutting during the breeding period or to the conversion of forage crops to cereal monoculture (Herkert, 1997; Martin and Gavin, 1995; Van Damme, 1999). It also does not tolerate disturbance at the nest site in early incubation, when adult females will occasionally abandon their nest after repetitive visits by humans (Martin and Gavin, 1995).

On its wintering grounds, the Bobolink seems to take advantage of the conversion of pampas to rice crops (Renfrew and Saavedra, 2007).

POPULATION SIZES AND TRENDS

Search effort

<u>North American Breeding Bird Survey (BBS)</u>

The BBS is a volunteer-based program that surveys North American breeding bird populations (Sauer *et al*., 2008). Breeding bird abundance data are collected at 50, 400-m radius stops spaced at 0.8 km intervals along permanent 39.2 km routes (Downes and Collins, 2008). In Canada, the surveys are generally conducted in June, i.e., during the breeding period of most bird species. Surveys start one half hour before sunrise and last 4.5 hours. The BBS is a suitable method for surveying Bobolinks because many surveys are carried out in open habitat, where the species occurs and Bobolinks can be

easily detected by their song and flight. In addition, the BBS covers virtually the entire range of the species in Canada. Relative abundance estimates from the BBS counts and the Ontario Breeding Bird Atlas point counts (see below) indicate that the highest relative abundances for the Bobolink are found in areas covered by the BBS (P. Blancher, unpubl. data, 2008).

Ontario Breeding Bird Atlas (OBBA)

The Ontario Breeding Bird Atlas compares the distribution and abundance of breeding birds between 1981-1985 and 2001-2005, and is an important source of information on the status of the Bobolink in Ontario (Cadman *et al*., 2007). The data are gathered by volunteers who visit representative habitats within 10 x 10-km squares for at least 20 hours during the breeding period (Cadman *et al*., 2007). The percent change in the distribution of the Bobolink in Ontario over a period of 20 years is then calculated by comparing the percentage of the 10 x 10-km squares/blocks with breeding evidence in the first atlas period to the percentage of squares/blocks with breeding evidence in the second atlas period, adjusting for observation effort (Cadman *et al*., 2007).

The main limitation of this method is that the trend analysis from the first to the second atlas was based on changes in the probability of detecting a species in a 10 X 10-km square after adjusting for effort (Blancher *et al*., 2007), but this underestimates the change in population numbers, especially for common species (Francis *et al*., 2009). Differences in effort between the two atlases may also have led to some biases in estimating change (Blancher *et al*., 2007) because non-point count effort was not standardized, and there can be important differences in efficiency of effort that cannot be captured by adjusting for quantity of effort. However, comparisons with future atlases, assuming they use point counts as were done for the second atlas, will allow for more reliable estimates of actual changes in abundance, at least for moderately common and common species. Another major limitation of atlases is that they are typically repeated only at 20-year intervals, which means they cannot detect changes in population status during intervening periods (Francis *et al*., 2009).

Atlas of Breeding Birds of Alberta (ABBA)

The ABBA compares the occurrence of Bobolinks between two survey periods (1987-1991 to 2001-2005). A checklist program was used to collect data on breeding birds across Alberta. Volunteer birdwatchers were asked to record all birds they observed at one time and at one location, along with the weather, habitat and duration of their observations (FAN, 2007). Both atlas projects used the same Universal Transverse Mercator (UTM) grid system in order to define sampling units and to allow comparison with other North American atlas projects.

Étude des Populations des Oiseaux du Québec (ÉPOQ)

In Quebec, the ÉPOQ database, which manages the bird checklists produced by thousands of volunteers since 1969 (more than 200,000 checklists accumulated), is a basic reference for determining Bobolink population trends in Quebec (Cyr and Larivée, 1995; Larivée, 2008). The ÉPOQ database covers all regions south of the 52nd parallel and all seasons (Cyr and Larivée, 1995). The abundance index is one of the two abundance measures produced by ÉPOQ and is a measure of the number of birds observed based on the number of checklists produced.

The strength of this survey method lies in the fact that it covers the entire breeding range of the species in Quebec (Cyr and Larivée, 1995). However, the current analysis method does not account for observation effort (i.e., the number of observers per checklist), weather conditions, or spatial variation in observation effort, but simply includes the number of hours of observation (Cyr and Larivée, 1995). Nonetheless, the trends produced by the ÉPOQ database are correlated with those of the BBS and generate adequate trend assessments (Cyr and Larivée, 1995; Dunn *et al*., 1996).

