# COSEWIC
# Assessment and Status Report

on the

# Lesser Yellowlegs
*Tringa flavipes*

**in Canada**

**THREATENED**
**2020**

**COSEWIC**
Committee on the Status
of Endangered Wildlife
in Canada

**COSEPAC**
Comité sur la situation
des espèces en péril
au Canada

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Lesser Yellowlegs — Provided by the author.


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# COSEWIC
# Assessment Summary

**Assessment Summary – November 2020**

**Common name**
Lesser Yellowlegs

**Scientific name**
*Tringa flavipes*

**Status**
Threatened

**Reason for designation**
This medium-sized shorebird has 80% of its breeding range in Canada's boreal region, migrates through the United States and Caribbean, and winters mostly in South America. It has experienced substantial long- and short-term declines, most recently estimated at 25% over three generations (12 years) based on the Breeding Bird Survey, and greater than 50% over 10 years based on International Shorebird Surveys. Declines are expected to continue. Key concerns include the loss of wetland and intertidal habitat used on migration and in winter, and hunting for sport and subsistence, which has been reduced in some areas but likely remains the most significant threat. Additionally, emerging threats from climate change include increased risk of drought in breeding areas, coastal flooding, and greater severity of hurricanes during fall migration.

**Occurrence**
British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland and Labrador, New Brunswick, Prince Edward Island, Nova Scotia, Yukon, Northwest Territories, and Nunavut

**Status history**
Designated Threatened in November 2020.

# COSEWIC
# Executive Summary

## Lesser Yellowlegs
*Tringa flavipes*

### Wildlife Species Description and Significance

Lesser Yellowlegs is a small, slender shorebird with greyish plumage, a long neck, a straight black bill that is roughly the same length as its head, and long, bright-yellow legs. This migrant travels up to 30,000 km in a round trip between its breeding and wintering grounds. Approximately 80% of Lesser Yellowlegs breed in Canada.

### Distribution

Lesser Yellowlegs breeds primarily in the boreal forest of Canada and Alaska, including all provinces and territories except the Maritimes. It winters in coastal areas from the southern United States through South America, with concentrations on the northern coast of South America and in the Pampas region of northern Argentina, Uruguay, and southern Brazil.

### Habitat

Lesser Yellowlegs nests on dry ground near peatlands, marshes, ponds, and other wetlands in the boreal forest and taiga. In winter and during migration, the species frequents coastal salt marshes, estuaries and ponds, as well as lakes, other freshwater wetlands, and anthropogenic wetlands such as flooded rice fields and sewage lagoons.

### Biology

Lesser Yellowlegs can begin breeding at one year old, and is estimated to have a generation length of 4 years. Females typically lay a single clutch of four eggs in mid-May, and may lay a second clutch if the first is lost to predation. Incubation lasts approximately 22 days; the young leave the nest shortly after hatching. Lesser Yellowlegs is monogamous and only defends a small area around the nest or brood. Adults may travel many kilometres from the nest to the wetlands where they forage, so home range may be as large as several dozen square kilometres.

## Population Sizes and Trends

The North American population of Lesser Yellowlegs as of 2020 is estimated to be at least 527,000 mature individuals, with 80% (422,000) breeding in Canada. Data from the North American Breeding Bird Survey (BBS) estimate an average annual trend of -2.40% in Canada over the most recent three generations (2007 to 2019), corresponding to a cumulative loss of 25%. From 1970 to 2019, the average annual BBS trend is -2.36%, amounting to a total decline of 69%. This is comparable to the significant 2.75% annual (69% cumulative) decline shown by shorebird migration monitoring data in North America between 1974 and 2016; over the most recent decade (2006 to 2016; slightly less than three generations) the decline based on these surveys accelerated to 7.28% annually, amounting to 53%. This estimate includes the Alaskan population, which BBS results indicate is declining more rapidly than the Canadian population. Periodic surveys at migratory stopovers in the Caribbean and at key wintering regions in South America also indicate steep rates of decline within the past three generations.

## Threats and Limiting Factors

Hunting of Lesser Yellowlegs during migration and on wintering grounds in the Caribbean and South America appears to be the greatest threat to the species. Ongoing habitat loss is also a concern, especially with respect to agricultural expansion and shoreline development in South America. Various impacts related to climate change remain poorly understood but may be increasing in importance. Other threats which may contribute to ongoing declines are energy production and mining, increasing abundance of predators, and various forms of pollution.

## Protection, Status and Ranks

In Canada, Lesser Yellowlegs and its nests and eggs are protected under the *Migratory Birds Convention Act, 1994*. The species was assessed as Threatened by COSEWIC in November 2020. NatureServe considers Lesser Yellowlegs to be Secure or Apparently Secure in Canada, although it is ranked Vulnerable in five provinces and territories, and Imperilled to Apparently Secure in the Northwest Territories. The Western Hemisphere Shorebird Reserve Network (WHSRN) aims to designate and protect migratory stopover sites of significance at regional to hemispheric scales, but offers no legal protection. Quill Lakes in Saskatchewan is the only Canadian WHSRN site with globally significant numbers of Lesser Yellowlegs, but habitat there has been severely degraded as a consequence of unregulated and unlicensed drainage of wetlands.

# TECHNICAL SUMMARY

*Tringa flavipes*

Lesser Yellowlegs

Petit chevalier

Range of occurrence in Canada: British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, Newfoundland and Labrador, New Brunswick, Prince Edward Island, Nova Scotia, Yukon, Northwest Territories, and Nunavut

