COSEWIC
Assessment and Status Report

on the

Yellow Rail
Coturnicops noveboracensis

in Canada

SPECIAL CONCERN
2023

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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Previous report(s):

COSEWIC. 2009. COSEWIC assessment and status report on the Yellow Rail *Coturnicops noveboracensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 32 pp. (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

COSEWIC. 2001. COSEWIC assessment and status report on the yellow rail *Coturnicops noveboracensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 62 pp. (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

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COSEWIC
Assessment Summary

Assessment Summary – December 2023

Common name
Yellow Rail

Scientific name
Coturnicops noveboracensis

Status
Special Concern

Reason for designation
This small, secretive marsh bird breeds in shallow, grassy marshes and wet meadows from eastern British Columbia and the Northwest Territories to New Brunswick, and the northern United States. About 90% of its breeding range is in Canada, and it winters in shallow coastal marshes and rice fields from Texas to North Carolina. Increased search effort has raised the population estimate to 18,000 to 65,000 mature individuals, 3-4 times the previous estimate. Population trends are poorly monitored, and although there is no evidence of an overall reduction in the Canadian population, there are indications of local declines. It is threatened by ongoing wetland loss and degradation in parts of its breeding and wintering grounds, often due to agriculture and industrial activity. Climate change may further alter hydrological regimes and cause drier conditions in some areas. This population may become Threatened if ongoing deterioration of wetland habitat is not reversed or managed effectively.

Occurrence
British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Northwest Territories, Nunavut

Status history
Designated Special Concern in April 1999. Status re-examined and confirmed in November 2001, November 2009, and December 2023.

COSEWIC
Executive Summary

Yellow Rail
Coturnicops noveboracensis

Wildlife Species Description and Significance

The Yellow Rail is a small, secretive marsh bird that is more often heard than seen. Its underparts are buffy brown, and its back is buff and black. The white secondary wing feathers are good field marks in flight. Males primarily vocalize at night with a distinctive series of “tic” sounds, following the pattern tic-tic, tic-tic-tic.

Interest in this enigmatic species is high among birdwatchers, due to its rarity and the difficulties of observing it. The Yellow Rail also serves as an indicator species for the health of shallow wetlands, such as fens and wet meadows.

Aboriginal (Indigenous) Knowledge

All species are significant and are interconnected and interrelated. There is no species-specific Aboriginal Traditional Knowledge in the report.

Distribution

The Yellow Rail breeds from northeastern British Columbia to New Brunswick, and in some adjacent northern U.S. states (e.g., Michigan, Minnesota), with a small disjunct breeding group in southern Oregon and northern California. Canada accounts for about 90% of the species’ global breeding range. Recent surveys in the Northwest Territories indicate that the species’ range extends farther north than previously known. Yellow Rails winter along the Atlantic and Gulf coasts of the United States, from Texas to North Carolina, with sporadic occurrences at some inland sites.

Habitat

The Yellow Rail is most often found in short, dense, emergent vegetation, usually *Carex* sedges (Cyperaceae), containing a dense mat of senescent vegetation from the previous growing season. Shallow water and moist soils are important, with water depths up to 15 cm. The Yellow Rail occurs in structurally similar vegetation communities in winter, often dominated by *Spartina* cordgrasses (Poaceae).

Biology

The Yellow Rail is generally considered uncommon, but occurs at high densities in suitable habitat. Males are territorial, patrolling territories and foraging during the day and vocalizing near the nest at night. Females have smaller home ranges and remain closer to the nest. Females construct a cup nest from nearby vegetation, under a canopy of dead plants, in which they lay 4–10 eggs. Incubation lasts about 18 days. Generation time is estimated to be about 2.13 years. The Yellow Rail undertakes quite complex movements, including a post-breeding moult migration and a long migration to and from the wintering grounds, with individuals dispersing considerable distances between breeding areas from year to year. The resulting low fidelity to breeding sites has precluded the useful analysis of the species' survival, mortality and longevity, as well as population trends. Diet studies indicate that the Yellow Rail feeds on arthropods (predominantly beetles), snails, and seeds and other marsh vegetation.

Population Sizes and Trends

Yellow Rail numbers are poorly sampled by standardized bird population monitoring programs, which may overlook this cryptic species spatially, due to its occurrence in remote wetlands, and temporally, due to its nocturnal vocal behaviour. The size of the Yellow Rail population in Canada is estimated at 18,000–65,000 mature individuals. This estimate is about 3-4 times higher than in previous status reports, as recent targeted surveys have found significant numbers of the rails in areas where the species was previously thought to be rare or absent. However, it is not interpreted as a population increase. Estimating population trends is challenging, as the species' absence from formerly occupied habitats may reflect either dispersal or population decline. Continental and regional breeding bird surveys provide no evidence of an overall reduction in the Canadian Yellow Rail population, although there are indications of local declines, and a gradual overall population decline may be inferred due to the continuing loss of wetland habitat.

Threats

The main threats to the Yellow Rail are habitat loss, caused by draining of wetlands for agriculture; destruction or degradation of wetlands for industrial use, especially in southern portions of its breeding range; and damage to some breeding habitats due to overgrazing by Snow Geese (*Anser caerulescens*). Wetland degradation encompasses alterations to water depth, vegetation composition or other components in ways that reduce habitat suitability. Habitat loss is a threat on both the breeding and coastal wintering grounds, although it is unclear whether it has led to Yellow Rail population declines. Climate change likely poses a threat by causing altered hydrological regimes, more frequent extreme weather and drier conditions.

Protection, Status and Recovery Activities

The Yellow Rail is protected under the *Migratory Birds Convention Act, 1994* in Canada and the *Migratory Bird Treaty Act* (1918) in the United States. It was assessed by COSEWIC as Special Concern in 2002 and is listed as such under the *Species at Risk Act*. The species was reassessed as Special Concern by COSEWIC in December 2023. A federal management plan for the species was completed in 2013. The Yellow Rail is also listed provincially: Special Concern in Ontario, Threatened in Quebec, Special Concern in New Brunswick, and on British Columbia's Red List. Globally, NatureServe ranks the Yellow Rail as G4 (Apparently Secure). It is ranked nationally in Canada as N4B, NUM (Apparently Secure Breeder, Unranked Migrant) and in the United States as N3B, N4N (Vulnerable Breeder, Apparently Secure Non-breeder). Subnational ranks in Canadian provinces and territories range from S1 to S3 (Critically Imperiled to Vulnerable). The Yellow Rail occurs in many national parks and other protected areas, but most individuals likely nest outside these areas.

TECHNICAL SUMMARY

Coturnicops noveboracensis

Yellow Rail

Râle jaune

Range of occurrence in Canada (province/territory/ocean): British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Northwest Territories, Nunavut

Demographic Information:

Generation time (usually average age of parents in the population).	Approximately 2.13 years	Based on Bird *et al.* (2020)
Is there an [observed, estimated, inferred, or projected] continuing decline in number of mature individuals?	Unknown	National and continental monitoring programs do not show evidence of clear declines, although there are some local declines, and a gradual overall decline may be inferred due to threats.
[Observed, estimated, or projected] percent of continuing decline in total number of mature individuals within [3 years or 1 generation; whichever is longer up to a maximum of 100 years].	Unknown	Overall population decline, at unknown but gradual rates, may be inferred due to threats such as continuing loss of wetland habitat.
[Observed, estimated, or projected] percent of continuing decline in total number of mature individuals within 5 years [or 2 generations; whichever is longer up to a maximum of 100 years].	Unknown	Overall population decline, at unknown but gradual rates, may be inferred due to threats such as continuing loss of wetland habitat.
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years, [or 3 generations; whichever is longer up to a maximum of 100 years].	Unknown	Overall population decline, at unknown but gradual rates, may be inferred due to threats such as continuing loss of wetland habitat.
[Projected, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the next 10 years [or 3 generations, whichever is longer up to a maximum of 100 years].	Unknown	Overall population decline, at unknown but gradual rates, may be inferred due to threats such as apparent continuing loss of wetland habitat.

[Observed, estimated, inferred, projected, or suspected] percent [reduction or increase] in total number of mature individuals over any period of 10 years [or 3 generations, whichever is longer up to a maximum of 100 years], including both the past and future (up to a maximum of 100 years in the future).	Unknown	Overall population decline, at unknown but gradual rates, may be inferred due to threats such as apparent continuing loss of wetland habitat.
Are the causes of the decline clearly reversible?	No	Restoration of wetlands may not result in usable breeding habitat for the Yellow Rail.
Are the causes of the decline clearly understood?	No	Habitat loss is likely the main cause of local declines.
Have the causes of the decline clearly ceased?	No	Habitat loss is ongoing, although at rates that may have slowed in recent years.
Are there extreme fluctuations in number of mature individuals?	Unknown, but unlikely	Significant local fluctuations are likely due to dispersal in response to changing water levels, but fluctuations are not consistent over large areas.

Extent and Occupancy information:

Estimated extent of occurrence (EOO).	~ 4,400,000 km²	Based on Canadian breeding range (Figure 1)
Index of area of occupancy (IAO), reported as 2x2 km grid value.	> 3,260 km² (breeding season)	Minimum estimate, based on eBird records from June to August; actual IAO is certainly much higher
Is the population “severely fragmented” i.e., is >50% of individuals or >50% of the total area “occupied” (as a proxy for number of individuals) in habitat patches that are both (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No b. No	The Yellow Rail is highly mobile and appears to disperse readily among habitat patches.
Number of “locations” (use plausible range to reflect uncertainty if appropriate).	>>100	Based on combined threats of wetland habitat loss and habitat degradation, which act locally in many different portions of the Yellow Rail’s distribution
Is there an [observed, inferred, or projected] continuing decline in extent of occurrence?	No	Insufficient survey effort to assess trends; estimated EOO is higher than in previous reports due to better information on occurrence.

Is there an [observed, inferred, or projected] continuing decline in index of area of occupancy?	Unknown	Insufficient survey effort to assess trends
Is there an [observed, inferred, or projected] continuing decline in number of subpopulations?	Not applicable	No subpopulations identified
Is there an [observed, inferred, or projected] continuing decline in number of “locations”?	Yes, inferred and projected	Many previously occupied locations have been, or are projected to be, lost due to land-use changes, or degraded due to Snow Goose grazing, with little new habitat being created.
Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality of] habitat?	Yes, inferred and projected	Climate change is projected to have widespread effects on rainfall, hydrology and fire regimes, likely with net negative effects on the Yellow Rail. Some habitat may be lost to industrial activity in the near future.
Are there extreme fluctuations in number of subpopulations?	Not applicable	No subpopulations identified
Are there extreme fluctuations in number of “locations”?	No	
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 subpopulation):

Subpopulations.	N Mature Individuals (give plausible ranges)	Notes on individual estimates
Canada (no subpopulations identified)	18,000–65,000	Sum of provincial and territorial population estimates, based on expert opinion and informed by published studies (**see Table 2**)

Quantitative Analysis:

Is the probability of extinction in the wild at least 20% within 20 years [or 5 generations], or 10% within 100 years?	Unknown	Analysis not conducted

Threats and Limiting Factors:

Was a threats calculator completed for this species?	Yes, on 28 February 2023 (see Appendix 1)	Overall assigned threat impact: High-Medium
The following contributing threats were identified; they are listed in decreasing order of impact and exclude those of negligible impact (see Appendix 1): IUCN 7. Natural System Modifications (Medium threat impact) IUCN 2. Agriculture & Aquaculture (Low threat impact) IUCN 3. Energy Production & Mining (Low threat impact) IUCN 4. Transportation & Service Corridors (Low threat impact) IUCN 9. Pollution (Low threat impact) IUCN 11. Climate Change & Severe Weather (Low threat impact)		
What limiting factors are relevant? The limiting factors for the Yellow Rail are generally unknown, although it may be limited by its restrictive breeding habitat requirements, i.e., specific water levels and the presence of mats of senescent vegetation.		

Rescue Effect (from outside Canada)

Status of outside population(s) most likely to provide immigrants to Canada.	Unknown	Little trend information for relatively small U.S. population
Is immigration known or possible?	Yes	The Yellow Rail disperses widely, so immigration from nearby U.S. states is possible.
Would immigrants be adapted to survive in Canada?	Yes	Climate and habitat features in adjacent U.S. states are similar to those in southern Canada during the breeding season.
Is there sufficient habitat for immigrants in Canada?	Possibly	Unknown whether habitat is limiting in Canada
Are conditions deteriorating in Canada?	Yes	Some wetlands continue to be drained or converted to other land uses, and climate change may further affect habitat availability through droughts or flooding.
Are conditions for the source (i.e., outside) population deteriorating?	Yes	Wetland loss continues in some adjacent areas in the United States.
Is the Canadian population considered to be a sink?	No	Canada is the primary breeding area.
Is rescue from outside populations likely, such that it could lead to a change in status?	No	Potential source populations in the U.S. are experiencing similar threats, and the vast majority of population breeds in Canada.

Wildlife Species with Sensitive Occurrence Data (general caution for consideration):

Could release of certain occurrence data result in increased harm to the Wildlife Species or its habitat?	No	

Status History:

COSEWIC	Designated Special Concern in April 1999. Status re-examined and confirmed in November 2001, November 2009 and December 2023.