Abundance

Between 1987 and 2006, BBS data indicate that the Bobolink reached its highest abundance in southern Manitoba, the far south of Ontario (Lake Simcoe-Rideau and Carolinian regions) and in the regions of Montérégie, Outaouais and Abitibi in southern Quebec. The species was not abundant in Saskatchewan, Alberta or British Columbia (Figure 4).

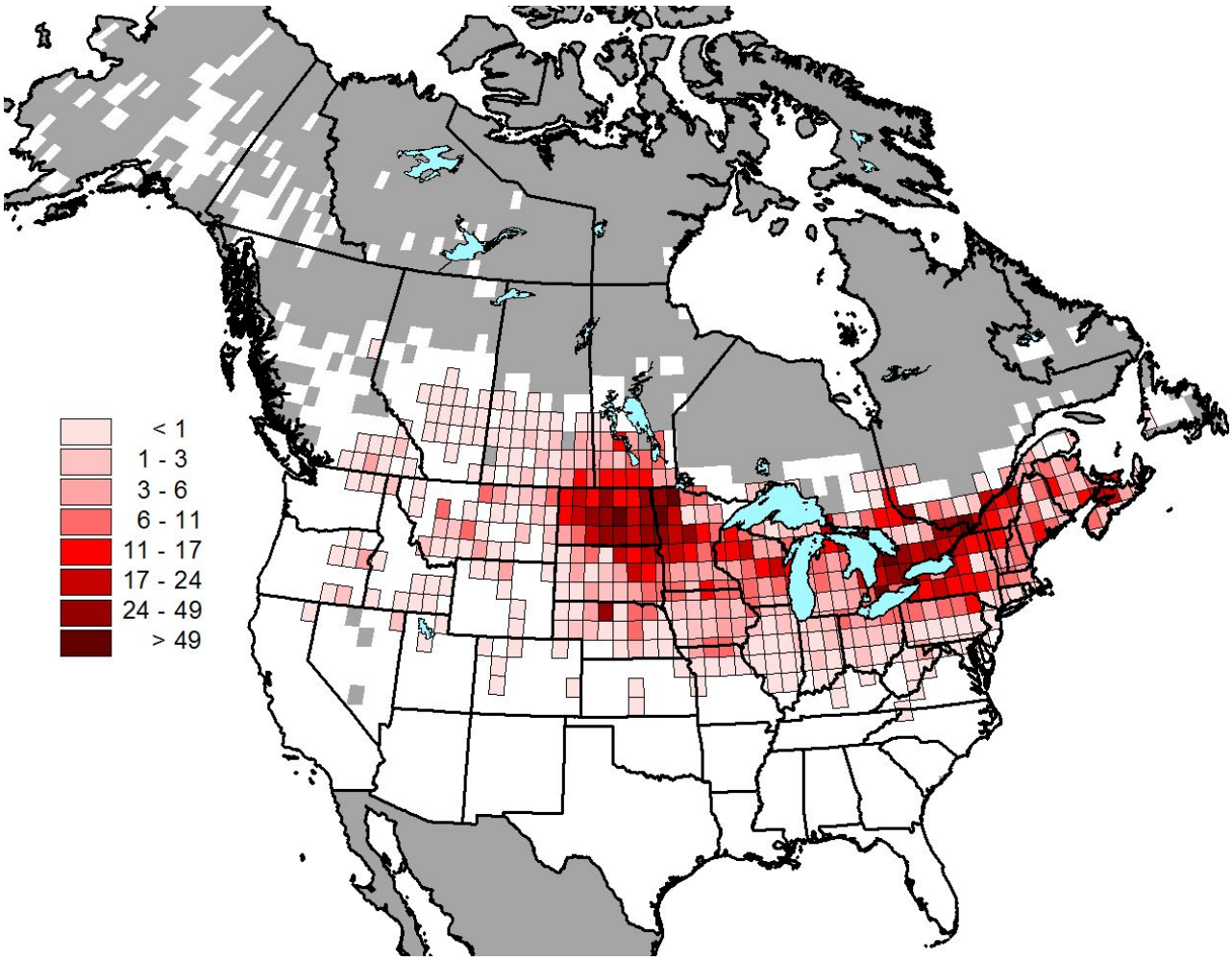

Figure 4. Relative abundance of the Bobolink, based on BBS data calculated for each latitude and longitude degree block from 1987 to 2006, in relation to the portion of the breeding range surveyed by the BBS. Grey areas = not surveyed by the BBS, white areas = surveyed, but no Bobolinks observed (P. Blancher, unpubl. data, 2008).