**Demographic Information:**

| | |
|---|---|
| Generation time (average age of parents in the population) | Approximately 4 years, based on IUCN estimate (Bird *et al.* 2020) |
| Is there an [observed, inferred, or projected] continuing decline in number of mature individuals? | Yes, observed through Breeding Bird Survey (BBS) data and International Shorebird Survey (ISS) migration monitoring |
| Estimated percent of continuing decline in total number of mature individuals within 5 years [or 2 generations] | At least 18% over two generations (2011-2019), inferred from the average annual BBS decline in Canada, and steeper declines for North America overall based on ISS results |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last 10 years [or 3 generations] | 25% over three generations (2006-2018) in Canada inferred from BBS trends, or potentially more, considering 53% decline over 10 years (2006-2016) in North America based on ISS analysis |
| [Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations] | 3-70% decline projected over three generations (2020-2032) based on assessment of overall medium to high threat impact |
| [Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any 10 year [or 3 generation] period, including both past and future | Approximately 20-60% decline inferred and projected over three generations |
| Are the causes of the decline clearly reversible? | Partly; impacts of hunting are reversible, but some aspects of habitat loss are not |
| Are the causes of the decline understood? | Yes, in part |
| Are the causes of the decline ceased? | No, known threats are ongoing |
| Are there extreme fluctuations in number of mature individuals | No |

**Extent and Occupancy Information:**

| | |
|---|---|
| Estimated extent of occurrence (EOO) | 6,996,722 $km^2$, based on a minimum convex polygon around the breeding range |
| Index of area of occupancy (IAO), reported as 2x2 km grid value | Likely >20,000 $km^2$, based on population size and breeding density |

| | |
|---|---|
| Is the population “severely fragmented”, i.e., is >50% of its total area of occupancy in habitat patches that are both (a) smaller than 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<br>b. No |
| Number of “locations” (use plausible range to reflect uncertainty if appropriate) | Unknown, but certainly >10, based on hunting and habitat loss occurring widely |
| Is there an [observed, inferred, or projected] continuing decline in extent of occurrence? | No |
| Is there an [observed, inferred, or projected] continuing decline in area of occupancy? | Yes, inferred continuing decline, based on long-term population decline |
| Is there an [observed, inferred, or projected] continuing decline in number of subpopulations? | Not applicable, as only one subpopulation is recognized in Canada |
| Is there an [observed, inferred, or projected] continuing decline in number of “locations”? | Unknown |
| Is there an [observed, inferred, or projected] continuing decline in [area, extent and/or quality] of habitat? | Yes, observed decline in area and quality of wintering and migratory stopover habitat in particular |
| Are there extreme fluctuations in number of subpopulations? | No, there is no known subpopulation structure in Canada |
| 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 (by subpopulation)**

| | |
|---|---|
| Total<br>(no subpopulations recognized) | Between 422,000 and 7.6 million, but more likely toward the lower end of that range |

**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:**

| | |
|---|---|
| Was a threats calculator completed for this species? | Yes (see Appendix 1); overall threat impact Medium to High |

| |
|---|
| Key threats were identified as:<br>i. IUCN 5.1 (Hunting and collecting terrestrial animals) – sport and subsistence hunting in the Caribbean and northern South America (low to medium impact threat)<br>ii. IUCN 2.1 (Annual and perennial non-timber crops) – primarily further conversion of wetlands to agriculture along migratory routes and on wintering grounds (low impact threat)<br>iii. IUCN 3 (Energy production and mining) – loss of habitat to oil and gas drilling (IUCN 3.1), especially in western Canada, and to mining and quarrying (IUCN 3.2) in various parts of its range (low impact threat)<br>iv. IUCN 7.3 (Other ecosystem modifications) – reduced availability of intertidal habitat due to shoreline hardening and mangrove planting, primarily in South America (low impact threat)<br>v. IUCN 8.2 (Problematic native species/diseases) – increasing populations of terrestrial predators in the breeding range, and of raptors along migration routes and on wintering grounds (low impact threat)<br>vi. IUCN 9 (Pollution) – potential exposure to various contaminants, including oil spills, mercury, neonicotinoids, and other pesticides (low impact threat)<br>vii. IUCN 11 (Climate change) – flooding of coastal habitat, increased frequency and severity of hurricanes affecting fall migrants, and potential effects of drought and increasing temperatures (low impact threat) |
| What additional limiting factors are relevant?<br>As a medium- to long-distance migrant, Lesser Yellowlegs is exposed to multiple threats throughout its life cycle. It has limited reproductive output, given a maximum clutch of four eggs, and may be vulnerable to environmental changes that impair physical condition or reduce reproductive fitness. |

**Rescue Effect (from outside Canada):**

| | |
|---|---|
| Status of outside population(s) most likely to provide immigrants to Canada. | Declining in Alaska at -2.84%/year (1970-2018), accelerating over the past three generations (2006-2018) to -6.22%/year |
| Is immigration known or possible? | Possible, given proximity of Alaskan breeding range |
| Would immigrants be adapted to survive in Canada? | Yes |
| Is there sufficient habitat for immigrants in Canada? | Yes |
| Are conditions deteriorating in Canada? | Yes, some decline in area and quality of breeding habitat |
| Are conditions for the source (i.e., outside) population deteriorating? | Possibly |
| Is the Canadian population considered to be a sink? | No |
| Is rescue from outside populations likely? | Possible but unlikely, as the source population is declining at a faster rate than the Canadian population |

**Data Sensitivity:**

| | |
|---|---|
| Is this a data sensitive species? | No |

**Status History:**

| |
|---|
| COSEWIC Status History<br>Designated Threatened in November 2020. |

**Status and Reasons for Designation**

| **Status**<br>Threatened | **Alpha-numeric codes**<br>A2bcd+4bcd |
|---|---|
| **Reasons for designation**<br>This medium-sized shorebird has 80% of its breeding range in Canada's boreal region, migrates through the United States and Caribbean, and winters mostly in South America. It has experienced substantial long- and short-term declines, most recently estimated at 25% over three generations (12 years) based on the Breeding Bird Survey, and greater than 50% over 10 years based on International Shorebird Surveys. Declines are expected to continue. Key concerns include the loss of wetland and intertidal habitat used on migration and in winter, and hunting for sport and subsistence, which has been reduced in some areas but likely remains the most significant threat. Additionally, emerging threats from climate change include increased risk of drought in breeding areas, coastal flooding, and greater severity of hurricanes during fall migration. | |

**Applicability of Criteria**

| |
|---|
| A: Decline in total number of mature individuals<br>Meets Threatened A2bcd + 4bcd. Inferred decline in number of mature individuals of at least 25% over the past three generations based on Breeding Bird Survey data, but likely greater given International Shorebird Survey trends, and projected to continue based on an assessed overall medium to high threat impact. |
| B: Small range and decline or fluctuation<br>Not applicable. EOO of 6,996,722 $km^2$ and IAO of >20,000 $km^2$ exceed thresholds. |
| C: Small and declining number of mature individuals<br>Not applicable. Number of mature individuals is estimated to be at least 422,000, exceeding thresholds. |
| D: Very small or restricted population<br>Not applicable. Estimate of at least 422,000 mature individuals exceeds thresholds for D1, and population is not vulnerable to rapid and substantial decline. |
| E: Quantitative analysis<br>Not applicable. Analysis not conducted. |

## 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 (2020)

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

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

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

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

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.