Status and Reasons for Designation

Current Status.	Special Concern
Alpha-numeric codes.	Not applicable
Reason for change of status.	Not applicable – no change
Reasons for designation (2023).	This small, secretive marsh bird breeds in shallow, grassy marshes and wet meadows from eastern British Columbia and the Northwest Territories to New Brunswick, and the northern United States. About 90% of its breeding range is in Canada, and it winters in shallow coastal marshes and rice fields from Texas to North Carolina. Increased search effort has raised the population estimate to 18,000 to 65,000 mature individuals, 3-4 times the previous estimate. Population trends are poorly monitored, and although there is no evidence of an overall reduction in the Canadian population, there are indications of local declines. It is threatened by ongoing wetland loss and degradation in parts of its breeding and wintering grounds, often due to agriculture and industrial activity. Climate change may further alter hydrological regimes and cause drier conditions in some areas. This population may become Threatened if ongoing deterioration of wetland habitat is not reversed or managed effectively.

Applicability of Criteria

A: Decline in Total number of Mature Individuals	
Not applicable	Not applicable. There is no evidence of an overall reduction in the number of mature individuals over the past 10 years.
B: Small Range and Decline or Fluctuation	
Not applicable	Not applicable. Extent of occurrence and index of area of occupancy exceed thresholds.
C: Small and Declining Number of Mature Individuals	
Not applicable	Not applicable. The number of mature individuals exceeds thresholds.
D: Very Small or Restricted Population	
Not applicable	Not applicable. The number of mature individuals exceeds thresholds.
E: Quantitative Analysis	
Not applicable	Not applicable. Analysis not conducted.

PREFACE

The Yellow Rail was previously assessed as Special Concern by COSEWIC in 1999, and its status was reassessed and confirmed in 2001 and 2009. A management plan was published in 2013 (Environment Canada 2013). Since the previous assessment, surveys targeting the Yellow Rail have been carried out in the Northwest Territories (McLeod *et al.* 2021), Alberta (Hedley *et al.* 2020), Saskatchewan (Drake and Latremouille 2016), and Manitoba (Martin *et al.* 2014). Together with Breeding Bird Atlas projects completed or underway in British Columbia (Phinney 2015), Saskatchewan (Birds Canada 2023), Manitoba (Bazin 2018), Ontario (Birds Ontario 2023), Quebec (Robert 2019) and the Maritimes (Makepeace 2015), these studies have improved our understanding of the range, distribution and population size of the Yellow Rail in Canada. The widespread adoption of autonomous recording units (ARUs) for acoustic surveys has increased the availability of nocturnal survey data and improved survey outcomes.

Estimating trends across the Canadian breeding range remains problematic due to the difficulty of detecting and monitoring the Yellow Rail using traditional survey methods such as the Breeding Bird Survey. Ongoing long-term trend monitoring has been carried out at about 500 survey stations in Alberta since 2013 (Hedley *et al.* 2022), but population trends are still unclear.

The movement biology of the Yellow Rail remains poorly understood, and movement patterns of individuals during the post-breeding period, in migration, and from year to year are unclear. Recent research has used stable isotope methods to assess migratory connectivity between the breeding and wintering grounds (Butler *et al.* 2021), although these methods provide only a coarse picture of migratory linkages. Remaining knowledge gaps contribute to uncertainty in determining population trends, due to difficulties in assessing whether apparent local declines are due to emigration and nomadism or are true population declines.

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
(2023)

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 is 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.

Environment and Climate Change Canada
Canadian Wildlife Service
Environnement et Changement climatique Canada
Service canadien de la faune
Canada

The Canadian Wildlife Service, Environment and Climate Change Canada, provides full administrative and financial support to the COSEWIC Secretariat.

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2023

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Figure 2. Number of Yellow Rails per hour of survey effort recorded on Christmas Bird Counts (CBC) in Texas, Oklahoma, Louisiana, Mississippi, Alabama, Florida, Georgia, and South Carolina, from 1966 to 2021. Numbers above data points indicate the total number of individuals observed across all counts in that year. The line of best fit has the equation: number/hour = 0.00002*Year + 0.040. The effect of year was significantly different from zero ($p<0.001$). Calculated for this report using data from National Audubon Society (2020). See discussion in **Data Sources, Methods, and Uncertainties** on interpretation of CBC trends for this species. 21

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Current classification:

Class: Aves
Order: Gruiformes
Family: Rallidae
Genus: *Coturnicops*
Species: *noveboracensis*

Common names:

English: Yellow Rail
French: Râle jaune
Indigenous: Pâhpâkipitêsiw (from Nêhinawêwin, or Swampy Cree)
Other names: Yellow Crake, Clicker

Description of Wildlife Species

The Yellow Rail (*Coturnicops noveboracensis*) is a member of the rail family, comprising small, chicken-like wetland birds. At about 18 cm and 60 g, it is small (about the size of a Red-winged Blackbird, *Agelaius phoeniceus*) and shaped like a domestic fowl chick (Leston and Bookhout 2020). Adult plumage is yellowish brown beneath, with alternating buff and black stripes on the back, narrowly and sparsely barred with white. The belly has a similar but less distinct pattern, and the head has a brown crown and smudgy brown mask through the eye. The bill is usually olive-grey, but is yellow in breeding males. The white tips of the secondary wing feathers form a white wing patch visible in flight. The body may be laterally compressed, and the long toes are used to manoeuver over and through aquatic vegetation. Juveniles are similar to adults but darker, with white speckles on the neck, head, and upper back and sides. The buffy striped back and white wing patches distinguish the Yellow Rail from the more common Sora (*Porzana carolina*). The Yellow Rail is rarely seen and is most often detected at night by its call, a repeated pattern of two, then three clicks—tic-tic, tic-tic-tic.

Designatable Units

<u>Recognized subspecies in Canada:</u>

Only one subspecies of the Yellow Rail breeds in North America (*C. n. noveboracensis*; Clements *et al.* 2021). An isolated subpopulation in Oregon and northern California shows shallow genetic divergence from those east of the Rocky Mountains (Miller *et al.* 2012), but at levels insufficient to warrant designation as a separate subspecies. A second subspecies (*C. n. goldmani*) once bred in Mexico but is now likely extinct (Howell and Webb 1995).

Designatable Units (DUs):

The Yellow Rail is highly mobile and appears to disperse significant distances between habitat patches (Leston and Bookhout 2020). There is no evidence that differences among breeding assemblages in Canada are sufficiently discrete or evolutionarily significant to warrant consideration as separate designatable units.

Special Significance

Roughly 90% or more of the Yellow Rail's global breeding range is in Canada (COSEWIC 2009). The species is considered a migratory game bird under the *Migratory Birds Convention Act*, *1994,* although there are currently no open hunting seasons anywhere in Canada (Government of Canada 2017) or the United States. Because of its rarity and secretive habits, the Yellow Rail is among the most sought-after species by birdwatchers in North America, supporting ecotourism at sites where it occurs regularly (Robert 1997), such as Douglas Marsh in Manitoba (Malcolm 2009), Île aux Grues in Quebec (Robert 1997) and several sites in the U.S. Gulf States. It often shares its wet meadow, fen and wet prairie habitats with the Short-eared Owl (*Asio flammeus*), Sedge Wren (*Cistothorus stellaris*), Nelson's Sparrow (*Ammodramus nelsoni*) and LeConte's Sparrow (*A. leconteii*). As a consequence, its presence serves as an indicator of the health of these often ephemeral ecosystems found between typical wetlands and drier uplands.

ABORIGINAL (INDIGENOUS) KNOWLEDGE

Aboriginal Traditional Knowledge (ATK) is relationship-based. It involves information on ecological relationships between humans and their environment, including characteristics of species, habitats and locations. Laws and protocols for human relationships with the environment are passed on through teachings and stories, and Indigenous languages, and can be based on long-term observations. Place names provide information about harvesting areas, ecological processes, spiritual significance or the products of harvest. ATK can identify life history characteristics of a species or distinct differences between similar species.

Cultural Significance to Indigenous Peoples

There is no species-specific ATK in the report. However, the Yellow Rail is important to Indigenous Peoples who recognize the interrelationships of all species within the ecosystem.

DISTRIBUTION

Global Range

The Yellow Rail breeds from British Columbia and the southern Northwest Territories east to the Gaspé Peninsula of Quebec, and occasionally as far as New Brunswick. In the recent past, it has nested in Nova Scotia. In the United States, it breeds in northeastern Montana, throughout most of North Dakota, and through northern Minnesota, Wisconsin, Michigan and Maine (Figure 1). The Yellow Rail is sparsely and unevenly distributed, and is rarely reported from northern Saskatchewan, northern Manitoba, and most of Ontario south of the Hudson Bay Lowlands. An isolated subpopulation breeds in southwestern Oregon and northern California (Stern *et al.* 1993), likely wintering in coastal California (R. Russell, cited in Waterbird Conservation for the Americas 2006).

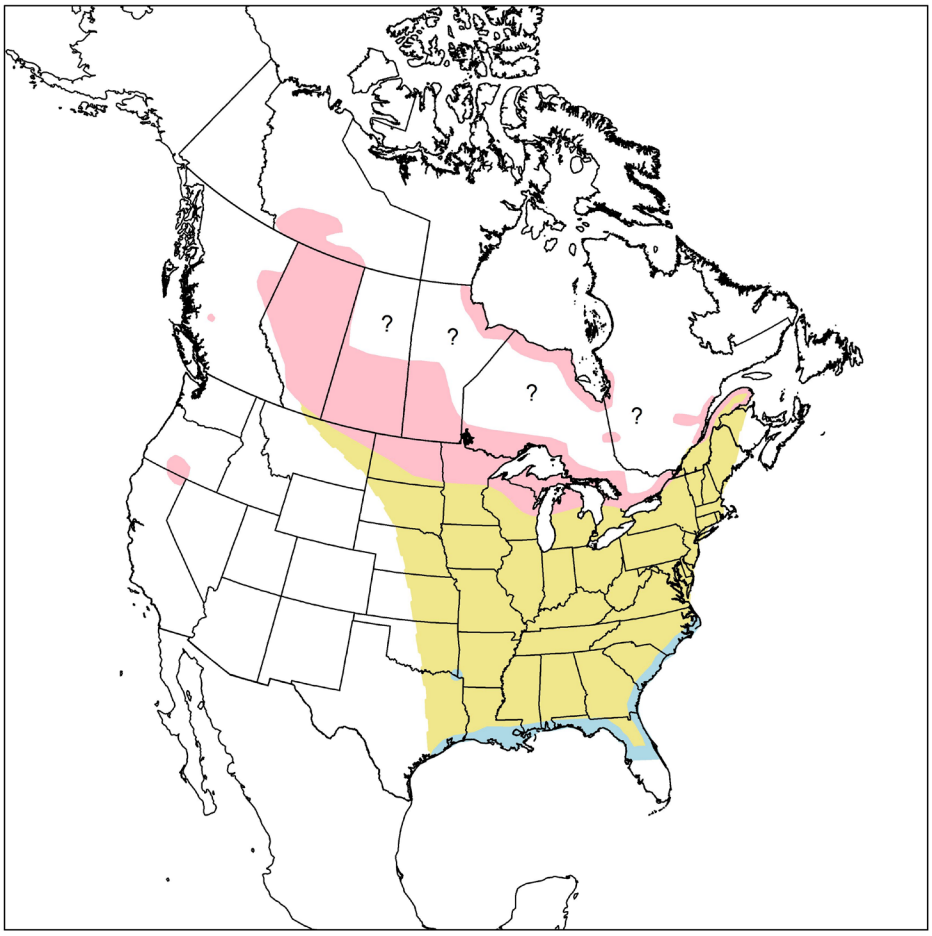

Figure 1. Approximate range of the Yellow Rail in North America during the breeding (pink), migration (yellow), and wintering (blue) periods. Question marks (?) indicate areas in boreal regions where breeding status is uncertain. Modified from COSEWIC 2009, based on information from recent studies, Canadian experts and Conservation Data Centres (see **POPULATION SIZES AND TRENDS – Abundance**).

Yellow Rails that breed in Canada winter along the U.S. Gulf Coast from Texas through Florida, and north along the Atlantic coast to North Carolina. A small number of birds were recently discovered wintering in southeast Oklahoma (Butler *et al.* 2010), although coastal wintering areas are much more important for the species. The size of the known wintering range is likely < 7% of that of the breeding range (Figure 1). Migrants have been recorded sporadically at stopovers between the breeding and wintering grounds (Leston and Bookhout 2020).

Canadian Range

The Canadian range of the Yellow Rail is poorly known, as the species often occupies relatively inaccessible habitats, and is difficult to detect due to its cryptic behaviour and coloration, and predominantly nocturnal vocalizations. It is most common in the Boreal Plains and Prairies ecozones, as well as the along the coastal edge of the Hudson Plains ecozone and in scattered areas of the Mixedwood Plains ecozone. Its main breeding range extends from extreme eastern British Columbia (Phinney 2015; B.C. Conservation Data Centre 2020) and the Northwest Territories south through Alberta, east through central and southern Saskatchewan and Manitoba, along the coasts of southwestern Hudson Bay and James Bay, through central Ontario, and along the St. Lawrence River to the Gaspé Peninsula of Quebec, with some sites in New Brunswick and past reports from Nova Scotia (Makepeace 2015; Leston and Bookhout 2020; Figure 1). It occurs rarely in the Chilcotin and Kootenay regions of British Columbia, where it may breed. A summary of Yellow Rail records from Canadian breeding bird atlas projects is presented in Table 1.