Using BBS-based calculations from the 1990s (Blancher *et al*., 2007), the Canadian Bobolink population was estimated at roughly 4.3 million adults, or 2.1 million breeding pairs (Blancher *et al*., 2007). Updating those BBS-based calculations using 1998-2007 data results in a reduced estimate of roughly 2.2 million adults or 1.1 million breeding pairs (P. Blancher, pers. comm., 2009). Approximately 86% of these birds are concentrated in Ontario (45%), Québec (24%) and Manitoba (17%), with the remainder scattered in relatively small numbers across the other provinces.

Data from the Atlas of the Breeding Birds of Ontario, gathered between 2001 and 2005, suggest a population of 800,000 individuals or 400,000 breeding pairs in the province (Blancher and Couturier, 2007). Extrapolating from the Ontario atlas estimate to Canada, based on the proportion of the population in Ontario, gives an estimate of approximately 1.8 million individuals or 900,000 pairs for Canada. This value is similar to the updated BBS-based estimate.

Fluctuations and trends

Historic trends

By the early 1900s, declines in Bobolink populations had been observed (Bollinger and Gavin, 1992). At that time, the species was considered a pest of rice fields in the southern United States and it was routinely shot (Martin and Gavin, 1995), with reports, for example, of over 700,000 Bobolinks killed in a single year in South Carolina (Forbush, 1927 in Bent, 1958). It was also intensively hunted for its meat (Bent, 1958). Following the proclamation of the *Migratory Birds Convention Act* in 1917, Bobolink populations rebounded in eastern North America, including Ontario, Quebec, New Brunswick and Nova Scotia (Robbins *et al*., 1986). Since the middle of 1980s, however, populations have decreased in Ontario, Quebec, the Maritimes, and Alberta (Cadman *et al*., 2007; FAN, 2007; BSC, 2008; Larivée, 2008). Populations have been stable in Manitoba since 1970 (MARC, 2003) and stable or increasing in British Columbia since 1940 (Campbell *et al*., 2001).

North American Breeding Bird Survey

In Canada, long-term BBS data show a significant decline of 5.2% per year between 1968 and 2008 (Table 1, Figure 5) (Downes and Collins, 2009), which corresponds to a population loss of 88% over the last 40 years. In the most recent 10-year period (1998 to 2008), BBS data show a significant decline of 4.6% per year (Table 1), or a loss of 38% of the population over the last 10 years or approximately three generations. Populations in Nova Scotia, New Brunswick, Quebec, and Ontario show mostly significant declines in both the long and short-term (Table 1; Downes and Collins, 2009). Populations in Manitoba and Saskatchewan show non-significant declines between 1968-2008, while Alberta and British Columbia show non-significant increases (Table 1), but information is only available for long-term analyses for the latter two provinces.

Ontario Breeding Bird Atlas

A comparison of the species distribution in Ontario from the first (1981-1985) to the second (2001-2005) atlas period found that the Bobolink was recorded in 141 (9.3%) fewer squares in the second atlas than in the first atlas. Most of this decline (9.1%) was in the Southern and Northern Shield regions, where the species occurs only sporadically. In the core of the species range in Lake Simcoe-Rideau and Carolinian regions the species was recorded in three fewer squares during the second atlas. The probability of observation (standardized probability of detection for a species in a square in 20 hours of coverage) showed a significant decline of 28% in all five regions of Ontario between the two atlas periods (Cadman *et al*., 2007). Declines in the probability of observation were highest in the Southern Shield (28%) and Northern Shield (68%), but less in the Lake Simcoe-Rideau (5%) and Carolinian (10%) regions (Cadman *et al*., 2007).

Atlas of Breeding Birds of Alberta

A comparison of the species distribution in Alberta from the first (1987-1991) to the second (2001-2005) atlas period indicates that the species' range has contracted, but there are too few records to statistically determine if there has been a decline in occurrence (FAN, 2007).