# COSEWIC Status Report

on the

# Lesser Yellowlegs

*Tringa flavipes*

**in Canada**

2020

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## WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

### Name and Classification

Order: Charadriiformes
Family: Scolopacidae
Scientific name: *Tringa flavipes*
English name: Lesser Yellowlegs
French name: Petit chevalier
Spanish names: Patamarilla Menor, Pitotoy Chico

Lesser Yellowlegs is one of 13 species in the genus *Tringa*, five of which breed in North America (Pereira and Baker 2005; Gibson and Baker 2012). Although Greater Yellowlegs (*Tringa melanoleuca*) appears very similar, molecular and phylogenetic studies suggest that Lesser Yellowlegs is more closely related to Willet (*Tringa semipalmata*) (Pereira and Baker 2005; Gibson and Baker 2012).

### Morphological Description

Lesser Yellowlegs is a slender, greyish shorebird with a long neck, fairly straight black bill that is roughly the same length as its head, and long bright-yellow legs (Tibbitts and Moskoff 2014). The non-breeding plumage is a more washed-out grey-brown. The wings are dark without any barring; the rump and tail are mostly white. During flight, the yellow legs extend well beyond the tail. A white eye ring is always present, but more noticeable in winter. In fall and winter, juveniles can be separated from adults by the dark-brown edges of their tertial feathers; sexes are not visually separable at any age (Tibbitts and Moskoff 2014). Lesser Yellowlegs is 23-25 cm long and weighs 67-94 g, slightly smaller than an American Robin (*Turdus migratorius*).

### Population Spatial Structure and Variability

Little is known about population structure of Lesser Yellowlegs. A recent study of breeding individuals tagged with GPS satellite transmitters in Alaska and Canada found that Lesser Yellowlegs exhibits some degree of breeding site fidelity (McDuffie unpubl. data). To date, no subpopulations have been described, although preliminary results suggest that individuals breeding near James Bay overwinter mainly in the Caribbean and northern South America, while those breeding in Alaska overwinter mainly in Argentina. Stable isotope analysis of Lesser Yellowlegs sampled in Barbados also indicates that most individuals there are from the James Bay area (Reed *et al*. 2018).

### Designatable Units

There are currently no morphometric, genetic, or other data to support subdividing Lesser Yellowlegs into more than one designatable unit (DU) in Canada (Prater *et al.* 1997; Tibbitts and Moskoff 2014).

## Special Significance of the Species

In Canada, Lesser Yellowlegs is most frequently seen during migration, and is popular with birdwatchers and photographers. It is considered a priority species for conservation at the national level (Hope *et al*. 2019), as well as in many Bird Conservation Regions in Canada (Government of Canada 2019). The majority of Lesser Yellowlegs breed in Canada, with the remainder from Alaska presumably all passing through Canada on migration.

Lesser Yellowlegs was hunted for the meat market in the United States from European colonization until the early 1900s, particularly along the Atlantic Coast (Tibbitts and Moskoff 2014). The species is still hunted in the Caribbean during migration, as well as on some of the wintering grounds in South America, for sport and for its meat (Wege *et al.* 2014).

There are indications that the species is currently hunted at least opportunistically by members of the Cree Nation along the lower James Bay Coast during the spring goose hunt (Sutherland pers. comm. 2019). There is strong concern in the Gwich'in Settlement Area regarding observed declines of shorebirds in general (Cooper pers. comm. 2020). Additional Aboriginal Traditional Knowledge was not available. However, Lesser Yellowlegs is part of an ecosystem that is important to Indigenous people who recognize the interconnectedness of all species.

# DISTRIBUTION

## Global Range

Lesser Yellowlegs generally breeds in the northern boreal forest of North America from Alaska to western Labrador (Figure 1). It winters from the southern United States through much of Central and South America (Tibbitts and Moskoff 2014). It is particularly abundant in winter on the northern coast of South America, especially in Suriname (Morrison and Ross 1989; Blanco *et al.* 2008 *in* Clay *et al.* 2012), as well as the Pampas ecoregion of Argentina, Uruguay, and Brazil, and along the Gulf of Mexico and Florida in the United States (Clay *et al.* 2012; Fink *et al.* 2020; McDuffie unpubl. data; Figure 1). The species is also reported as a regular vagrant in Hawaii, Europe, and the British Isles (Clay *et al.* 2012; NatureServe 2018).