Table 1. Summary of records for the Yellow Rail in the most recent Canadian breeding bird atlas projects. Results are presented as the number of 10 km x 10 km survey squares in which Yellow Rails were detected during Atlas survey years.

Province/region	Years of atlas	Number of atlas squares in which Yellow Rail was detected	Main ecozones with Yellow Rail detections	Reference
British Columbia	2008–2012	13	Boreal Plains	Phinney (2015)
Alberta	2000–2005	39	Boreal Plains, Prairies, Taiga Plains	Federation of Alberta Naturalists (2007)
Saskatchewan	2017–2022	12	Boreal Plains, Prairies	Birds Canada (2023)
Manitoba	2010–2014	140	Boreal Plains, Prairies, Hudson Plains, Boreal Shield	Bazin (2018)
Ontario	2001–2005	47	Boreal Shield, Hudson Plains, Mixedwood Plains	Cadman *et al*. (2007)
Quebec	2010–2014	9	Atlantic Maritime	Robert (2019)
Maritimes	2006–2010	2	Atlantic Maritime	Makepeace (2015)

Recent surveys have confirmed the importance of western boreal areas for the Yellow Rail. For example, it was detected in substantial numbers in the Edéhzhíe National Wildlife Area and Dehcho Protected Area west of Great Slave Lake, N.W.T. (McLeod *et al.* 2021), which had yielded only sporadic records in the past (COSEWIC 2009). A vocalizing male was reported near Fort Good Hope, N.W.T., over 500 km north of the species' previously known range, although it is uncertain whether this record was indicative of breeding activity (McLeod *et al.* 2021).

The Yellow Rail is a rare and local summer resident in the Peace River region of British Columbia (Phinney 2015). It was detected in thirteen 10 km x 10 km squares during the recent breeding bird atlas project, primarily in the Peace River region (Table 1; Phinney 2015). Reports of Yellow Rails near Anahim Lake in the Cariboo region (B.C. Conservation Data Centre 2020) suggest that the species may be somewhat more widespread in British Columbia than atlas records suggest.

The Yellow Rail breeds throughout Alberta, where the most recent breeding bird atlas project detected it in 39 squares scattered across the province in areas of suitable habitat, in the Boreal Plains, Prairies and Taiga Plains ecozones (Table 1; Federation of Alberta Naturalists 2007).

The species' known distribution in Saskatchewan has not changed since the previous status report (COSEWIC 2009). The ongoing Saskatchewan Breeding Bird Atlas project has detected Yellow Rails in 12 squares, all in the southern half of the province in the Boreal Plains and Prairie ecozones (Birds Canada 2023). Scattered records have occasionally been reported from the Boreal Shield ecozone (eBird 2021), but the sparsely populated northern half of Saskatchewan has received much less search effort.

The distribution of the Yellow Rail in Manitoba has not changed substantially since the previous status report (COSEWIC 2009). The Manitoba Breeding Bird Atlas recorded Yellow Rails in 140 squares (Table 1; Bazin 2018), with this high number driven in part by an exceptional year in 2010, when many individuals were detected in southern Manitoba. The Yellow Rail is apparently scarce in most of the northern half of the province (Boreal Shield ecozone) inland from the Hudson Bay coast, likely due to the lack of suitable shallow wetlands in this rocky landscape (Bazin 2018).

The coastal James Bay lowlands of Ontario and Quebec, and the Hudson Bay coast northwest to Churchill, Manitoba, are among the most important known breeding areas for the species (Robert *et al.* 2004; Tozer 2007; COSEWIC 2009). The Yellow Rail is also thought to nest on Akimiski Island, Nunavut, in James Bay. It is very occasionally recorded at widely scattered sites in southern Ontario, with confirmed breeding in the Rainy River region, around Georgian Bay, and along the Trent–Severn Waterway (Tozer 2007). The second Ontario Breeding Bird Atlas project detected Yellow Rails in 47 squares in the Boreal Shield, Hudson Plains and Mixedwood Plains ecozones (Table 1; Tozer 2007).

The Yellow Rail has been recorded in summer at scattered sites through the interior of southern Quebec, mainly along the St. Lawrence River, with confirmed breeding on Île aux Grues and at Coin-du-Banc (Robert 2019). The second Quebec Breeding Bird Atlas project found the species in nine squares in southern Quebec, in the Atlantic Maritimes, Mixedwood Plains and Boreal Shield ecozones (Table 1; Robert 2019).

In the Maritimes, the only confirmed breeding of the Yellow Rail was in 1881 in New Brunswick (Makepeace 2015). The species has occurred regularly only at Grand Lake Meadows in central New Brunswick, with birds also found sporadically in the Tantramar Marshes near Sackville, New Brunswick, and neighbouring Amherst, Nova Scotia (Kehoe *et al.* 2000; Makepeace 2015). Reports of calling birds in 1998 near Glen Margaret, Nova Scotia, and in the 1920s and 1930s near North Sydney and Noel, suggest that the Yellow Rail may have occasionally bred there (Tufts 1986). It was detected in just two squares during the recent Maritimes Breeding Bird Atlas project, both in New Brunswick (Table 1; Makepeace 2015).

Population Structure

Genetic analysis of mitochondrial DNA and six microsatellite loci indicated only very weak genetic differentiation among Yellow Rails sampled from Oregon, Manitoba, Minnesota, Wisconsin, Michigan and Quebec, with the greatest level of differentiation found between the geographically isolated Oregon subpopulation and groups east of the Rocky Mountains, which include nearly all Canadian birds (Miller *et al.* 2012). Genetic patterns in birds east of the Rocky Mountains, including those in Canada, are generally consistent with isolation by distance (Miller *et al.* 2012).

Extent of Occurrence and Area of Occupancy

Current extent of occurrence:

The species' current extent of occurrence (EOO) is approximately 4,400,000 km^2 in Canada, based on a minimum convex polygon drawn around the species' known Canadian breeding range (Figure 1). This polygon excluded possible extralimital observations, including records near Anahim Lake in British Columbia (B.C. Conservation Data Centre 2020) and near Fort Good Hope in the Northwest Territories (McLeod *et al.* 2021), which warrant further study.

Current index of area of occupancy:

A minimum estimate of the index of area of occupancy (IAO) was calculated based on eBird observations. A raster grid with a cell size of 2 km x 2 km was overlaid across the breeding range, and eBird observations made during the period from June to August (when the species was in its breeding range) of any year until 2021 were selected. A cell was deemed occupied if it contained at least one eBird observation. Using this approach, 815 cells were occupied, equivalent to an IAO of 3,260 km^2. Given the challenges of detecting the Yellow Rail, the incompleteness of eBird observations and the relative inaccessibility of many nesting areas, this value certainly underestimates IAO and should be considered a lower bound of the estimate.

The same approach using eBird data was used to estimate the minimum IAO in winter, defined as the period from December to February. During those months, 134 cells (2 km x 2 km) were reported to contain at least one eBird observation of the Yellow Rail, providing a lower bound estimate for IAO during winter of 536 km^2. However, as this species has even lower detectability in winter, when it is less likely to vocalize, and as the other challenges noted above also apply in winter, the actual IAO is likely much higher and cannot be reliably estimated here.

Fluctuations and Trends in Distribution

The difference between the current EOO of 4.4 million km^2 and the estimate of 3 million km^2 in the previous status report (COSEWIC 2009) largely reflects recent discoveries of occupied areas rather than an actual increase in range, although some range expansion cannot be completely ruled out. Though Yellow Rails in Canada are concentrated in a relatively narrow band along the southeastern U.S. Atlantic and Gulf Coasts in winter, the EOO is normally only calculated in Canada.

BIOLOGY AND HABITAT USE

The Yellow Rail is one of the most secretive and least understood of North American birds. The available information pertaining to basic biology has changed little since the previous status report (COSEWIC 2009). The Birds of the World species account (Leston and Bookhout 2020) provides the most comprehensive overview of the species' biology, and key elements relevant to status determination are highlighted below.

Life Cycle and Reproduction

Yellow Rails arrive on their southern Canadian breeding grounds from late April to mid-May, and several weeks later on their breeding grounds on the Hudson and James Bay coasts. Males begin producing their nocturnal territorial calls at this time. Calling males are spatially separated, and may display, call or approach in response to call broadcasts or imitations of their call (Stalheim 1974 in COSEWIC 2009; Stenzel 1982; Robert and Laporte 1997).

Nesting begins in early June (Robert and Laporte 1996, in COSEWIC 2009), and clutch size is 5–10 (mean = 8) eggs (Leston and Bookhout 2020). Incubation begins after the last egg is laid, and continues for about 18 days (Elliot and Morrison 1979). After hatching, the young may be brooded in a separate nest nearby (Leston and Bookhout 2020). Broods are fed at the nest by parents for the first two days, and then follow the female as she forages and feeds them near the nest. Chicks may be brooded for up to three weeks and are able to fly at about 35 days of age (Stalheim 1974 in COSEWIC 2009).

Most demographic parameters are unknown. Age at first breeding is undetermined but presumed to be one year (Leston and Bookhout 2020). Bird *et al.* (2020) provide model-based estimates of maximum longevity of 8.93 years, adult annual survival rate of 0.460, and generation time of 2.13 years. These estimates for the Yellow Rail were imputed by models based on data on the traits and life history of related species, rather than calculated directly from survival or longevity data collected for the Yellow Rail. Additional research would help verify these estimates. In the small number of existing studies of marked Yellow Rails, return rates vary considerably and are generally low, ranging from about 1% to 11% (Robert and Laporte 1999; Lundsten and Popper 2002; Leston and Bookhout 2020). As with other rails (Remsen and Parker 1990), dispersal rates are likely so high that mortality rates cannot be inferred from these parameters.

Habitat Requirements

Breeding habitat:

The Yellow Rail breeds in wet, marshy areas of extensive short, grass-like vegetation, usually sedges (Cyperaceae, especially *Carex* spp.), but also grasses (Poaceae) and rushes (Juncaceae) that have the required structure. The habitat must remain wet throughout the breeding season, usually with less than about 15 cm of standing water (Robert *et al.* 2000; Wilson 2005; Leston and Bookhout 2020). Water depth often declines through the breeding season (Bookhout and Stenzel 1987; Lundsten and Popper 2002; Drake and Latremouille 2016). An overlying layer of dead grass-like vegetation is required, likely used for roofing the nest or for hiding the birds' movements from predatory birds (Stenzel 1982; Robert and Laporte 1999; Popper and Stern 2000; Robert *et al.* 2000).

The Yellow Rail primarily inhabits sedge meadows, fens and bogs, but is also found in wet hay fields, grassy meadows, floodplains, wet prairie, wet montane meadows and in the upper margins of estuaries and coastal salt marshes (Peabody 1922; Gibbs *et al.* 1991; Sherrington 1994; Alvo and Robert 1999; Popper and Stern 2000; Leston and Bookhout 2020). In coastal James Bay, birds have been found in summer in wetlands dominated by Bog Buckbean (*Menyanthes trifoliata*), although they may have used these sites only after breeding in grassy habitats elsewhere (Robert *et al.* 2004).

Most Yellow Rails are found in wetlands larger than 10 ha (Robert 1996, in COSEWIC 2009; Alvo and Robert 1999), although it is unclear whether they require such a large area, as calling males have been observed in wetlands of 0.5–4.0 ha (Robert 1996, in COSEWIC 2009; Alvo and Robert 1999). Radio-tracking studies have shown wide variations in home range size, including 1.5–20 ha in Quebec (Robert 1996, in COSEWIC 2009), and 6–10 ha for males and less than 2 ha for females in Michigan (Bookhout and Stenzel 1987). Densities of calling males were in the range of 0.04–0.06 males/ha in most studies (Robert and Laporte 1999; Robert *et al.* 2004; Wilson 2005; Tozer 2007; Leston and Bookhout 2020; McLeod *et al.* 2021), but densities of 0.08 males/ha and about 0.3 males/ha were found along the coast of James Bay (Robert *et al.* 2004) and in Saskatchewan (Drake and Latremouille 2016), respectively. It appears that home ranges may overlap (Bookhout and Stenzel 1987), and weak coloniality has been suggested at some sites (Bart *et al.* 1984).

Migration habitat:

The Yellow Rail is difficult to detect in the breeding range during the post-breeding moult period (Robert and Laporte 1999) and during migration, when habitat needs are poorly known. Outside of the breeding season, the Yellow Rail has a broader tolerance for different water levels and the presence of senescent vegetation mats. The latter may help it escape from predators, especially when birds are moulting (Robert and Laporte 1999; Robert *et al.* 2000; Wilson 2005). In Missouri, Yellow Rails used shallow flooded areas with annual moist-soil plants, including smartweeds (*Polygonum* spp.) and millets (*Echinochloa* spp.; Fournier *et al.* 2017). Relatively high densities of the species have been reported in dry hay fields, suggesting that drier habitats may be used more often in migration than while breeding (White 2007; Mueller 2013).