Table 1: Annual indices of population change for the Bobolink based on BBS surveys (Downes and Collins, 2009).

	1968-2008			1998-2008		
Region	**Annual rate of decline**	**P[a]**	**N[a]**	**Annual rate of decline**	**P**	**N**
Canada	-5.2	*	410	-4.6	*	364
Nova Scotia	-5.1	*	30	3.2		27
New Brunswick	-5.2	*	32	-3.6		26
Quebec	-6.1	*	81	-5.7	*	70
Ontario	-2.6	*	115	-7.1	*	106
Manitoba	-2.1	n	48	-1.1		48
Saskatchewan	-0.8		53	6.6		38
Alberta	5.4		24	--		
British Columbia	0.3		18	--		

[a] *= P <0.05; n = 0.05<P<0.10; blank = not significant; N = number of BBS routes.

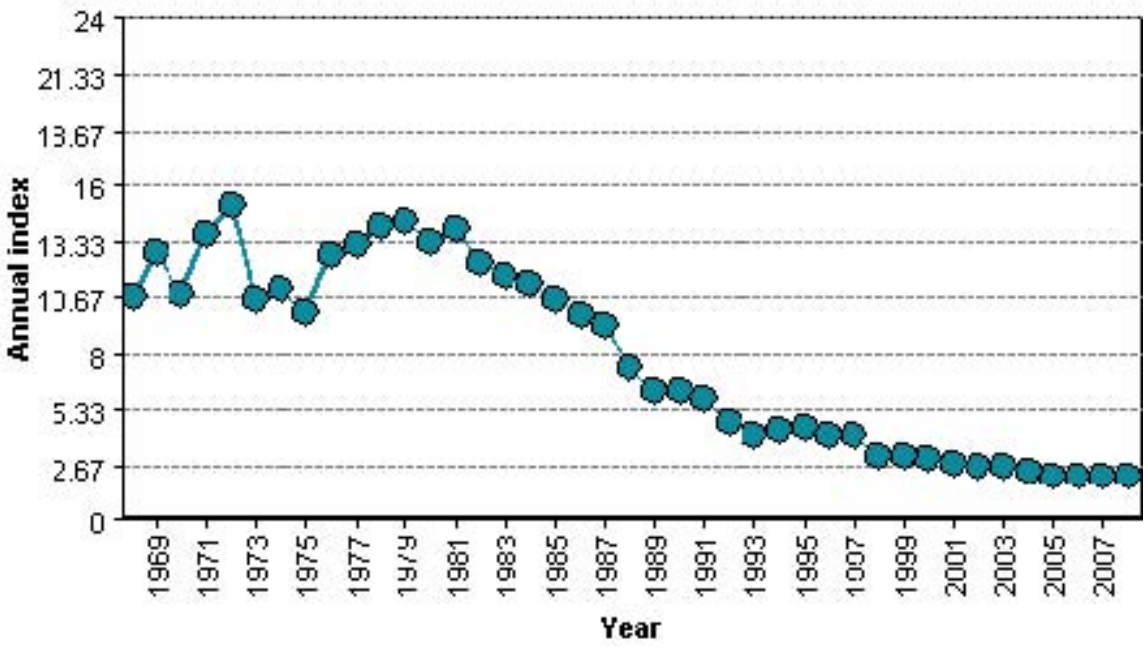

Figure 5. Annual indices of population change between 1968 and 2008 based on Breeding Bird Survey data (Downes and Collins, 2009).

Étude des Populations des Oiseaux du Québec (ÉPOQ)

The ÉPOQ database shows a significant long-term decline in Bobolink abundance in Quebec of 4.6% per year ($P \leq 0.0001$) between 1970 and 2007, representing an 83% decline over 37 years. This database also shows a significant short-term decline of 4.0% per year ($P = 0.026$) between 1997 and 2007, which represents a loss of 34% of the population in the most recent 10-year period.

In summary, BBS data show significant long- and short-term declines in Bobolink populations in Canada. Declines of varying degrees are also evident from regional surveys conducted in Ontario (i.e. Ontario Breeding Bird Atlas) and Quebec (i.e. Étude des Populations des Oiseaux du Québec), where the bulk of the population occurs.