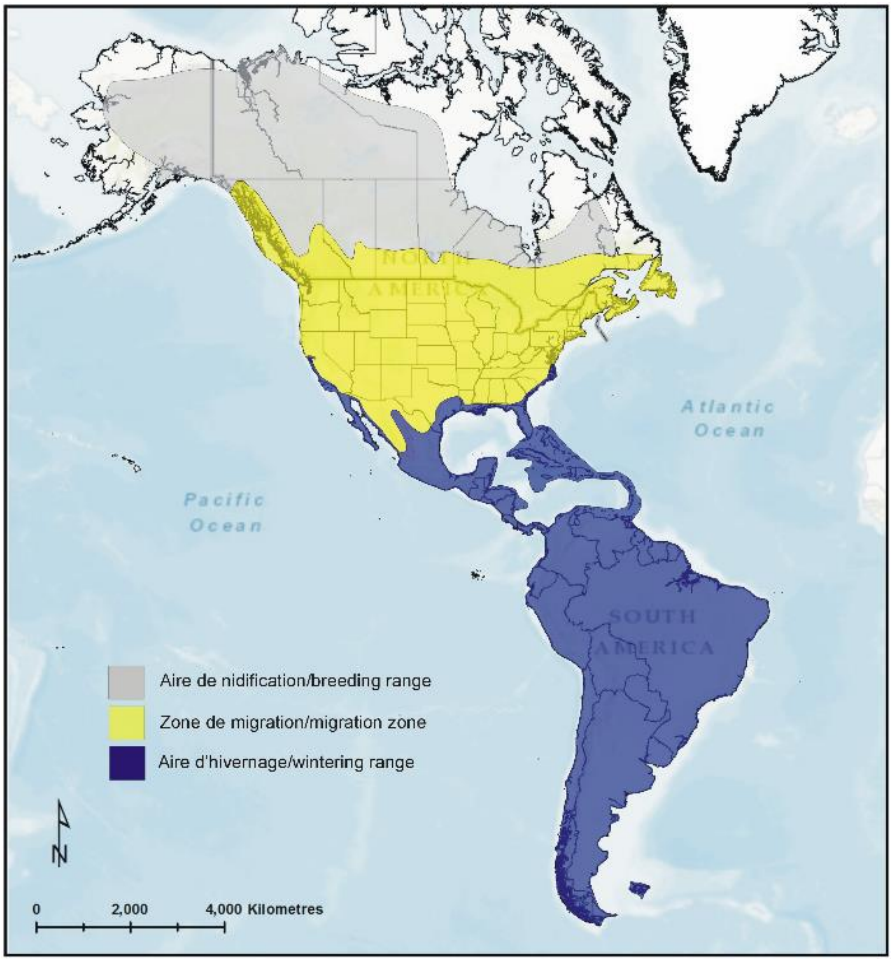


Figure 1. Breeding, migration, and wintering range of Lesser Yellowlegs (NatureServe 2018).

## Canadian Range

The breeding range of Lesser Yellowlegs in Canada extends through most of the boreal forest from northern Yukon to western Labrador (Figure 2). Donaldson *et al.* (2000) estimated that roughly 80% of the breeding range lies in Canada, with the remainder in Alaska. During migration, Lesser Yellowlegs passes through all provinces.

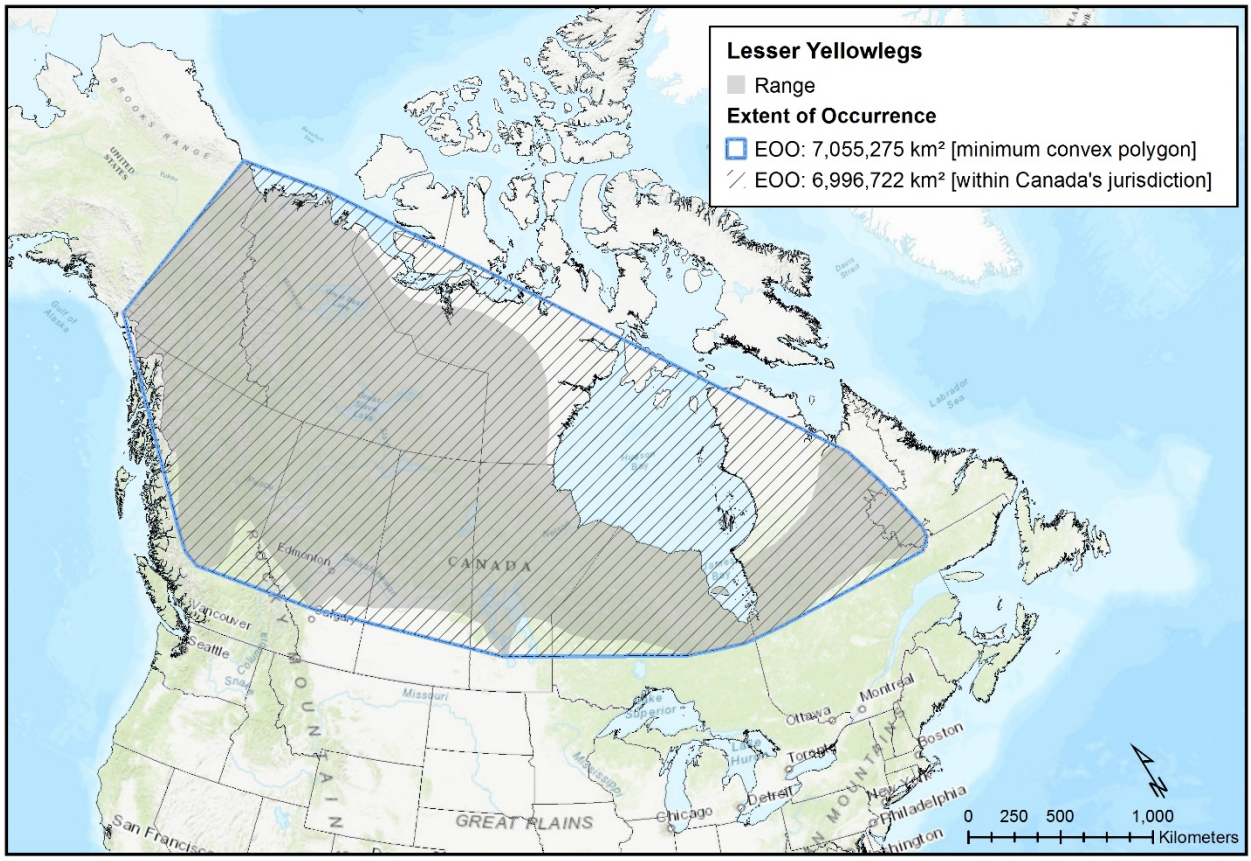


Figure 2. Canadian breeding range and estimate of extent of occurrence of Lesser Yellowlegs. Range estimate based on Sinclair *et al.* (2003); Cadman *et al.* (2007); FAN (2007); eBird (2012); Davidson *et al.* (2015); Artuso (2018); Bird Studies Canada (2018); (Map generated by the COSEWIC Secretariat).