Winter habitat:

In winter, Yellow Rails mainly occur in coastal salt marshes—especially those dominated by cordgrasses (*Spartina* spp.)—and rice fields, as well as fields of hay, other grasses and cereals (Alvo and Robert 1999; Post 2008; Butler *et al.* 2014). In Oklahoma, birds were predominantly found in fields dominated by dropseeds (*Sporobolus* spp.) with 0–4 cm of standing water (Butler *et al.* 2010). Birds usually occur in areas with low water levels and dense, low vegetation (Mizell 1998; Grace *et al.* 2005; Post 2008). Radio-tracking studies in Texas showed winter home ranges of 0.5–4 ha that often overlapped (Mizell 1998; Grace *et al.* 2005). Indeed, wintering birds are often flushed in groups, suggesting that the species may be quite gregarious (Mizell 1998; Grace *et al.* 2005; Post 2008). The Yellow Rail has recently been discovered to winter in wet pine savannahs in Mississippi and Alabama (Soehren *et al.* 2018). The common feature across breeding, migration and winter habitats is a preference for dense, grass-like vegetation that provides concealment near ground level.

Movements, Migration, and Dispersal

The Yellow Rail is highly mobile throughout its life cycle, with movements documented during the breeding and post-breeding periods and spring and fall migration, when it moves long distances. In addition, high apparent rates of dispersal are found from year to year. In Oregon, several dispersal events have been documented during the breeding season, involving distances of 3–57 km, which were thought to have occurred in response to changes in water levels during the season (Popper pers. comm. 2021).

Adult Yellow Rails moult all their flight feathers and many body feathers after they finish breeding, but before they undertake fall migration. This post-breeding moult, typical among rails, renders them flightless for about two weeks (Stalheim 1974, in COSEWIC 2009; Leston and Bookhout 2020). The presence of calling males after nesting, at Île aux Grues, Quebec (Robert and Laporte 1999) and Grand Lake Meadows, New Brunswick (Kehoe *et al.* 2000), suggests that birds travel to specific areas to moult before migrating to their wintering grounds. Some birds moulting at Île aux Grues had been tagged on breeding grounds hundreds of kilometres farther up the St. Lawrence River, suggesting that they undergo moult migration as described for many waterfowl (Robert and Laporte 1999) and other bird species (Pyle *et al.* 2018). Stable isotope signatures of feathers of Yellow Rails wintering in Texas suggest that some birds moult at sites between the breeding and wintering ranges (Perkins 2007).

Yellow Rails likely migrate across a broad front at night, probably in small flocks (Pulich 1961; Seets and Bohlen 1977; Goldade *et al.* 2002; Leston and Bookhout 2020). Observations in Missouri show fall migration movements occurring from 22 August to 6 November, with a median date of 30 September (Fournier *et al.* 2017). Birds return to most breeding sites between late April and mid-May (Leston and Bookhout 2020), but reach western Hudson Bay in the third week of June, suggesting that they may stage for weeks along the migration route (Jehl 2004). The species appears to exhibit some degree of migratory connectivity (Butler *et al.* 2021). Stable isotope analysis suggests that individuals wintering along the western Gulf of Mexico and in Oklahoma likely breed in the western part of the breeding range (from Alberta to Minnesota and the Hudson Bay Lowlands), whereas individuals wintering in Florida likely breed farther south and east (from North Dakota through southern Ontario, southern Quebec, Maine, and New Brunswick; Butler *et al. 2021*).

Most species of rails, including the Yellow Rail, have high rates of dispersal, presumably an adaptation to respond to ephemeral local water conditions (Remsen and Parker 1990). Low rates of inter-annual band returns provide indirect evidence of high inter-annual dispersal (e.g., Robert and Laporte 1999). During five years of banding at one site in Saskatchewan, Drake (pers. comm. 2021) recorded only one inter-annual recapture among 108 banded rails. Winter site fidelity also appears to be low, with just five inter-annual recaptures among 532 banded birds in Oklahoma and Texas from 2008 to 2019 (Butler pers. comm. 2021). Overall, inter-annual return rates are far below levels that could be attributed to mortality, suggesting a tendency to regularly disperse among breeding sites across years.

In summary, Yellow Rail movements appear to be complex, involving within-season movements, post-breeding movements associated with moulting and low inter-annual site fidelity suggestive of a relatively nomadic lifestyle. The complexity of these movements and the species' low site fidelity likely account for fluctuations in site occupancy from year to year (Prescott *et al.* 2002; Hedley *et al.* 2022), as birds disperse to track suitable habitat. In turn, variable site occupancy patterns complicate efforts to assess population trends (see **Population Sizes and Trends**) and impede understanding of longevity and migratory connectivity.

Interspecific Interactions

Diet:

Although early reports concluded from indirect and anecdotal evidence that Yellow Rails fed principally on snails (e.g., Peabody 1922), a more recent detailed study of the species' diet in Quebec showed snails constitute only 5% of the diet, which consisted mainly of arthropods such as beetles, spiders and flies (43%, 13%, and 5% of diet, respectively), and the seeds of sedges, rushes and grasses (16%, 7% and 2%, respectively; Robert *et al.* 1997). Birds may rely more heavily on seeds during winter (Robert *et al.* 1997).

Predators and competitors:

The main predators of Yellow Rails appear to be raptors (Walkinshaw 1939, Grace *et al.* 2005), although rails are small enough to be taken by a wide range of predators, including foxes, herons, and, in Texas, Water Moccasins (*Agkistrodon piscivorus*; Alvo and Robert 1999). Two known cases of predation by Domestic Cats (*Felis catus*) have occurred in Oregon (Popper pers. comm. 2023), which may indicate a broader threat near human population centres, although cats likely rarely occur in the wetland habitats occupied by Yellow Rails. Eggs and nestlings are presumably subject to a broad range of predators, with clear evidence only of pecking by Red-winged Blackbirds and Marsh Wrens (*Cistothorus palustris*; Popper and Stern 2000).

There is no information available on interspecific competitors (Leston and Bookhout 2020). In many localized parts of the Hudson Bay Lowlands, heavy grazing pressure from large populations of breeding and staging Snow Geese (*Anser caerulescens*) (Abraham *et al.* 2005; Jefferies *et al.* 2006) may destroy or disrupt Yellow Rail nesting habitat.

Physiological, Behavioural, and Other Adaptations

Disease, parasitism and environmental toxins are suspected of being important limiting factors for other species of rails, at least locally (Eddleman *et al.* 1988; Ackerman *et al.* 2012), but no physiological studies have been conducted on the Yellow Rail. One bird was found dead during a botulism outbreak in Oregon, suggesting that, like other rallids, this species may sometimes succumb to this disease (Popper pers. comm. 2023)

The Yellow Rail is presumed to be relatively intolerant of human disturbance, as it is usually found away from areas of human activity, although this may largely reflect the loss of its preferred habitat in environments developed for industrial or commercial use (Robert pers. comm. 2023).

Limiting Factors

Limiting factors are generally not human-induced and include intrinsic characteristics that make the species less likely to respond to conservation efforts. Limiting factors may become threats if they result in population decline. The main limiting factors for the Yellow Rail are generally unknown, aside from its narrow breeding habitat requirements, which include specific water levels and the need for senescent mats of vegetation. Although water levels may exceed 50 cm at breeding sites when birds arrive in spring, they typically subside below 15 cm by the onset of nesting and must not flood out the mats of dead vegetation. Indeed, annual variations in the presence or abundance of Yellow Rails at several sites closely track variations in water levels (Robert and Laporte 1999; Kehoe *et al.* 2000; Lindgren 2001; Austin and Buhl 2013; Leston and Bookhout 2020).

POPULATION SIZES AND TRENDS

Data Sources, Methodologies, and Uncertainties

The Yellow Rail is poorly sampled by most existing broad-scale population monitoring programs, which rely largely on detecting bird calls during the day.

North American Breeding Bird Survey:

Point counts conducted during the road-based Breeding Bird Survey (BBS) are carried out during early morning, when the Yellow Rail seldom vocalizes. In addition, much of the species' range is in roadless areas far from population centres and from BBS routes, which further limits the detection of the species. Consequently, few individuals are detected in the BBS, and it is of relatively little use for estimating either population sizes or trends. BBS trend estimates for the Yellow Rail are rated as having low credibility due to a lack of precision (Sauer *et al.* 2020).

Christmas Bird Count:

Low numbers of Yellow Rails are detected in the Christmas Bird Count (CBC), largely due to the species' secretive nature. Trends for the species derived from CBC data may be biased due to changes over the years in search methods, observer experience, and in the search effort targeting this species (Butler *et al.* 2013). A good illustration of the influence of search methods on CBC detections of the species is the count circle in the San Bernard National Wildlife Refuge in Texas, which has accounted for 33% of all historical CBC detections of Yellow Rails, with an average of 11 birds/year in 2002–2020 (range: 2–

22/year). Search methods there previously involved driving through wetlands with a “marsh buggy” to flush birds, a practice discontinued beginning in the 2021 count year in order to protect wetland habitats. In 2021, no Yellow Rails were detected for the first time in twenty years. Although it is difficult to draw conclusions from a single year, Yellow Rails are expected to be detected at lower rates on this count in the future (Wilson pers. comm. 2022). Given the status of the San Bernard National Wildlife Refuge count as the pre-eminent CBC count for this species, this change may result in an apparent decline in overall Yellow Rail numbers in the CBC, even if the actual numbers are stable. In general, the lack of a standardized search effort and the extremely low number of detections at a small number of sites make interpreting CBC trends for this species problematic.

Breeding bird atlases:

Breeding bird atlas projects could potentially provide an adequate picture of Yellow Rail distribution and relative abundance, as greater effort is usually made to ensure coverage of remote areas and all habitats. In atlas projects, the province or region is typically divided into 10 km x 10 km squares, where volunteers attempt to confirm breeding for as many species as possible over a five-year period. Volunteers search all habitats in their square, so Yellow Rail habitats that are often overlooked are potentially well covered in an atlas project. Data on abundance are usually limited to subjective estimates on a log scale, often based on point counts, which usually fail to detect this species for the reasons noted above. Atlases also suffer from biased effort that favours populated areas (i.e., such as southern Canada), which may result in the species being missed in remoter areas. Nevertheless, atlas projects provide reasonably accurate information on the species’ distribution and, since they are usually repeated every 20 years, on long-term trends in occurrence.

eBird:

The number of eBird observations has increased substantially since the previous status report, and eBird data now comprise the largest single dataset on the Yellow Rail (e.g., 5,182 observations during the peak breeding season in June and July; eBird Basic Dataset 2021). However, eBird data are not standardized and suffer from sampling biases, with a disproportionate amount of data collected near human population centres and effort often concentrated in areas that are not important for the Yellow Rail. As the Yellow Rail is highly sought after by birdwatchers, data are also likely biased due to repeated observations at sites where birds have been reported. In the absence of relevant quantitative analyses, eBird data are likely best suited to informing distribution and related parameters such as the IAO.

Other data sources:

Targeted surveys are the most effective method for monitoring the Yellow Rail, and have successfully detected appreciable numbers in the Northwest Territories (McLeod *et al.* 2021), Alberta (Prescott *et al.* 2002; Hedley *et al.* 2020), Saskatchewan (Drake and Latremouille 2016), Manitoba (Martin *et al.* 2014), Ontario (Peck pers. comm. 2021) and Quebec (Robert and Laporte 1999; Robert *et al.* 2004). Targeted surveys can be carried out at the appropriate time of day and year, which maximizes the probability of detection, and can focus exclusively on, or at least favour, the specialized habitats used by the Yellow Rail. Since suitable wetlands for the species may cover only about 1% of regional landscapes (McLeod 2019; Hedley *et al.* 2020; Morris *et al.* 2020), random or systematic surveys are inefficient at detecting the species. On the other hand, targeted surveys usually lack the spatial and temporal scale needed to estimate population size or trends at a broad scale.

Autonomous recording units (ARUs) have the potential to improve Yellow Rail monitoring (Sidie-Slettedahl *et al.* 2015; Drake *et al.* 2016), as they can be programmed to record the species' calls during both day and night. Nocturnally vocalizing species such as the Yellow Rail are less likely to be overlooked by ARUs, even by surveys largely targeting diurnal species. The Yellow Rail may have somewhat lower detection probabilities on ARUs compared with traditional in-person call-broadcast surveys, but this is offset by the reduced need to conduct nocturnal fieldwork in remote wetlands (Sidie-Slettedahl *et al.* 2015). In recent years, the Canadian Wildlife Service has greatly expanded its ARU-based biodiversity monitoring programs (e.g., Van Wilgenburg *et al.* 2020), as have academic researchers (Bayne pers. comm. 2021) and breeding bird atlases (Drake pers. comm. 2021; Friis pers. comm. 2021). If applied across broad areas, this technology could fill gaps in our understanding of Yellow Rail distribution, population size, and trends.

Caution is required in interpreting local or regional trends in occupancy in a broader context. The number of Yellow Rails at specific sites often fluctuates considerably from year to year. In Alberta, monitoring at the Western McClelland Lake fen detected variable numbers of rails annually in 2013–2017, followed by their apparent absence in 2018–2019 and their return to former abundance in 2021 (Hedley *et al.* 2022). These dynamics, likely driven by inter-annual changes in habitat suitability, appear typical for this species and make trend estimation challenging.