Rescue effect

Long-term (1966 and 2007) data from the BBS in the U.S., where most of the breeding Bobolink population occurs, show significant annual rates of decline of 0.8% per year ($P = 0.01$, $n = 953$ routes) (Sauer *et al*., 2008). At this rate of decline the population will have decreased by 28% over the last 41 years (Sauer *et al*., 2008). In the shorter-term (1997-2007), the annual rate of decline is 0.41% per year ($P = 0.50$, $n = 700$ routes) (Sauer *et al*., 2008), which is equivalent to a population loss of 4% over the last 10 years. Although rescue from the U.S. is possible, the probability of it occurring is reduced given the declines shown in that portion of the range.

LIMITING FACTORS AND THREATS

Incidental mortality from agricultural operations

Modernization of agricultural techniques that favour earlier, more frequent cutting of hay fields during the breeding period is believed to be one of the primary threats to Bobolink populations in the breeding range (Bollinger and Gavin, 1992; Martin and Gavin, 1995; Nocera *et al*., 2005; Perlut *et al*., 2006; Frei *et al*., submitted). Because the climate favours a period of rapid growth, forage crops are increasingly being cut earlier in the season, namely before the end of June, and more frequently (i.e., up to three times) (Bollinger and Gavin, 1989; Jobin *et al*., 1996; MARC, 2003) when Bobolink nests still contain eggs or nestlings (Bollinger and Gavin, 1992; Martin and Gavin, 1995; Herkert, 1997; Ingold, 2002; Perlut *et al*., 2006). Hay cutting in eastern North America is carried out approximately two weeks earlier now than it was in the 1950s (Bollinger *et al*., 1990). When fields with active nests are cut, mowing initially destroys 51% of the eggs and nestlings (Bollinger *et al*., 1990). Subsequent mortality due to nest abandonment, nest predation, raking and baling increased mortality to 94% (Bollinger *et al*., 1990). Adult birds that brood at night or roost on the ground in hay fields can also be killed by night haying (Rodenhouse *et al*., 1992). A recent modelling exercise was conducted to determine the annual number of young and adult Bobolinks lost to mowing, seeding and tilling operations across a variety of geographical regions and

agricultural habitat types (e.g., hay, cereal; Tews *et al*., 2009). The results of a preliminary model showed that on an annual basis in Canada over 600,000 Bobolink eggs and young are potentially destroyed by these agricultural operations (Tews *et al*., 2009).

Habitat loss

A second important cause of population declines on the breeding range is habitat loss in the eastern and midwestern U.S. beginning in the 1950s (Bollinger and Gavin, 1992; Rodenhouse *et al*., 1995; Murphy, 2003). This loss is largely attributable to the conversion of artisanal crops (i.e. pastures and hayfields) to intensive cereal crops (e.g., soybean and corn), the abandonment of farms, the increase in the use of Alfalfa as the principal forage plant (Bollinger and Gavin, 1992; Jobin *et al*., 1996) and the spread of urbanization into agricultural lands (Herkert, 1991). Habitat loss is also a significant factor on wintering grounds (Di Giacomo *et al*., 2005), but it is not clear how the conversion of natural habitats to crops affects wintering Bobolink populations, given this species seems to adapt well to the expansion of new rice crops (Renfrew and Saavedra, 2007).

Habitat loss in several parts of northeastern North-America is also attributed to afforestation of abandoned hay and pastures fields (Brennan and Kuvleski, 2005; Cadman *et al.*, 2007).

Habitat fragmentation and nest predation

Throughout its breeding range, the main effect of habitat fragmentation is an increase in nest predation by various avian and terrestrial species (Johnson and Temple, 1990; Lavallée, 1998; Van Damme, 1999; Renfrew and Ribic, 2003; Bollinger and Gavin, 2004; Renfrew *et al*., 2005). Rates of nest predation on grassland birds, including the Bobolink, decline only on large habitat fragments ($\geq$ 1,000 ha; Herkert *et al*., 2003). Nest predation rates are generally higher near forest edges and decline as the distance from forest edges increases (Johnson and Temple, 1990; Bollinger and Gavin, 2004; Renfrew *et al*., 2005). In the Wisconsin prairie, predators primarily attack nests that are located near forest edges and up to 190 m into pastures. These predators seem to prefer woodland edges and make little use of other types of agricultural edges, such as those formed by various crops (Renfrew and Ribic, 2003).