## Extent of Occurrence and Area of Occupancy

The extent of occurrence (EOO) of Lesser Yellowlegs in Canada is approximately 6,997,000 km², based on a minimum convex polygon encompassing the breeding range as of 2019 (Figure 2). Its index of area of occupancy (IAO) is unknown, and difficult to calculate using a grid of 2 x 2 km squares. However, considering an average nesting density of 11 pairs/km$^2$ in Alaska, where its abundance is high (Spindler and Kessel 1980), and an estimated population of >200,000 breeding pairs in Canada, the IAO would be at least 20,000 km², given that average density is likely less than in Alaska.

## Search Effort

In Canada, surveys of Lesser Yellowlegs have largely been conducted during migration by teams of volunteers organized mostly by Environment and Climate Change Canada (ECCC), including the Atlantic Canada Shorebird Survey (ACSS) and Ontario Shorebird Survey (OSS) schemes, as well as along the St. Lawrence River corridor (Aubry and Cotter 2007) and the Great Lakes region, Prairies, and in the Arctic under the Program for Regional and International Shorebird Monitoring (PRISM). The species is also

monitored by the James Bay Shorebird Project, a multi-agency collaborative project coordinated by ECCC's Canadian Wildlife Service (CWS), which has been monitoring staging migrant shorebirds on the southwest James Bay coast since 2009. A breeding season survey of Lesser Yellowlegs was undertaken by CWS around Yellowknife in 2000 and 2017 (Rausch unpubl. data). CWS has also been active in monitoring wintering shorebirds in South America since the 1980s, most notably an exhaustive aerial inventory of 28,000 km of coastline in the late 1980s (Morrison and Ross 1989), partially repeated on the north coast of South America in the 2000s (Morrison *et al.* 2012).

Information on distribution and abundance of Lesser Yellowlegs is incomplete (Elliott *et al.* 2010; Tibbitts and Moskoff 2014). CWS and the U.S. Fish and Wildlife Service/Alaska Department of Fish and Game (USFWS/ADF&G) recently undertook a joint study to capture Lesser Yellowlegs within the breeding range in Alaska and Canada. The purpose was to attach GPS transmitters and geolocators to track these individuals during migration, and to determine migration phenology and routes, including key stopover sites and wintering areas (Friis 2018; McDuffie unpubl. data).

# HABITAT

## Habitat Requirements

Breeding

Lesser Yellowlegs breeds mainly in boreal wetlands. Although its breeding range covers parts of five Bird Conservation Regions (BCRs), three are considered most important: Taiga Shield and Hudson Plains (Northwest Territories, Ontario, Quebec), Boreal Taiga Plains (British Columbia, Alberta and Saskatchewan) and Northwestern Interior Forest (Yukon and northern British Columbia; Sinclair *et al.* 2004).

Nest sites are usually near peatlands (both bogs and fens), ponds, or marshes (Gauthier and Aubry 1995; Sinclair 2003; Cooper *et al.* 2004; Aubry and Cotter 2007; Harris 2007; Tibbitts and Moskoff 2014; Buidin unpubl. data; McDuffie unpubl. data). In northeastern Canada, large fens provide particularly suitable breeding habitat (Aubry and Cotter 2007; Buidin unpubl. data), specifically forests dominated by open fens containing floating mats of mosses and/or decomposing vegetation supporting herbaceous plants such as Bog Buckbean (*Menyanthes trifoliata*) and sedges (*Carex* spp.; C. Buidin unpubl. data). In Churchill, Manitoba, the species nests mainly on taiga with extensive sandy mudflats and a few small ponds, as well as in bogs and wet meadows with clumps of conifers (Jehl 2004; Buidin pers. comm. 2019).

In the Northwest Territories, Lesser Yellowlegs favours forest mosaics dominated by open Black Spruce (*Picea mariana*) stands interspersed with numerous ponds (7-19 ponds/km$^2$) and rocky areas (Johnston 2000). In this region, the ponds used for brood rearing and foraging are dominated by floating or emergent vegetation, grasses, cattails or shrubs and small trees (Johnston 2000). The species also occurs in summer in muskeg

and former burns (Cooper *et al.* 2004) as well as in landscapes that include shallow pools, ponds, or small lakes and raised open areas such as gravel ridges and palsas (Cadman *et al.* 2007). In Alberta, Lesser Yellowlegs is more numerous in forests where recent fires have occurred, but where wetlands remain abundant (FAN 2007).

Lesser Yellowlegs may also use human-modified habitats such as seismic line rights-of-way, road allowances, and recent forest clear-cuts and mine clearings (Peck and James 1983; Campbell *et al.* 1990). Where it co-occurs with Greater Yellowlegs, Lesser Yellowlegs often uses drier habitats with denser vegetation (Clay *et al.* 2012).

In Alaska, breeding densities were found to vary by habitat types: low and medium shrub thicket (1.6 territories/10 ha), tall shrub thickets (1.4 territories/10 ha), lowland Black Spruce bogs (1.2 territories/10 ha), and lowland White Spruce (*Picea glauca*) - birch woodland (0.3 territories/10 ha), for an average of 1.13 territories/10 ha (Spindler and Kessel 1980).

Migration

In Canada, Lesser Yellowlegs frequents a variety of wetlands during migration. In the Prairie Potholes region, it uses mudflats and shallow saline ponds and lakes, among other habitats (Alexander and Gratto-Trevor 1997). In the Great Lakes region, it is found at various natural and anthropogenic wetlands (including sewage lagoons), as well as river and lake shorelines and agricultural landscapes. Along the St. Lawrence River, it occurs in intertidal zones in the fluvial estuary characterized by the presence of marshes dominated by Softstem Bulrush (*Schoenoplectus tabernaemontani*) and Smooth Cordgrass (*Sporobolus alterniflorus*), as well as limestone flats subject to tidal action (Aubry and Cotter 2007; Buidin *et al.* 2010). In the Maritimes, Lesser Yellowlegs uses both freshwater and marine shorelines during migration.