Yellow Rail studies are also open to site selection bias, which may skew population trend estimates in a negative direction (Fournier *et al.* 2019). If long-term monitoring sites are selected based on the presence of the target species, natural colonization and extinction dynamics will introduce a bias towards observing declines, even if the overall population remains constant. This type of bias is evident in some Yellow Rail studies. For instance, among the 62 Alberta survey sites selected because they had historical observations of Yellow Rails dating as far back as 1914, only 7% still had rails in the summer of 2000, which may represent dispersal or a true population decline (Prescott *et al.* 2002). A five-year study in Saskatchewan documented a decline in local Yellow Rail abundance, but was initiated in response to the presence of notable numbers (Drake and

Latremouille 2016). Biased site selection may be necessary to ensure that an adequate sample of detections can be achieved for relatively rare species such as the Yellow Rail, but raises concerns about the extrapolation of observed trends.

Abundance

The first COSEWIC status report for the Yellow Rail estimated the Canadian population at roughly 5,000–6,000 pairs or 10,000–12,000 mature individuals (Alvo and Robert 1999). This estimate was still considered plausible by writers of the subsequent status report (COSEWIC 2009).

Despite the paucity of rigorous range-wide abundance estimates, the global Yellow Rail population likely exceeds previous estimates. Indirect evidence of higher numbers includes the rate at which Yellow Rails are killed at communication towers. For example, Longcore *et al.* (2013) calculated that 9.0% of the estimated global Yellow Rail population of 25,000 individuals died each year due to tower strikes. This proportional mortality estimate was the highest among 234 species analyzed, 88% of which were estimated to lose less than 1% of their population to tower strikes annually. The high mortality estimate has three possible interpretations. First, Yellow Rails may indeed be especially susceptible to tower strikes relative to other species. While Yellow Rails have sometimes been found dead under towers in considerable numbers (e.g., Goldade *et al.* 2002), no traits are known that would make them disproportionately vulnerable. Second, the number killed (the numerator) may have been overestimated, although it is not obvious why this would be the case for Yellow Rail, but not for other species. Third, the continental population (the denominator) may have been underestimated. Even if the assumed population size were 100,000 individuals—four times larger than the number used in the analysis—the Yellow Rail would still rank among the top ten species in proportional annual mortality from tower strikes, but it would be less of an outlier and mortality rates would better align with those of other species. This analysis thus hints at the possibility that the continental population of the Yellow Rail could be several times larger than previously estimated.

A second line of evidence that population abundance has been underestimated is the fact that targeted regional surveys often encounter Yellow Rails in fairly high numbers in places where their presence was previously unknown—which is a reflection of their ability to occur unnoticed across large areas. Surveys in the Edéhzhíe National Wildlife Area and Dehcho Protected Area of the Northwest Territories detected about 40 calling males in a small area, suggesting that about 900 pairs may occur in suitable habitat in the entire protected area (McLeod *et al.* 2021). With so many rails in a single area, Alvo and Robert's (1999) earlier estimate that the entire Northwest Territories contained 20–100 pairs is a substantial underestimate. Once thought to reach its highest densities in Alberta in the east-central part of the province (Pinel *et al.* 1991), the Yellow Rail was encountered most frequently in northwestern Alberta, in the Boreal Forest region of the province, in 2000 (Prescott *et al.* 2002), and a recent study in northeastern Alberta estimated that 500–5,000 male Yellow Rails were present in an area making up 7% of the province (Hedley *et al.* 2020). These results support a significant upward revision of the estimate of 500 breeding pairs in the entire province (Alvo and Robert 1999; Table 2). In Saskatchewan,

recent intensive surveys reported up to 0.3 males/ha, among the highest breeding Yellow Rail densities ever recorded (Drake and Latremouille 2016). Although this study was restricted to a single wetland complex that may host over 100 breeding pairs in good years, similar wetlands likely exist elsewhere in the province. Targeted surveys in Manitoba found Yellow Rails in 35 of 80 wetlands, showing that occurrence can be high in suitable habitat (Martin *et al.* 2014). Butler *et al.* (2014) estimated that 1,170 ± 300 individuals likely wintered in a study site covering about 5% of the potential habitat in the San Bernard National Wildlife Refuge in Texas, which represents only a small portion of the species' winter range. While it is possible that Yellow Rails recently dispersed into these areas for the first time, the fact that these discoveries generally came from the first dedicated surveys with methodology suited to detecting the species suggests that the species likely had previously occurred undetected in these areas. Collectively, these studies suggest that, although the Yellow Rail is relatively uncommon, its abundance has previously been significantly underestimated due to insufficient targeted search effort.

Table 2. Estimates of the number of mature Yellow Rail individuals breeding in Canadian provinces and territories

Province or territory	Estimate by Alvo and Robert (1999)	Current estimate (this report)	Comments
British Columbia		100–200	According to Phinney (2015), "probably fewer than 100 pairs"
Alberta	1,000+	4,000–20,000	500–5,000 males estimated in study area covering 7% of the province (Hedley *et al.* 2020).
Saskatchewan	1,000+	2,000–5,000	Very high densities recorded in Fishing Lake wetland complex (Drake and Latremouille 2016). Species appears less abundant in boreal Saskatchewan than in boreal Alberta, although the paucity of records there may reflect low survey effort.
Manitoba	1,000+	3,000–10,000	High numbers in suitable habitat (Martin *et al.* 2014). More breeding bird atlas observations in Manitoba than other provinces (Bazin 2018). The northern half of Manitoba may lack suitable habitat outside coastal areas.
Ontario	254–310	5,000–20,000	Breeding bird atlas project reported 157 males in one area (Tozer 2007); current estimate includes Hudson and James bays.
Hudson Bay, James Bay	a few 1,000 pairs	N/A	Now included in Ontario and Quebec provincial estimates
Quebec	80–320	2,000–5,000	Robert *et al.* (2004) found 205 males on James Bay coast, and estimated that the area may contain more than 1,000 males. Unknown numbers (although likely much fewer) scattered elsewhere in the province.
New Brunswick	0–100	5–20	First and second atlases have two records each (Makepeace 2015).

Province or territory	Estimate by Alvo and Robert (1999)	Current estimate (this report)	Comments
Nova Scotia	0–100	0–10	One record in first atlas record only (Makepeace 2015)
Northwest Territories	40–200	2,000–5,000	Surveys revealed new breeding areas (McLeod *et al.* 2021). A considerable amount of unsurveyed potential habitat remains, especially in southern N.W.T.
Nunavut		0–100	Likely restricted to a few islands in James Bay.
Canada	**10,000–12,000**	**18,000–65,000**	

Given the above information, the previous estimate of 10,000–12,000 mature individuals by Alvo and Robert (1999) is considered too conservative. It is unlikely that there are as few as 10,000 individuals, unless researchers have been remarkably successful at finding them, and the current evidence suggests that the upper bound far exceeds 12,000 individuals. An updated Canadian population estimate of 18,000 to 65,000 mature individuals is provided in Table 2, based on the sum of revised individual provincial and territorial estimates, which were in turn based on expert opinion and recent studies and informed by published reports. Although Alvo and Robert (1999) had suggested that about 2,000 pairs could be found away from the Hudson Bay and James Bay coasts, the current estimate suggests that there may be tens of thousands outside that area. Considering the size of the species' breeding range, the remoteness of its habitat, its likelihood of being overlooked, and the large amount of potentially suitable habitat yet to be searched, the upper bound of 65,000 individuals remains uncertain. Refining the current estimate will require additional data, as well as a thorough, range-wide analysis of all data sources.

Fluctuations and Trends

Long-term historical trends:

The Yellow Rail is presumed to have declined historically in Canada and the United States, based mainly on declines in the amount of available habitat (see **Habitat Trends** below) rather than evidence from population surveys. It has disappeared from the former southern edge of its breeding range in southern Wisconsin (Grimm 1991), northern Illinois and central Ohio (Alvo and Robert 1999). It was formerly recorded in large marshes in southern Ontario, notably Holland Marsh in Simcoe County, where about ten rails were heard in 1937 and breeding was confirmed in 1938 (Devitt 1939). Holland Marsh has since been largely drained and converted to agriculture, with few Yellow Rails reported there since the 1980s (Tozer 2007; eBird Basic Dataset 2021). An Alberta-wide survey failed to find Yellow Rails at 90% of 42 historically occupied sites (Prescott *et al.* 2002).

The long-term trend based on data from 57 BBS routes in Canada and the United States that detected Yellow Rails failed to discern either positive or negative trends for the 1993–2019 period (1.8% per year; 95% CI: -2.2%–6.4%; Sauer *et al.* 2020). Analyses of BBS data at smaller spatial scales (Canada-wide or provincial-scale analyses) also failed to discern trends. All analyses were rated as having low credibility, due to the low detectability of this species using BBS methods.

Numbers detected in U.S. wintering areas covered by the CBC showed a significant positive trend from 1966 to 2011, when analyzed in terms of detections/unit effort, although this may reflect improved search methods or better knowledge of the species by birders rather than a population increase (Butler *et al.* 2013). An analysis of data from nine CBC circles found a significant increase of 2.9%/year (95% CI: 0.2%–5.4%) from 1966 to 2013 (Soykan *et al.* 2016). The findings from an updated analysis conducted for this report closely mirrored these results, showing that the number of Yellow Rails detected/hour of CBC effort increased significantly from 1966 to 2021 (Figure 2; but see **Data Sources, Methods, and Uncertainties** for a discussion of the limitations of this data source).

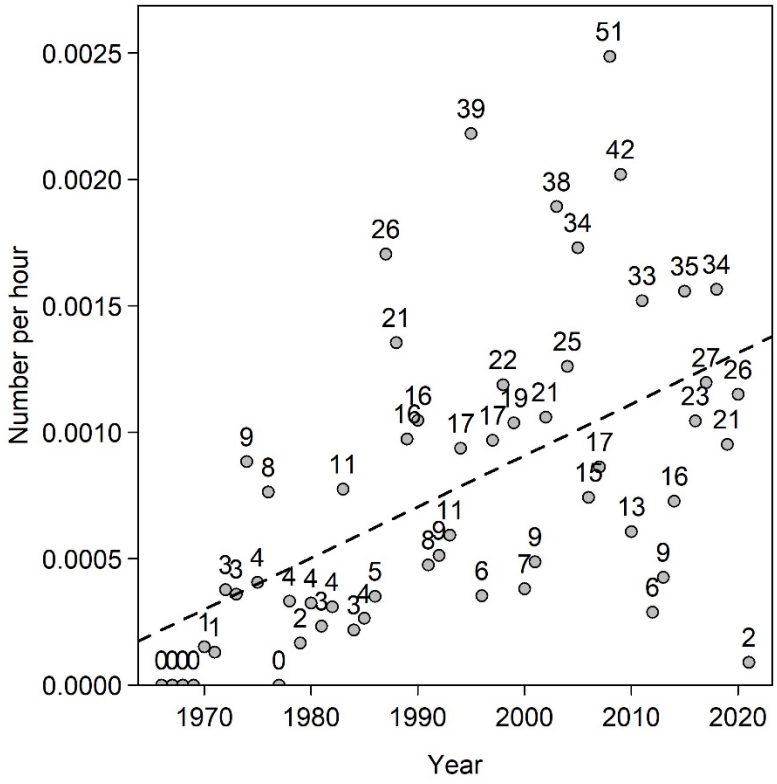

Figure 2. Number of Yellow Rails recorded on Christmas Bird Counts (CBC) in Texas, Oklahoma, Louisiana, Mississippi, Alabama, Florida, Georgia and South Carolina per hour of survey effort, from 1966 to 2021. Numbers above data points indicate the total number of individuals observed across all counts in that year. The line of best fit has the equation: number/hour = 0.00002 * year + 0.040. The year effect was significantly different from zero ($p < 0.001$). These figures were calculated for this report using data from the National Audubon Society (2020). See discussion in **Data Sources, Methods, and Uncertainties** on the interpretation of CBC trends for this species.

Evidence for an observed or inferred continuing decline over the past 10 years:

BirdLife International (2022) reported global population trends as apparently decreasing, although at rates of less than 30% over 10 years, apparently based largely on the previous status report (COSEWIC 2009). In provinces with a second (or third) breeding bird atlas project, the number of detections has been too few, and the occurrence of the Yellow Rail too variable, to discern clear trends (Federation of Alberta Naturalists 2007; Tozer 2007; Makepeace 2015; Robert 2019).

The main bird monitoring programs with sufficient spatial coverage to ascertain trends across the species' range have been largely unsuccessful at detecting either positive or negative population trends. A BBS trend analysis specific to Canada had low reliability and estimated that the population change over the past ten years could be anywhere from -71.4% to +37.5% (point estimate -19.3%; Smith *et al.* 2020). eBird does not report trends for this species (Fink *et al.* 2021). Two published analyses of CBC data suggest an increasing trend in that dataset (Butler *et al.* 2013; Soykan *et al.* 2016), but these analyses were based on data from more than ten years ago. More recent data were collated for this report (Figure 2), showing that recent Yellow Rail counts have remained high relative to historical numbers, albeit with considerable inter-annual variability and potentially driven by increasingly targeted survey efforts, and so considerable caution is warranted when interpreting these trends (see **Data Sources, Methods, and Uncertainties**).