Pesticide use on breeding and wintering grounds

Few studies have been conducted on the potential effects of pesticides on the Bobolink during the breeding period. Vickery *et al*. (1994) report a decline in Bobolink breeding densities for a period of 2 to 5 years following the application of the herbicide hexazinone to control shrubs. There was also a direct link made between the decline of several species of grassland birds and the widespread use in Canada of granular pesticides in agricultural areas (Potts, 1986; Mineau *et al*., 2005; Mineau and Whiteside, 2006). In the Prairie Provinces, organophosphates and cholinesterase-inhibiting

carbamates (e.g., carbofuran and terbufos) used to control insect pests in canola were known to be highly toxic to birds that ingest these compounds in the form of granules. Carbofuran is now banned in granular form in Canada. The liquid form is not, however, banned and it appears that it may also be toxic to birds (Martin and Forsyth 1993). In addition, Mineau and Whiteside (2006) have found that in the United States Alfalfa is one of the five crops that poses the highest risk of mortality in grassland passerines due to the high use of pesticide in this type of crop, although the impact on Bobolinks will depend on their use of Alfalfa fields, which varies across the range. In general, mortality associated with pesticide exposure is expected to be a significant contributor to the decline of grassland/farmland bird species in North America (Mineau, 2009).

Bobolink populations also face threats during migration and on the wintering grounds in South America. The species is gregarious in rice cultures, which exposes large numbers of them to highly toxic cholinesterase (ChE)-inhibiting insecticides (e.g., carbofuran, monocrotophos, phorate) that are applied to rice crops (Renfrew *et al*., 2007; Renfrew and Saavedra, 2007; Parsons *et al*., In press). For example, Bobolinks feeding in Bolivian rice fields were exposed to monocrotophos that was applied for insect control. Approximately 40% of birds captured in nets at roosts away from the fields exhibited lethal and sublethal levels of cholinesterase activity in their blood (Renfrew *et al.,* 2007). Netted birds likely provide a conservative estimate of the actual proportion of birds with depressed cholinesterase, because nets do not sample birds with moderately to severely impaired motor skills. (Renfrew *et al*., 2007; Renfrew and Saavedra, 2007). The impact of this pesticide on the Bobolink could result in direct mortality, physiological constraints preventing the initiation of migration and a reduction in productivity (Hooper *et al*., 1999).

In addition, given that the Bobolink is also considered a pest of rice crops and congregates in large numbers in roosts in South America (e.g., >130,000 individuals in Bolivia; Renfrew *et al*., 2007), chemical control carried out at these roosts could have a major impact on Bobolink populations (Basili and Temple, 1999; Temple, 2002; Renfrew and Saavedra, 2007; Parsons *et al*., In press).

Overgrazing and trampling by livestock

The Bobolink responds negatively to intensive livestock grazing or overgrazing (Kantrud, 1981; Bock *et al*., 1993). Overgrazing reduces not only the abundance of the plants used as nesting cover, but also alters the composition and structure of prairie vegetation (Kantrud and Kologiski, 1982; Baker and Guthery, 1990) and modifies the diversity and availability of herbivorous insects that are a food source for several species of birds (Jepson-Innes and Bock, 1989; Quinn and Walgenbach, 1990). Sheiman *et al*. (2007) report that a breeding Bobolink population in the U.S. midwest became extirpated when livestock was brought into a hayfield during two consecutive years, making the vegetation too short for nesting. However, the Bobolink responds positively to low-moderate livestock grazing (Bock *et al*., 1993; Bélanger and Picard, 1999; Renfrew and Ribic, 2001) given that a low grazing pressure can create pastures having a more horizontally and vertically diversified structure (Patterson and Best, 1996;

Delisle and Savidge, 1997; Hughes *et al*., 2000). However, on dryer sites (i.e., producing a lower plant density and height), even moderate grazing can negatively affect Bobolink habitat.

As for livestock trampling, it affects plant growth, which reduces nesting cover (Holechek *et al*., 1982). The higher the livestock density in a pasture, the higher the risk of trampling of the eggs and nestlings (Jensen *et al*., 1990). Studies have reported losses due to trampling of 7.7% of nests (3/39 nests) in treatments with various degrees of grazing pressure in southern Quebec (Lavallée, 1998), and losses of 9% (n = 85 nests) in Wisconsin (Renfrew *et al*., 2005).