Wintering

Lesser Yellowlegs uses a wide range of aquatic features on its wintering grounds, including estuaries, mangrove swamps, coastal flats and mudflats along coasts and at the confluence of rivers, as well as sewage lagoons, flooded pastures, the shores of lakes and rivers, reservoirs and salt ponds in grassland areas farther inland, at elevations up to 3800 m (Ridgely and Greenfield 2001; Restall *et al.* 2006; Clay *et al.* 2012; Tibbitts and Moskoff 2014).

Flooded rice fields near the coast of Suriname appear to be a very important wintering habitat (Hicklin and Spaans 1993). Densities there were estimated at 7.8 birds/ha in recently flooded, ploughed, and levelled fields, at 4.6 birds/ha in flooded fields that had not been ploughed, harrowed, or levelled, and 2.6 birds/ha in the same type of field several days after these agricultural activities had taken place (Hicklin and Spaans 1993). Even higher densities (62.2 birds/ha) have been recorded in flooded rice fields in Florida in fall (Sykes and Hunter 1978). In Argentina and Brazil, Lesser Yellowlegs is one of the most abundant shorebird species in both flooded and unflooded rice paddies (0.5 and 0.04

birds/ha respectively; Dias *et al.* 2014). In Argentina's Pampas ecoregion, the species uses temporary ponds and shallow lakes (Brandolin *et al.* 2016), and shallow ponds in large river deltas (e.g., the Parana delta; Ronchi-Virgolini *et al.* 2009).

## Habitat Trends

Breeding habitat

Forestry, mining, and oil and gas industries have a growing footprint within the breeding range of Lesser Yellowlegs (Rooney *et al.* 2012), although overall they overlap with only a small portion of it, and the species sometimes nests in human-modified areas such as seismic lines and clear-cuts. Some boreal wetlands are degrading or drying up as the water table is lowered, in response to permafrost thawing and increased evapotranspiration (Woo 1992; Klein *et al.* 2005; Riordan *et al.* 2006; Carroll *et al.* 2011). In Canada, Carroll *et al.* (2011) concluded that the area of shallow lakes and ponds in the boreal, subarctic and Arctic zones decreased by 6700 $km^2$ between 2000 and 2009. It is anticipated there will be further drying of peatlands (Bergeron *et al.* 2010; Turetsky *et al.* 2011; Lukenbach *et al.* 2015) and that the frequency (Kasischke and Turetsky 2006) and severity (Turetsky *et al.* 2011) of forest fires in the boreal forest will increase, particularly in northwestern Canada (Price *et al.* 2013).

Non-breeding habitat

Since the early 1900s, severe habitat loss has occurred along migration routes and wintering areas used by Lesser Yellowlegs (Tibbitts and Moskoff 2014). In the North American prairie region, used by Lesser Yellowlegs as a mid-continental migration route, over 50% of wetlands are believed to have been converted to farmland since about the end of the 19th century (Skagen *et al.* 2008). In Saskatchewan and Manitoba, cumulative wetland loss resulting from agricultural drainage exceeds 95% in some watersheds (Badiou 2013). Over 70% of wetlands in southern Ontario had been drained by 2002, with losses of over 85% in extreme southwestern Ontario and around the west end of Lake Ontario (DUC 2010). Habitat losses along the Atlantic Coast, another important migration route for Lesser Yellowlegs (Aubry and Cotter 2007), have also been severe since European colonization and continue today due to further residential and industrial development. Worldwide, coastal salt marshes are disappearing at an estimated rate of 1–2% a year (Arizaga *et al.* 2017).

The Pampas ecoregion of Argentina is dominated by grasslands and wetlands, but conversion to agricultural crops and cattle ranches has resulted in a 66% loss of natural areas since European colonization (Miñarro and Bilenca 2008). The proportion of the ecoregion used for agriculture has been increasing rapidly, with a 45% increase in cultivated area between 1990 and 2006, mainly for annual crops such as soybeans; overall 900,000 ha of natural or semi-natural grasslands were lost between 1988 and 2002 (Miñarro and Bilenca 2008). Moreover, between 1987 and 2007, the southeast part of the province of Cordoba lost nearly 40% of its wetlands due to drainage and channelization associated with intensive row crop agriculture (Brandolin *et al.* 2013).

# BIOLOGY

## Life Cycle and Reproduction

Bird *et al.* (2020) calculated the adult survival rate of Lesser Yellowlegs as 0.76, and reported maximum longevity to be 13.2 years, resulting in an estimated generation length of 4.06 years.

Lesser Yellowlegs can breed in its second calendar year of life, i.e., at just under one year of age (Tibbitts and Moskoff 2014), but has an average first breeding age of 1.3 years (Bird *et al.* 2020), reflecting that some remain on their wintering grounds or for other reasons do not breed in their second year. The species is monogamous, with pair formation taking place shortly after arrival on the breeding grounds, between late April and mid-May (Johnston 2000; McDuffie unpubl. data). It is generally single-brooded, with an average clutch size of four eggs (Tibbitts and Moskoff 2014). Incubation, shared by both parents, lasts 22-23 days. Young typically hatch between mid-June and early July and are precocial, leaving the nest soon after hatching (McDuffie unpubl. data).

The species typically nests on dry upland sites within 30-200 m of extensive wetlands (Johnston 2000; Cadman *et al.* 2007), but sometimes in forest openings farther away from wetlands (ABMI 2018).

No data are currently available on the reproductive success of Lesser Yellowlegs in Canada. In southern Alaska, hatching success (% of pairs with ≥1 young) was 78% in 1996 (n = 27 pairs) and 91% in 1997 (n = 30) (Tibbitts and Moskoff 2014). In the same study area, fledging success (% of broods fledging ≥1 young) was 34% in 1995 (n = 32 broods), 28% in 1996 (n=53), and 27% in 1997 (n = 60) (Tibbitts and Moskoff 2014).

## Dispersal and Migration

Lesser Yellowlegs is a long-distance migrant, travelling up to 15,000 km each way between subarctic forests and southern South America (McDuffie unpubl. data; Fink *et al.* 2020; Figure 3). In fall, most adult females leave the breeding grounds in early July, followed by adult males in mid-July. Failed breeders may depart as early as mid-June; juveniles set off from mid-July to late September (Tibbitts and Moskoff 2014).