Some useful trend information can be garnered from local or regional monitoring programs that have more successfully targeted Yellow Rail. A broad monitoring program in northeastern Alberta showed relative stability in occupancy at 495 sites from 2013 to 2021, although substantial inter-annual fluctuations could mask underlying trends (Hedley *et al.* 2022). Analyses relating these changes to water depth or disturbance are ongoing (Bayne pers. comm. 2021).

In the Fishing Lake wetland complex in Saskatchewan, monitoring at 168 stations over five years showed a decline of about 50% from an initial index of abundance of 5.3 in 2011 to a final index of abundance of 2.77 in 2015 (Drake and Latremouille 2016). Changes in abundance were attributed to natural fluctuations in water levels, which decreased throughout the study. Incidental observations by shorebird researchers along the James Bay coast in Ontario since 2010 have shown no discernible trends (Friis pers. comm. 2021).

Taken together, empirical evidence of either positive or negative population trends is scarce, especially when considered in light of the species' high mobility, which makes it impossible to distinguish between emigration and true declines. It seems likely that slight declines may be occurring, driven by ongoing threats (see **Current and Future Threats** below). Overall declines are very unlikely to exceed COSEWIC thresholds of 30% or 50% over ten years, although the current monitoring programs would be unlikely to detect a decline of that magnitude.

Population fluctuations, including extreme fluctuations:

The size of the overall Yellow Rail population in Canada is not known to fluctuate widely, although local numbers may vary dramatically from year to year at specific sites, likely as a result of movements in response to changes in annual water levels (e.g., Kehoe *et al.* 2000; Lindgren 2001; Hedley *et al.* 2022).

Severe Fragmentation

The Yellow Rail is highly mobile throughout its life cycle and disperses readily among habitat patches, with low inter-annual breeding and wintering site fidelity (Butler pers. comm. 2021; Drake pers. comm. 2021) and high apparent rates of dispersal within and between years (e.g., Popper pers. comm. 2021). Birds apparently readily move among available habitat patches with no indication of severe fragmentation.

Rescue Effect

The Yellow Rail often disperses widely, presumably in response to changes in water levels in ephemeral local habitats (Remsen and Parker 1990), and since many sites in the northern United States are within dispersal distance of Canadian breeding areas, individual birds likely move between the two countries. However, as Canada supports about 90% of the global population and U.S. populations are relatively small and likely declining, the likelihood of rescue from the United States is low.

THREATS

Historical, Long-term, and Continuing Habitat Trends

Historical long-term trends in the quality and quantity of Yellow Rail habitat are difficult to assess, as estimates of wetland losses rarely document changes in the very shallow wetland habitats used by this species. Published estimates of historical wetland losses are likely conservative, as these relatively dry areas are more likely to be converted to uses such as agriculture than are deeper wetlands (e.g., Oswald 2000). Estimates of historical wetland losses in different regions include 71% in the Canadian Prairies (Cox 1993), 70% in southern Manitoba (Oswald 2000), 68% in southern Ontario (Penfound and Vaz 2022), 80% along the St. Lawrence River in Quebec (Jean 2002), 85% in the northeast reaches of the Bay of Fundy (Reed and Smith 1972, in COSEWIC 2009), and 50% in the conterminous United States (Dahl 2006). Coastal marshes in the heart of the species' wintering range in Texas cover 52% less area than they did when Europeans first settled there (Mizell 1998). In Louisiana, 23–35% of coastal wetlands were lost between 1932 and 1990 (Barras *et al.* 2003), and these wetland losses are continuing, albeit at a slower rate (Couvillion *et al.* 2017).

The above trends can only be loosely linked to Yellow Rail habitat, as nearly none of the lost or degraded habitats were surveyed to determine if the species was present prior to anthropogenic impacts. However, in several cases, known or suspected Yellow Rail habitat has been destroyed, including an occupied marsh in southern Manitoba (Wilson 2005), over 50% of potential habitat along the St. Lawrence and Saguenay rivers (Robert *et al.* 1995, in COSEWIC 2009; Alvo and Robert 1999), and a large patch of breeding habitat at Holland Marsh, Ontario (Tozer 2007).

More recent habitat trends suggest that some loss of Yellow Rail habitat continues. In forested areas of Canada (i.e., excluding the Prairies), overall wetland extent was roughly stable from 1984 to 2017 (Wulder *et al.* 2018). However, the Boreal Plains ecozone, which contains significant numbers of nesting Yellow Rails, showed a loss of 0.31% per year of wetland cover. Wetlands in this region were also highly dynamic, regularly transitioning from wetland to non-wetland, which may produce good breeding habitat for Yellow Rails, while also making these wetlands susceptible to drainage or loss. In the Hudson Plain ecozone, wetlands showed a stable trend and were much less dynamic, tending to remain in a wetland state from year to year (Wulder *et al.* 2018), although it is uncertain whether the Yellow Rail breeds away from the coast in much of this ecozone. The Canada-wide analysis by Wulder *et al*. (2018) also found an increase in treed wetlands at the expense of non-treed wetlands, and as the former are not suitable for Yellow Rail, this effect may further contribute to a decline in habitat availability.

In the Prairies ecozone, the Prairie Habitat Monitoring Program estimated a 5% net loss of wetland habitat on the Canadian Prairies from 1985 to 2001 (Watmough and Schmoll 2007). Among the habitats lost, wetlands with grass and sedge cover, which are most important for the Yellow Rail, accounted for about 50% of total losses while comprising about 54% of wetland area, suggesting they were lost at rates proportional to their coverage. However, most observed wetland gains were dominated by wetland types unsuitable for the Yellow Rail (e.g., dugouts, ditches and dammed impoundments). Transition to annual cultivation accounted for 62% of wetland losses. A follow-up study in 2011, using the same transects, showed that these wetland losses continued, with a further 3.7% decline in grass and sedge wetlands, and a 2% loss in wetlands overall, over 10 years (Watmough *et al.* 2017). Recovery rates of shallow wetlands have lagged behind impact rates (Bartzen *et al.* 2010).

In parts of the Hudson Bay Lowlands, coastal marsh habitat has been destroyed or fragmented due to heavy grazing by large numbers of Snow Geese (Peterson *et al.* 2013), including sites where the Yellow Rail formerly nested at La Pérouse Bay and Wapusk National Park (Jehl 2004; Rockwell *et al.* 2009). Although Snow Goose numbers are now declining (Pearce *et al.* 2022), the species remains superabundant, and habitat degradation caused by its grazing appears to be ongoing (Mowbray *et al.* 2020).

In Saskatchewan, a conveyance channel was cut through a wetland complex used by large numbers of nesting Yellow Rails, and their numbers declined substantially over the next five years (Drake and Latremouille 2016). However, this decline was attributed to a natural drying trend, as similar water level reductions occurred in nearby control areas.

Across the continental United States, marine and estuarine intertidal wetlands like those used by the Yellow Rail in winter declined by 1.4% between 2004 and 2009 (Dahl 2011). Most eBird observations of Yellow Rails in winter (December to February) come from National Wildlife Refuges (eBird Basic Dataset 2021), suggesting that these areas may be protected from threats such as drainage and agriculture. However, projections suggest existing Gulf Coast marshes will continue to decline in extent in the coming decades, due to ongoing subsidence and sea-level rise (Couvillion *et al.* 2017; Moon *et al.* 2021).

In summary, both historical and recent trends in the quality and quantity of the habitats used by the Yellow Rail appear to be negative both on the breeding and wintering grounds, although it is unknown how habitat loss has affected the persistence of the Yellow Rail. As a species adapted to using ephemeral habitats, its nomadic tendencies may buffer it against local declines in habitat quality or quantity. However, declines in the overall availability of the specific habitats on which the Yellow Rail relies, which are already limited, may be problematic, especially as this species is not known to use restored wetlands. For example, in the oil sands region of Alberta, the Yellow Rail relies heavily on graminoid fens (Hedley *et al.* 2020), and fen restoration is considered a complex challenge, with only a few proof-of-concept projects completed to date (e.g., Vitt *et al.* 2016). Understanding whether the Yellow Rail will use reclaimed wetlands is a priority, in order to better understand whether habitat loss can be reversed.

Current and Projected Future Threats

The Yellow Rail is vulnerable to the cumulative effects of various threats. The threats are categorized below and in Appendix 1, following the IUCN-CMP (International Union for the Conservation of Nature – Conservation Measures Partnership) unified threats classification system (based on Salafsky *et al.* 2008). The evaluation assesses the impacts of each of the 11 main categories of threats and their subcategories, based on the scope (proportion of population exposed to the threat over the next 10-year period), severity (predicted population decline among those exposed to the threat, during the next 10 years or 3 generations, whichever is longer) and timing of each threat. The overall threat impact is calculated by taking into account the separate impacts of all threat categories and can be adjusted by the species experts participating in the evaluation.

The overall threat impact for the Yellow Rail is considered to be High - Medium, corresponding to an anticipated further decline of between 3% and 70% over the next ten years (see Appendix 1 for details). Threats are discussed below in order of decreasing severity of impact (greatest to least), ending with those for which the scope or severity is unknown. Those threats with negligible threat impact are noted in Appendix 1 but are not discussed here.

IUCN category 7, Natural System Modifications (Medium threat impact):

Description of threat:

The Yellow Rail is considered to be sensitive to natural system modifications due to its reliance on shallow wetlands. Within this category, dams and other water management changes likely pose a considerable threat, as even slight changes in water depth may reduce the suitability of habitat (see **Habitat Requirements**). In British Columbia, about 24% of Yellow Rail habitat in the Site C dam local assessment area is expected to be lost once the dam is operational (Site C Joint Review Panel 2014). A long-term drying trend in the Peace-Athabasca Delta has been attributed to the construction of the Bennett dam upstream (Beltaos 2014). Effects of this drying trend on the Yellow Rail, which breeds in the delta (Parks Canada 2017), are unknown.

The species is more likely to encounter modified hydrological regimes during migration and on its wintering grounds, where the habitats used are less remote and often actively managed. The identification of the Yellow Rail by some U.S. National Wildlife Refuges as a target for management (e.g., USFWS 2013) may lead to favourable habitat management practices. However, management practices that target waterfowl may negatively affect rails due to their different habitat requirements and migration timing (Goldade *et al.* 2002; Fournier *et al.* 2017).

Fire suppression could negatively affect habitat quality on both the breeding and wintering grounds due to shrub encroachment. In both seasons, Yellow Rail abundance has been positively linked to areas that were recently burned (breeding: Austin and Buhl 2013; winter: Morris *et al.* 2017; Soehren *et al.* 2018).

Other ecosystem modifications that affect the Yellow Rail are caused by the expansion of invasive or problematic species, which alter the vegetation structure at breeding sites. Overgrazing by Snow Geese has posed a major threat to Yellow Rail breeding habitat along the Hudson Bay and James Bay coasts over the past several decades. Snow Goose grazing caused a 46% decline in graminoid cover and a threefold increase in barren ground from 1976 to 2010, at a study site on the west coast of Hudson Bay (Peterson *et al.* 2013). The loss of graminoid cover removes a key habitat feature required by the Yellow Rail, rendering the habitat unsuitable. Snow Goose overgrazing near Churchill and La Pérouse Bay, Manitoba, was suggested as the root cause of Yellow Rail population declines there since the 1980s (Jehl 2004; Rockwell *et al.* 2009).

The invasive non-native form of European Common Reed (*Phragmites australis australis*) has colonized Yellow Rail habitat on Île aux Grues, Quebec, over the last 25 years (Marineau *et al.* 2002 in COSEWIC 2009; Dalpé-Charron 2006, in COSEWIC 2009; Rivard 2007, in COSEWIC 2009), and active management is needed to halt encroachment by Speckled Alder (*Alnus incana*) in breeding habitats in the Lake Saint-François National Wildlife Area in Quebec (Boivin *et al.* 2020). Other potentially problematic ecosystem modifications are caused by cattle grazing too close to breeding wetlands and the invasion of Purple Loosestrife (*Lythrum salicaria*). On the wintering grounds, invasive species such as Cogongrass (*Imperata cylindrica*) can out-compete native plants and may reduce habitat suitability in certain areas (Prince *et al.* 2018).

Scope: Large (31–70%)

Most individual Yellow Rails likely use habitats that experience unnatural hydrological regimes or altered vegetation conditions during part of the annual cycle. The Hudson Bay and James Bay coasts are an important breeding area for Yellow Rails, so degradation of coastal marshes there could affect a substantial proportion of the breeding population. Snow Goose populations have increased substantially over recent decades (Mowbray *et al.* 2020). However, at the microhabitat level, the degree of overlap between problematic Snow Goose foraging and Yellow Rail habitat may not be substantial (Artuso pers. comm. 2023), and declines in Snow Goose abundance since about 2007 may have reduced this threat (Pearce *et al.* 2022). Invasion by European Common Reed and alder appears to be a local problem, currently affecting only a small proportion of the total Yellow Rail population (Environment Canada 2013).