Parasitism by the Brown-headed Cowbird

In general, the Bobolink is not a frequent host of the Brown-headed Cowbird (*Molothrus ater*) in North America (Peck and James, 1987; Winter *et al*., 2004; Renfrew *et al*., 2005). However, the rate of parasitism could vary locally. Parasitism rates are 37% (n=47 nests) in Wisconsin (Johnson and Temple, 1990), 5.9 % (n=136 nests) in Ontario (Peck and James, 1987) and 10.8% in northwest Minnesota and southeast North Dakota (Winter *et al*., 2004).

Climate change

In certain parts of its breeding range, exposure of nests to heavy rain or periods of frost during the breeding season can cause significant mortality in Bobolinks (Martin and Gavin, 1995). In the U.S. midwest, abundance is highly influenced by variation in annual precipitation, which might affect food availability (insects), the degree of plant cover and the distribution of predators and competitive species (Thogmartin *et al*., 2006). Moreover, it is not impossible that the increased frequency of tropical storms in the Gulf of Mexico adversely affects the Bobolink during fall migration. Further studies are needed to evaluate the impact of climate change on Bobolink ecology.

Illegal trade

Since the early 1900s, unknown numbers of Bobolinks have been captured in several South American countries for illegal sale in the local pet trade (Martin and Gavin, 1995; Di Giacomo *et al*., 2005). The magnitude of this threat is currently not known but illegal trade may be possibly affecting some local Bobolink wintering populations.

SPECIAL SIGNIFICANCE OF THE SPECIES

The Bobolink may be a beneficial species in some agricultural areas because it feeds on a wide variety of insect pests (Martin and Gavin, 1995). The distinctive song and plumage of the male Bobolink make it one of the most recognizable members of the grassland bird community.

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

In Canada, the Bobolink and its nests and eggs are protected under the *Migratory Birds Convention Act, 1994* (Environment Canada, 2004). The species is also protected by various provincial wildlife acts. For instance, in British Columbia, it receives protection under the provincial *Wildlife Act* and the *Forest Practices Code of British Columbia Act* (Van Damme, 1999). In Saskatchewan, the Bobolink is protected under *The Wildlife Act*, 1998. In Quebec, the species is protected under the *Act respecting the conservation and development of wildlife* (R.S.Q., c. C-61.1), and in New Brunswick it is protected under the *New Brunswick Fish and Wildlife Act*.

At the global level, NatureServe (2009) considers the species secure (G5, Table 2). In the United States, it is not listed under the *Endangered Species Act* (and it is considered secure (N5B; Table 2). It is listed as a species of special concern in some U.S. states and is listed as threatened in New Jersey (http://www.nj.gov/dep/fgw/ensp/pdf/end-thrtened/bobolink.pdf; Martin and Gavin, 1995). The Bobolink does not appear on the Watch List of the North American Landbird Conservation Plan given its score of 11/20, 20 being a species with the highest level of concern (Rich *et al*., 2004). The species is considered secure according to the IUCN Red List (NatureServe, 2009). In the midwest U.S. states, the Bobolink is considered a species of regional conservation concern (Thogmartin *et al*., 2006). It is considered critically imperiled (S1) or imperiled (S2) in 11 U.S. states (NatureServe, 2008) and a species of concern in three bird conservation regions (BCRs 12, 13 and 23) by the U.S. Fish and Wildlife Service (USFWS, 2002). In Canada, it is considered secure and common (N5). In most provinces, it is considered vulnerable (S3) or apparently secure (S4) (Table 2). The species is not considered to be at risk in several Canadian provinces and is not tracked by Conservation Data Centres (Saskatchewan, Government of Saskatchewan, 2008); Manitoba, Manitoba Government, 2009; Ministry of Natural Resources of Ontario, 2009; Quebec, Gouvernement du Québec, 2009; Maritimes, S. Blaney, pers. comm., 2008). The Bobolink is designated sensitive in Alberta (FAN, 2007) but is not the subject of any monitoring programs. In British Columbia, the CDC tracks the species and breeding occurrences, which are mapped and available through the BC Species and Ecosystems Explore (http://a100.gov.bc.ca/pub/eswp/eoMap.do?id=16574).