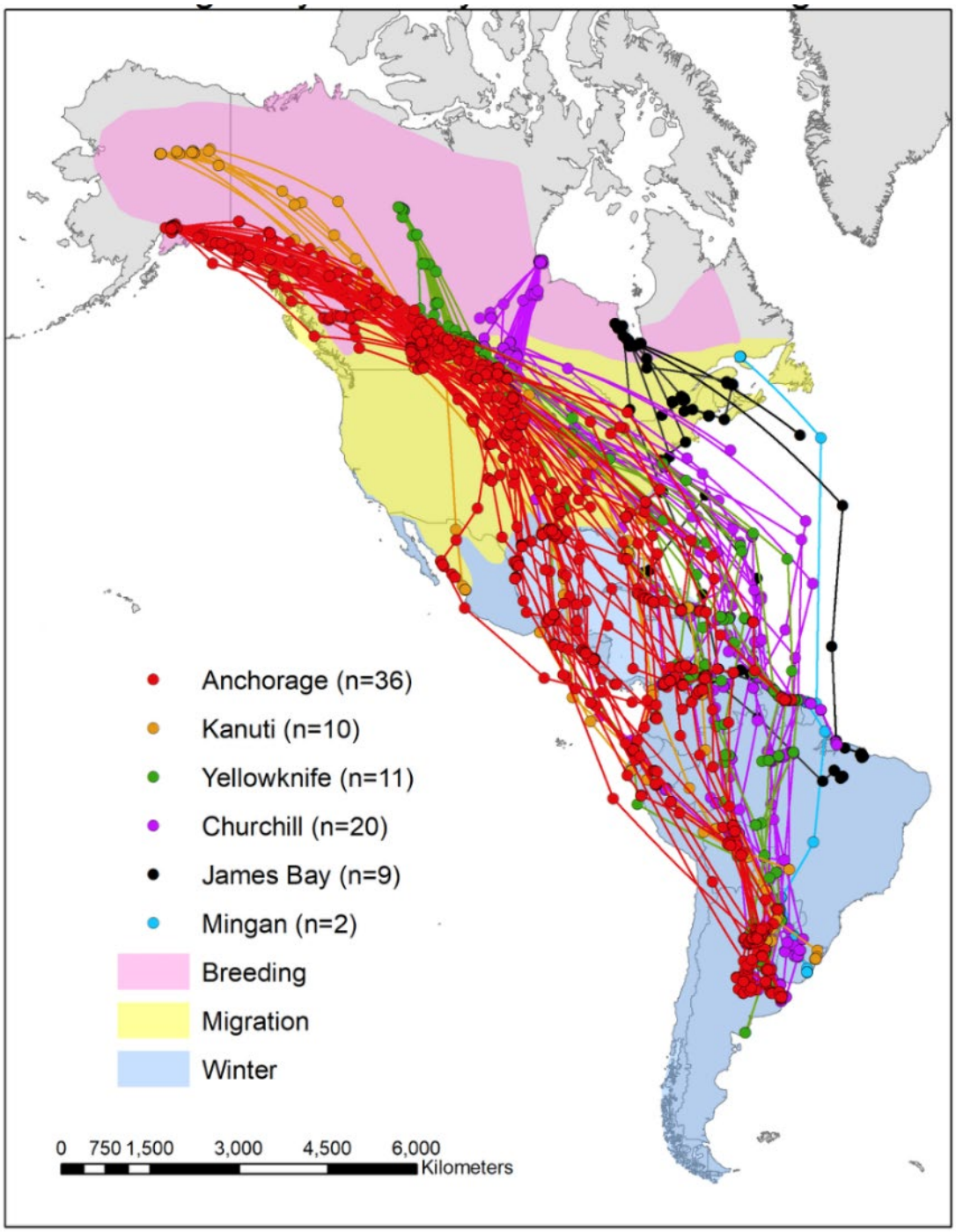


Figure 3. GPS positions along the southward migration routes of 88 adult Lesser Yellowlegs captured at six sites (denoted with different colours) in 2018 and 2019, and fitted with PinPoint GPS Argos transmitters (USFWS/ADF&G unpubl. data).

Satellite tracking of 88 adult Lesser Yellowlegs during southward migration has provided insights into migratory routes and links between breeding and wintering grounds (Friis 2018; McDuffie unpubl. data; Figure 3). Individuals from two breeding areas in Alaska (n=46) stopped over in the Canadian Prairies before either turning south toward the western Gulf of Mexico and Central America, or continuing southeast toward the Atlantic coast of the United States, then across the Caribbean to South America. Birds from two breeding areas in western Canada (i.e., Yellowknife, Northwest Territories, n=11; Churchill, Manitoba, n=20) went toward the same staging areas in the prairies, then continued on to the Atlantic coast of the United States and beyond. Lesser Yellowlegs tagged along James Bay, Ontario (n=9) went directly to the Atlantic coast and continued south following the same route as others. Only one of two individuals tagged in Mingan, Quebec yielded data, heading directly over the Atlantic Ocean to South America. Overall, the data reveal a substantial concentration of Lesser Yellowlegs moving through the Canadian Prairies and United States Great Plains, and a smaller number dispersed over a broader eastern corridor along the Atlantic coast and across the Caribbean. Individuals from James Bay, and a few from Churchill, Manitoba, wintered mostly along the northern coast of South America from Guyana to Brazil; all others wintered primarily in northeastern Argentina, Uruguay, and southern Brazil.

Limited phenological data are available from recent tracking studies. Birds captured on their breeding grounds near James Bay and followed through their first winter (n=3) spent an average of 63 days on fall migration and 176 days on wintering grounds in South America; their average wintering arrival date was September 7 (range August 31 – September 11; Friis 2018; McDuffie unpubl. data). Spring migration lasted 48 days for one bird tracked until summer (McDuffie unpubl. data).

Satellite tracking has shown that southward and northward migration routes can differ greatly. For example, a bird taking a mid-continent route in fall may return in spring via a transoceanic leg across the Caribbean, along the Atlantic Coast and then across the mid-continent (McDuffie unpubl. data). However, the majority of Lesser Yellowlegs appear to follow an inland route in spring, generally west of the Mississippi River (Skagen *et al.* 1999; Aubry and Cotter 2007; Clay *et al.* 2012; Tibbitts and Moskoff 2014). eBird data suggest that the Los Llanos grassland of Colombia and Venezuela is an important staging area during the spring migration for birds wintering in southern South America (Fink *et al.* 2020).