Severity: Moderate (11–30%)

Although the effects of natural system modifications are largely unstudied, declines due to this threat are unlikely to exceed 30% in the next ten years. Yellow Rails are known to move in response to local water conditions, which may allow them to respond to modified hydrological regimes. Grazing by Snow Geese in areas overlapping Yellow Rail breeding habitat can cause severe damage to sedges and grasses, while also increasing the amount of barren ground (Peterson *et al.* 2013), which would undoubtedly reduce the habitat's suitability for the Yellow Rail. However, the species' mobility may allow it to respond to habitat damage by moving to suitable habitat elsewhere, if available.

<u>IUCN category 2, Agriculture & Aquaculture (Low threat impact):</u>

Description of threat:

Drainage of wetlands for agricultural purposes has historically been the primary cause of habitat loss (see **Habitat Trends**). Recent research suggests that this practice—particularly in shallow wetlands to the point where they are no longer suitable for Yellow Rails—continues in parts of the Canadian Prairies (Watmough *et al.* 2017).

Scope: Small (1–10%)

Recent research estimated the rate of loss of grass and sedge wetlands on the Canadian Prairies to be about 3.4% between 2001 and 2011 (Watmough *et al.* 2017). Assuming a similar rate of loss in the future, as well as elsewhere in the breeding and wintering range, it is unlikely that over 10% of the population would be affected by wetland drainage within the next ten years.

Severity: Serious (31–70%)

The extent to which the Yellow Rail is potentially limited by habitat is unknown. This mobile species appears to be adapted to ephemeral habitats, and birds may simply move elsewhere when habitat is lost, although such movements are likely limited by the availability of alternative habitat and the birds' ability to respond. With limited information on the species' movement ecology and the demographic consequences of habitat loss, it is assumed that habitat loss likely has serious consequences, especially considering the relative rarity of suitable shallow wetland habitat for this species in most regions (McLeod 2019; Hedley *et al.* 2020).

<u>IUCN category 3, Energy Production & Mining (Low threat impact):</u>

Description of threat:

The primary known threat in this category is habitat loss from open-pit extraction in Alberta's oil sands region. During oil sands mining, organic material (vegetation and soils) is removed, and water is drained, leaving a large sandy pit that is mined for oil (Alberta Chamber of Resources 2004). The resulting barren landscape is unsuitable for the Yellow Rail. Habitats well beyond the edge of these mines may be altered through resulting changes in hydrology (Hedley *et al.* 2020). This is of concern in the McClelland Lake wetland complex, which is one of the most important breeding wetlands known for the Yellow Rail, likely hosting over 100 pairs (Hedley *et al.* 2020). Part of that wetland is slated for removal in the next few years, and the magnitude of the impact on the Yellow Rail will largely depend on whether the delicate hydrological balance is maintained in unmined portions of the wetland complex. Other types of mining, such as potash mining in Saskatchewan, may also lead to loss of breeding habitat (SNC-Lavalin Inc. 2018).

Another energy-related threat is collisions with wind turbines (AWWI 2020). Given the rapid expansion of wind energy in North America, turbine collisions have the potential to cause population-level declines in some migratory species (e.g., Frick *et al.* 2017).

Scope: Small (1–10%)

The scope of this threat is small, as open-pit mining is largely confined to northeastern Alberta and parts of Saskatchewan. Hedley *et al.* (2020) summarized the survey results for the region and estimated that about 17% of Yellow Rails there likely resided on oil sands leases. As the region was estimated to contain about 500– 5,000 pairs, this threat likely endangers 85–850 pairs, or a few percent of the Canadian population. The wind energy threat covers a broader geographic area, but the post-construction monitoring of wind turbines across Canada has documented just one Yellow Rail fatality among 3,931 bird carcasses, suggesting that collisions may be uncommon (Bird Studies Canada 2018). In the United States, rails and coots accounted for about 1.4% of avian turbine mortalities (AWWI 2020).

Severity: Extreme (71–100%)

In oil sands extraction operations, wetlands in the mine site footprint are lost. It is unknown whether sufficient habitat is available to allow some Yellow Rails to respond by moving elsewhere. Restoration of lost wetlands may be possible in the long term (Vitt et al. 2016), but will likely be insignificant in the next ten years. Collisions with wind turbines are usually fatal.

IUCN category 4, Transportation & Service Corridors (Low threat impact):

Description of threat:

Construction of roads through suitable habitat can destroy potential Yellow Rail nesting areas, as has occurred at Douglas Marsh, Manitoba, where a highway cuts through high-quality Yellow Rail breeding habitat (Wilson 2005). Important breeding habitat was similarly lost in recent decades with the construction of Highways 132 and 20 near Kamouraska, Rivière-du-Loup, and Les Basques, Quebec (Robert pers. comm. 2023). Road construction is likely a threat in the southern portion of the breeding range (e.g., the Prairies ecozone), and also on the wintering grounds. Vehicle collisions are not known to be a source of mortality.

Collisions with communications towers during migration present a pervasive threat, and Yellow Rails have occasionally been found dead in substantial numbers beneath communications towers (e.g., 34 individuals recovered in a single night in Kansas; Ball et al. 1995).

Scope: Small (1–10%)

Although many individuals probably migrate through areas where communication towers present some collision risk, a relatively small proportion of these birds are likely at risk of directly striking a tower.

Severity: Serious (31–70%)

Longcore et al. (2013) estimated that about 9% of the global Yellow Rail population may suffer mortality due to communication towers each year, which would make this the species most at risk among the 239 species examined. However, this estimate is sensitive to the assumed global population size, and as current population estimates are about twice as large as those considered by Longcore et al. (2013; see **POPULATION SIZES AND TRENDS - Abundance**), this likely overestimates mortality by at least a similar factor.

IUCN category 9, Pollution (Low threat impact):

Description of threat:

Like most migratory birds, Yellow Rails are exposed to a wide array of potential pollutants during their annual cycle. Agricultural pesticides are known to have various adverse effects on birds, resulting in farmland birds being among the fastest declining groups of birds (Stanton *et al.* 2018). Pesticides may impact the Yellow Rail either directly, or indirectly via their effects on its food supply (Eddleman 1988), across the southern part of its breeding range and likely during migration and in winter. Industrial effluents also pose a threat. In the oil sands region of Alberta, for example, oil extraction introduces pollutants such as mercury into the environment (Kelly *et al.* 2010). Elevated mercury levels have been found in the eggs of gulls and terns over 100 km downstream of oil extraction sites (Hebert 2019). Use of coastal marshes in winter may be another risk factor for mercury accumulation in the species (Ackerman *et al.* 2016). Although no studies have examined the effects of mercury on Yellow Rails specifically, California Clapper Rails (*Rallus crepitans*) with higher levels of mercury in their blood were found to have a poorer body condition (Ackerman *et al.* 2012). Use of coastal wetlands may occasionally expose Yellow Rails to oil spills during winter. Yellow Rail carcasses were not recovered after the Deepwater Horizon oil spill, although 33 individuals of other rallid species were recorded (Haney *et al.* 2014). In addition, the wintering areas along the Texas coast used by Yellow Rails contain some of the highest concentrations of microplastics in the world, although the effects of this pollutant on the fitness of birds remain unknown (Grace *et al. 2022*).

Scope: Large - Restricted (11–70%)

Given the species' migratory patterns and habitat preferences, most individuals are likely exposed to pollution at some point in their annual cycle.

Severity: Slight (1–10%)

The severity of this threat is uncertain, and largely contingent upon the amount of exposure experienced by an individual bird (Ackerman *et al.* 2012). Although much of the population may be exposed to pollution, it is likely that most individuals are not exposed to sufficiently high levels to experience negative outcomes. Extreme exposures, such as direct exposure to oil spills, are likely to have more severe outcomes, but are rare and most probably geographically restricted. Population declines due to this threat will probably not exceed 10% in ten years.

IUCN category 11, Climate Change & Severe Weather (Low threat impact):

Description of threat:

Climate change is expected to affect the Yellow Rail primarily through its impacts on habitat availability. Changes in precipitation patterns, permafrost thawing, or increased frequency of drought and warmer temperatures may shift and alter the species' wetland habitat, although the overall effects are difficult to predict. In particular, the Yellow Rail's mobility may allow it to respond to shifting habitat availability, provided that the total amount of habitat is adequate.

The species' use of salt marshes during winter may further buffer the Yellow Rail from changes in precipitation regimes, as water levels in these habitats are at least partially maintained by tides rather than rainfall (USFWS 2013). However, the extent of suitable wetlands along the Gulf Coast may decline in the coming decades due to sea level rise (Moon *et al.* 2021). The closely related Eastern Black Rail (*Laterallus jamaicensis jamaicensis*) is thought to be vulnerable to tidal flooding events along the U.S. Gulf Coast; high tide events could force individuals from the cover of dense vegetation and expose them to predators (USFWS 2019). Given their similar habitat use, the same could apply to wintering Yellow Rails. Increasing storm severity could also lead to higher rates of direct mortality during storms (USFWS 2019). In the Great Lakes region of Ontario, the Yellow Rail was assessed as being moderately vulnerable to climate change due to its specialized hydrological niche (Brinker *et al*. 2018).

Scope: Restricted - Small (1–30%)

Although climate change will likely affect the entire species' range eventually, the effect is expected to be relatively limited in the next ten years.

Severity: Moderate - Slight (1–30%)

Although severity is difficult to predict, and likely to vary across the range, it is very unlikely that declines will exceed 30% due to this threat in the next ten years. In addition, some climate-related changes could be beneficial to the Yellow Rail.

Number of Threat Locations

The number of Yellow Rail locations in Canada is much greater than ten. Overall, the most important threat to the species is wetland habitat loss and degradation due to industry, agriculture, water management, climate change and overgrazing by Snow Geese. As habitat loss tends to occur at a local scale (in the case of industry or agriculture) or at a regional scale (in the case of hydroelectric dams, etc.), the number of locations inhabited by this species is probably in the hundreds or more.

PROTECTION, STATUS AND RECOVERY ACTIVITIES

Legal Protection and Status

The Yellow Rail is listed as a species of Special Concern under the *Species at Risk Act* (2002). It was first designated Special Concern in 1999, with this status reassessed and confirmed in 2001, 2009, and 2023. It is also protected as a migratory game bird under the *Migratory Birds Convention Act, 1994* (Government of Canada 2017), but there are currently no open hunting seasons for the Yellow Rail in Canada. The Yellow Rail is on British Columbia's Red List and is listed as Special Concern in Ontario. In Quebec, it is designated as Threatened under the *Act Respecting Threatened or Vulnerable Species* (CQLR c E-12.01), and is afforded protection under the *Act Respecting the Conservation and Development of Wildlife* (CQLR c C-61.1). It listed as Special Concern under New Brunswick's *Species at Risk Act*.

The Yellow Rail is not listed under the *Endangered Species Act* in the United States but is designated a Migratory Nongame Bird of Management Concern (USFWS 2021). It is designated Special Concern, Threatened, or Endangered in several U.S. states (Table 3).

Table 3. Conservation status of the Yellow Rail in Canada and the United States, from the *General Status of Species in Canada* (Canadian Endangered Species Conservation Council 2022) and NatureServe (2022)

Jurisdiction	Status[1]	Legal Status[2]
Global	**G4**	
Canada	**N3N4B, NUM**	**Special Concern**
British Columbia	S1B	Red List
Alberta	SUB (Undetermined)	
Saskatchewan	S3B	
Manitoba	S3B	
Ontario	S3B	Special Concern
Quebec	S3B	Threatened
New Brunswick	S1? B	Special Concern
Prince Edward Island	SNA	

Jurisdiction	Status[1]	Legal Status[2]
Nova Scotia	SUB	
Newfoundland and Labrador	SNA	
Yukon	SNA	
Northwest Territories	S3	
Nunavut	S3B	
United States	**N3B, N4N**	**Migratory Nongame Bird of Management Concern**
Alabama	S2N	
Arkansas	SNA	
California	S1S2	Special Concern
District of Columbia	SHN	
Florida	S2S3N	
Georgia	SU	
Illinois	SXB, S2N	Endangered
Indiana	SNA	
Iowa	SNA	
Kansas	SNA	
Kentucky	SNA	
Louisiana	S3S4N	
Maine	SNRB	Special Concern
Massachusetts	S1N	
Michigan	S2	Threatened
Minnesota	S3B	Special Concern
Mississippi	S2N	
Missouri	SU	
Montana	S3B	
Nebraska	SNRN	
New Jersey	SUN	
New York	SNRN	
North Carolina	S2N	
North Dakota	S2	Threatened
Ohio	SX	
Oregon	S2B	
South Carolina	S3N	
South Dakota	SUB	
Texas	S3N	
Virginia	SNRN	
Wisconsin	S1B	Threatened

[1] G = Global; N (at start of rank) = National; S = Subnational; B = Breeding; N (at end of rank) = Non-breeding; M = Migrant. 1 = Critically Imperilled; 2 = Imperilled; 3 = Vulnerable; 4 = Apparently Secure; 5 = Secure; NA = Not Applicable; NR = Not Ranked; U = Unrankable (due to lack of information or conflicting information); ? = inexact numeric rank.

[2] Listing as endangered / threatened / special concern (or equivalent designations) at a jurisdictional scale.