Table 2. Ranks assigned to the Bobolink in North America, based on NatureServe (2009) and General Status Ranks (CESCC, 2006)

Region	Rank*	General Status
Global	G5	—
United States	N5B	—
Canada	N5B	Secure
British Columbia	S3B	Sensitive
Alberta	S2S3	Sensitive
Newfoundland/Labrador	S2B	May be at risk
New Brunswick	S3S4B	Sensitive
Nova Scotia	S3B	Sensitive
Prince Edward Island	S3B	Sensitive
Saskatchewan	S5B	Secure
Manitoba	S4B	Secure
Ontario	S4B	Secure
Quebec	S4	Secure
Nunavut		Accidental

*G = is a global status rank; S = is a subnational rank assigned to a province or state; N = is a national status rank. S1 indicates that a species is critically imperiled because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines, making it especially vulnerable to extirpation; S2 indicates that a species is imperiled because of rarity or other factors making it very vulnerable to extirpation, usually with 6 to 20 occurrences or few individuals remaining (i.e., 1,000 to 3,000); S3 indicates that a species is vulnerable at the subnational level because it is rare or uncommon, or found only in a restricted range, or because of other factors making it vulnerable to extirpation; S4 indicates a species is apparently secure; S5 indicates that a species is secure because it is common, widespread, and abundant in the state/province.

TECHNICAL SUMMARY

Dolichonyx oryzivorus
Bobolink Goglu des prés
Range of Occurrence in Canada: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland/Labrador, New Brunswick, Nova Scotia, Prince Edward Island.

Demographic Information

Generation time (usually average age of parents in the population; indicate if another method of estimating generation time indicated in the IUCN guidelines(2008) is being used)	2 to 3 yrs
Is there an [observed, inferred, or projected] continuing decline in number of mature individuals?	Yes
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
Estimated percent reduction in total number of mature individuals over the last [10 years, or 3 generations]. - Based on BBS data showing a decline of 4.6% per year between 1998 and 2008 - Also a long-term decline of 5.2% per year between 1968 and 2008, equivalent to a population reduction of 88% for this period	38% reduction
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased?	Not reversible, generally understood and not ceased
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence Based on a minimum convex polygon of the species range map shown in Figure 2	3.73 million km²
Index of area of occupancy (IAO)	> 2000 km²
Is the total population severely fragmented?	No
Number of "locations*"	Not applicable
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	May be some loss in Alberta
Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Yes
Is there an [observed, inferred, or projected] continuing decline in number of populations?	Not applicable
Is there an [observed, inferred, or projected] continuing decline in number of locations?	Not applicable
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat?	Yes

∗See definition of location.

Are there extreme fluctuations in number of populations?	Not applicable
Are there extreme fluctuations in number of locations*?	Not applicable
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Total: Based on Breeding Bird Survey-based estimates and an extrapolation from the Ontario Breeding Bird Atlas	1.8 – 2.2 million
Quantitative Analysis	
Probability of extinction in the wild is at least [20% within 20 years or 5 generations, or 10% within 100 years].	Not done

Threats (actual or imminent, to populations or habitats)

- Incidental take of young and adults from agricultural operations during the nesting season;
- Habitat loss caused by conversion of forage crops to intensive grain crops and other row crops and by reforestation;
- Habitat fragmentation which promotes a higher rate of predation on nests located near edges;
- Pesticide use on breeding and wintering grounds;

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? USA: significant decline of 0.8% per year (1966-2007)	
Is immigration known or possible?	Likely
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Yes
Is rescue from outside populations likely?	Possible, but populations in the U.S. also declining

Current Status

COSEWIC: Threatened (April 2010)

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Threatened	A2b

Reasons for designation:

Over 25% of the global population of this grassland bird species breeds in Canada, which is the northern portion of its range. The species has suffered severe population declines since the late 1960's and the declines have continued over the last 10 years, particularly in the core of its range in Eastern Canada. The species is threatened by incidental mortality from agricultural operations, habitat loss and fragmentation, pesticide exposure and bird control at wintering roosts.

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Meets Threatened A2b because the population has declined by more than 30% over the last 10 years (approximately three generations) based on an appropriate index of abundance (b).
Criterion B (Small Distribution Range and Decline or Fluctuation): Does not meet criterion, range exceeds thresholds.
Criterion C (Small and Declining Number of Mature Individuals): Does not meet criterion, population size exceeds thresholds.
Criterion D (Very Small Population or Restricted Distribution): Does not meet criterion, both population and distribution exceed thresholds.
Criterion E (Quantitative Analysis): None conducted.

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