Non-Legal Status and Ranks

Globally, NatureServe (2022) ranks the Yellow Rail as G4 (Apparently Secure). It is ranked nationally in Canada as N4B, NUM (Apparently Secure Breeder, Unranked Migrant), and in the United States as N3B, N4N (Vulnerable Breeder, Apparently Secure Non-breeder). Its subnational rankings range from S1 (Critically Imperiled) to S3 (Vulnerable) in the provinces and territories where it has been assessed (Table 3), and between S1 and S3 in several U.S. states (NatureServe 2022; Table 3).

Land Tenure and Ownership

The Yellow Rail occurs in many parks across Canada, although less than 10–20% of its known habitat is within protected areas. Several hundred individuals breed in the Edéhzhíe National Wildlife Area and Dehcho Protected Area in the Northwest Territories (McLeod *et al.* 2021). It is considered an uncommon breeder in Wood Buffalo National Park (Parks Canada 2017). Significant numbers breed in the Douglas Marsh Important Bird Area in Manitoba (Lindgren 2001). Protected areas on the Hudson and James bay coasts include Wapusk National Park in Manitoba; Polar Bear Provincial Park, Hannah Bay Migratory Bird Sanctuary (MBS) and Moose River MBS in Ontario; and Boatswain Bay MBS and the Ministikawatin Peninsula Biodiversity Reserve (including Cabbage Willow Bay) in Quebec (Robert *et al.* 2004). It is estimated that less than 10% of occupied wetlands in the remaining range west of Quebec are protected (Wiken *et al.* 2004 in COSEWIC 2009). About half of known sites in Quebec are protected, mainly as national wildlife areas (Robert *et al.* 1995 in COSEWIC 2009). Sites in New Brunswick where this species has most reliably been found are protected as national wildlife areas and provincially significant wetlands (e.g., Portobello Creek, Tintamarre, and Grand Lake Meadows).

Although much of the remaining habitat is partly protected by federal, provincial, and municipal policies and regulations concerning development in wetlands (reviewed in Rubec and Hanson 2009), many sites remain unprotected.

A substantial proportion of the global population winters in U.S. national wildlife refuges along the Gulf Coast (Butler *et al.* 2014), which likely affords the species protection as well as consideration in management planning (USFWS 2013).

Recovery Activities

The management plan for the Yellow Rail summarizes the actions to be undertaken to help maintain Yellow Rail numbers (Environment Canada 2013). These include acquisition of properties by the Nature Conservancy of Canada in Quebec, and the designation of important sites such as Douglas Marsh, Île aux Grues, Baie de Gaspé, and Barachois de Malbaie as Important Bird Areas. Actions that may increase numbers include removal of invasive species to prevent shrub encroachment in breeding wetlands, such as the removal of Speckled Alder from the Lake Saint-François National Wildlife Area in Quebec (Brisson *et al.* 2006; Boivin *et al.* 2020).

In general, recovery activities focused on the Yellow Rail to date have been insufficient to meaningfully influence its status in Canada, when considered in light of the species' vast distribution.

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COLLECTIONS EXAMINED

No collections were examined for the preparation of this report.

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Richard William Hedley grew up in Vancouver, British Columbia, and received his B.Sc. degree from the University of Victoria in 2010. He completed his Ph.D. in 2016 at the University of California, Los Angeles, studying the acoustic communication system of Cassin's Vireo (*Vireo cassinii)*. He has worked on population monitoring of birds since 2010, including surveying and monitoring Yellow Rail populations in Saskatchewan and Alberta, and recently conducted postdoctoral research at the University of Alberta on the acoustic monitoring of the health of natural ecosystems. He is currently a Species at Risk Biologist in the Fish and Wildlife Stewardship Branch of the Alberta Department of Environment and Protected Areas.

Appendix 1. Threats Calculator assessment for the Yellow Rail

Species or Ecosystem Scientific Name	Yellow Rail			
Element ID			**Elcode**	
Date (Ctrl + ";" for today's date):	2023-02-28			
Assessor(s):	Jennifer Heron (facilitator), Richard Hedley (report writer), Richard Elliot (Birds SSC co-chair), Christian Artuso, Erin Bayne, Louise Blight, Mike Burrell, Pete Davidson, Kiel Drake, Christian Friis, Colin Jones, Eve Lamontagne, Logan McLeod, Kelly Morris, Brent Patterson, Ken Popper, Michel Robert, Jean-Pierre Savard, Sarah Vinge-Mazer, Liana Zanette, Paul Knaga, Chris Butler, Dave Moore, John Brett			
References:	Draft status report and draft threats calculator for the Yellow Rail			
	Overall, Threat Impact Calculation Help:		**Level 1 Threat Impact Counts**	
	Threat Impact		**high range**	**low range**
	A	Very High	0	0
	B	High	0	0
	C	Medium	1	1
	D	Low	5	5
	Calculated Overall Threat Impact:		High	High
Assigned Overall Threat Impact:	**BC = High - Medium**			
Impact Adjustment Reasons:	Overall threat impact adjusted downwards by threat experts, due to uncertainty in estimating population numbers, lack of quantitative information for several threats, and potential spatio-temporal overlap of level 1 threats.			
Overall, Threat Comments	Generation time for the Yellow Rail is approximately 2.13 years (Bird *et al.* 2020), so the timeframe for considering severity and timing is 10 years. Threats to the Canadian population of the Yellow Rail are considered on the breeding grounds in Canada, during migration, and on its wintering grounds in the southeastern United States.			

Threat		**Impact (calculated)**		**Scope (next 10 Yrs)**	**Severity (10 Yrs or 3 Gen.)**	**Timing**	**Comments**
1	Residential & commercial development		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	
1.1	Housing & urban areas		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	On rare occasions, Yellow Rails may inhabit some urban wetland areas, and may occasionally strike buildings, but not at high or unusual rates.
1.2	Commercial & industrial areas						Commercial and industrial areas do not support appreciable numbers of Yellow Rail.
1.3	Tourism & recreation areas		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Tourism and recreation areas do not overlap with Yellow Rail breeding habitats, although tourism development could potentially threaten some coastal U.S. winter habitat.
2	Agriculture & aquaculture	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
2.1	Annual & perennial non-timber crops	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	Historical loss of wetlands used for nesting due to conversion to agriculture continues in the Prairies, and conversion of wetland habitat to agriculture is likely a continuing threat in some migration and winter habitat.
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching		Negligible	Negligible (<1%)	Moderate (11-30%)	High (Continuing)	Threat from ranching relates to trampling only, as livestock may occasionally trample nests and nesting habitat in the Prairies.
2.4	Marine & freshwater aquaculture						
3	Energy production & mining	D	Low	Small (1-10%)	Extreme (71-100%)	High (Continuing)	
3.1	Oil & gas drilling	D	Low	Small (1-10%)	Extreme (71-100%)	High (Continuing)	Some high-quality breeding habitat is slated for oil extraction in the Alberta oil sands region, with much less than 10% of total population likely affected.
3.2	Mining & quarrying		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	Potash mining threatens a small number of nesting sites in Saskatchewan.
3.3	Renewable energy	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	Mortality from striking wind turbines has been recorded, and construction of wind turbines is rapidly increasing in migration pathways.
4	Transportation & service corridors	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	
4.1	Roads & railroads		Negligible	Negligible (<1%)	Extreme (71-100%)	High (Continuing)	Road development through wetland habitat has affected Yellow Rail habitat in the past; little ongoing effect.
4.2	Utility & service lines	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	Collision with communication towers is an important ongoing mortality risk faced by many Yellow Rails during migration.
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use						
5.1	Hunting & collecting terrestrial animals						Although the Yellow Rail is classified as a migratory game bird in Canada and the United States, there are no open hunting seasons in either country.
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
5.4	Fishing & harvesting aquatic resources						
6	Human intrusions & disturbance		Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)	
6.1	Recreational activities		Negligible	Negligible (<1%)	Slight (1-10%)	High (Continuing)	Recreational activities are not a major threat to the Yellow Rail, except for extremely localized concerns about birdwatchers possibly trampling nests at certain sites (e.g., Douglas Marsh, Manitoba).
6.2	War, civil unrest & military exercises						
6.3	Work & other activities		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Biologists who undertake research in Yellow Rail habitat generally restrict their activities to avoid disturbing birds, trampling nests or damaging habitat, so negative impacts are likely very rare.
7	Natural system modifications	C	Medium	Large (31-70%)	Moderate (11-30%)	High (Continuing)	
7.1	Fire & fire suppression		Not a Threat	Restricted (11-30%)	Neutral or Potential Benefit	High (Continuing)	Most breeding areas are likely subject to a natural fire regime. Some wintering areas are regularly subjected to prescribed burning, which may have positive effects by supressing shrub growth.
7.2	Dams & water management/use	C	Medium	Large (31-70%)	Moderate (11-30%)	High (Continuing)	Human-induced changes to hydrology (e.g., through dams, waterfowl habitat management, flood control) are a widespread concern, but magnitude of the threat is uncertain. Most breeding areas are likely unaffected by human water-use decisions, but impacts, both negative and positive, are more likely during migration and winter, and water management in some wintering habits, such as rice fields, may be beneficial.
7.3	Other ecosystem modifications	CD	Medium - Low	Restricted (11-30%)	Serious - Moderate (11-70%)	High (Continuing)	Several invasive or problematic native species have indirectly altered vegetation structure at nesting or wintering sites. These include European Common Reed, Speckled Alder, and Purple Loosestrife in Quebec, Cogongrass along the U.S. Gulf Coast, Snow Goose in Manitoba, and cattle in various places. Shrub encroachment due to fire suppression may also affect some habitats.
8	Invasive & other problematic species & genes		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
8.1	Invasive non-native/alien species/diseases		Negligible	Negligible (<1%)	Serious (31-70%)	High (Continuing)	Domestic cats have been documented preying on Yellow Rails, although cats likely rarely occur in Yellow Rail habitat, and are scored here. Invasive plants, and possibly grazing by domestic cattle, have altered the vegetation structure of Yellow Rail habitat, and are considered an indirect effect under **7.3 Other ecosystem modifications**.
8.2	Problematic native species/diseases						Overgrazing by Snow Goose may negatively alter vegetation structure of some nesting habitat but is considered an indirect effect under **7.3 Other ecosystem modifications**.
8.3	Introduced genetic material						
8.4	Problematic species/diseases of unknown origin						There is some evidence that avian botulism may infrequently affect this species when outbreaks occur.
8.5	Viral/prion-induced diseases						Not known to pose a threat.
8.6	Diseases of unknown cause						Not known to pose a threat.
9	Pollution	D	Low	Large - Restricted (11-70%)	Slight (1-10%)	High (Continuing)	
9.1	Domestic & urban waste water		Negligible	Negligible (<1%)	Negligible (<1%)	High (Continuing)	Domestic wastewater may affect water quality of some wintering habitats.
9.2	Industrial & military effluents	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Oil sands mining in Alberta likely exposes some Yellow Rails to industrial pollutants known to have negative effects on birds.
9.3	Agricultural & forestry effluents	D	Low	Large - Restricted (11-70%)	Slight (1-10%)	High (Continuing)	Pesticides applied to crops have many negative lethal and sublethal effects on birds and on their food supply in agricultural areas. Specific effects on the Yellow Rail have not been studied, but most individuals likely rely on agricultural areas during breeding, in migration, and/or in winter.
9.4	Garbage & solid waste						Not known to pose a threat, and effect of microplastics in wintering habitat is unknown and likely negligible.
9.5	Air-borne pollutants						Airborne pollutants are not known to pose a threat, and much of the breeding range is likely relatively free of airborne pollutants.

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
9.6	Excess energy						Not known to pose a threat.
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather	D	Low	Small (1-10%)	Moderate - Slight (1-30%)	High (Continuing)	
11.1	Habitat shifting & alteration	D	Low	Small (1-10%)	Slight (1-10%)	High (Continuing)	Climate change is likely to affect the hydrology of many wetlands used by the species, including influencing water depth, which is a key determinant of Yellow Rail habitat. Scope and severity are likely small in the next ten years, potentially increasing thereafter.
11.2	Droughts	D	Low	Small (1-10%)	Moderate - Slight (1-30%)	High (Continuing)	Droughts are likely to reduce the availability of the shallow wetlands used by this species, although the extent of drought is likely to be small relative to the species' range, within the next ten years.
11.3	Temperature extremes	D	Low	Small (1-10%)	Moderate - Slight (1-30%)	High (Continuing)	Temperature extremes are likely to increase, and extreme heat waves may detrimentally affect birds. Direct effects on the Yellow Rail may be limited due to its reliance on wetlands.
11.4	Storms & flooding		Not a Threat	Pervasive (71-100%)	Neutral or Potential Benefit	High (Continuing)	Storms and flooding can create ephemeral shallow habitat, and in many parts of the range, the highest numbers of breeding birds occur during wet years. Increased storms and flooding are unlikely to have negative effects on the species as a whole.
11.5	Other impacts		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	Incidence of wildfire in the western parts of its range and elsewhere due to warmer and drier conditions, though most change likely to occur beyond ten years.

Classification of Threats adopted from IUCN-CMP, Salafsky et al. (2008).