Some individuals remain on the wintering grounds in spring (Tibbitts and Moskoff 2014; Fink *et al.* 2020). Most are believed to be first-year birds, which spend the summer in small groups along beaches and lakeshores, both along the coast and inland (Scherer and Petry 2012). The Argentine Pampas seems to be the most important area for Lesser Yellowlegs that remain in the south year-round (Fink *et al.* 2020).

Natal dispersal has been documented only in Alaska, where it is estimated that 19% (7 of 37 individuals tagged as juveniles) were resighted as one- or two-year-olds within a 12-km radius of where they hatched (Tibbitts and Moskoff 2014). In Alaska, 67% of banded adults (n = 100) resighted within two years were <15 km from their previous nest sites (Tibbitts and Moskoff 2014).

## Diet and Foraging Behaviour

The Lesser Yellowlegs' bill, although fairly long, is not used to probe for prey buried in the sand or mud (Tibbitts and Moskoff 2014). Instead, the species uses it to snatch aquatic insects (Hemiptera, Odonata, Coleoptera, and Diptera) and their larvae, Crustacea (e.g., sand fleas), worms, small fish, and Gastropoda at the surface of the substrate (Bent 1927; Robert and McNeill 1989). It also occasionally feeds on terrestrial invertebrates such as ants, grasshoppers, and spiders. The species typically forages by walking in shallow water, gleaning its prey from the surface of the water or from the mud (Michaud and Ferron 1986). On the wintering grounds, Lesser Yellowlegs may hunt by using tactile sweeping, during the day as well as at night, scything its bill back and forth (Robert and McNeill 1989).

At migratory stopover sites, Lesser Yellowlegs feeds mainly in small groups of a few dozen individuals, although flocks of several thousand birds can be found foraging at some sites (Gollop 1986; Smith 1996).

## Interspecific Interactions

During migration, Lesser Yellowlegs may travel in mixed flocks with other shorebird species such as Greater Yellowlegs and Solitary Sandpiper (*Tringa solitaria*). It may also forage with Hudsonian Godwit (*Limosa haemastica*), American Avocet (*Recurvirostra americana*), White-rumped Sandpiper (*Calidris fuscicollis*), and Semipalmated Sandpiper (*Calidris pusilla*) (Tibbitts and Moskoff 2014).

During the breeding season, agonistic interactions (threat displays, attacks, and chases) have been reported between male Lesser Yellowlegs and individuals of other species such as Greater Yellowlegs, Short-billed Dowitcher (*Limnodromus griseus*), and Solitary Sandpiper that venture too close to the female or young (Bent 1927; Gibson 1970; Oring 1973). Males perform flight displays over the nesting area until several days into incubation, and both members of the pair defend this area against other Lesser Yellowlegs and potential predators (Tibbitts and Moskoff 2014). Lesser Yellowlegs may also defend foraging territories against Solitary Sandpiper during migration and over winter (Brooks 1967; Bolster and Robinson 1990).

Lesser Yellowlegs is often hunted by raptors, particularly Peregrine Falcon (*Falco peregrinus*), Merlin (*Falco columbarius*), and Northern Goshawk (*Accipiter gentilis*) (Hunter *et al.* 1988; Tibbitts and Moskoff 2014). During the breeding season, adult Lesser Yellowlegs may respond aggressively to the following species, suggesting that they are potential predators of eggs and/or young: Sandhill Crane (*Antigone canadensis*), Northern Harrier (*Circus hudsonius*), Bald Eagle (*Haliaeetus leucocephalus*), Mew Gull (*Larus canus*), Herring Gull (*L. argentatus*), Short-eared Owl (*Asio flammeus*), Common Raven (*Corvus corax*), Black-billed Magpie (*Pica hudsonia*), and Coyote (*Canis latrans*); isolated cases of predation by domestic cats have also been reported (Tibbitts and Moskoff 2014). A number of other species found on the breeding grounds are likely also predators of Lesser Yellowlegs, such as Red Fox (*Vulpes vulpes*), American Marten (*Martes americana*), American Mink (*Neovison vison*), and probably Ermine (*Mustela erminea*), although no interactions with these species have been documented (Tibbitts and Moskoff 2014).

## Home Range and Territory

Detailed studies on territorial behaviour in Lesser Yellowlegs during the breeding season in Canada are scarce (Johnston 2000); most studies have been conducted in Alaska (Tibbitts and Moskoff 2014).

Home range can be highly variable. During the incubation period, parents may travel up to 13 km away from the nest to forage, but adults with young remained <3 km from their nest sites (Tibbitts and Moskoff 2014). Near Anchorage, Alaska, some breeding pairs remained within a 10 $km^2$ area during the incubation and brood-rearing periods, while others ranged across areas as large as 100 $km^2$ (McDuffie unpubl. data). Home range sizes seem to depend on the quality of the available habitat and the density of breeding pairs within a specific area (McDuffie unpubl. data).

Territoriality also varies, with some Lesser Yellowlegs nesting in isolated pairs and others in small loose colonies (Tibbitts and Moskoff 2014). After hatching, family groups move away from nesting areas and the adults defend an area around the brood rather than a defined space. At this time, the parents may attack intruders that venture within about 200 m of the brood, and persistently displace intruders from any nearby perches (Tibbitts and Moskoff 2014). Males also defend small areas around females at foraging sites during courtship and egg-laying (Tibbitts and Moskoff 2014). During migration, Lesser Yellowlegs may defend intertidal foraging areas by attacking conspecifics within 60 m (Tibbitts and Moskoff 2014) and, on the wintering grounds, may defend territories ranging from 0.1 to 0.5 ha in size, depending on the density of individuals and type of habitat present.

## Behaviour and Adaptability

Lesser Yellowlegs sometimes nest in human-modified habitats such as rights-of-way for seismic lines, pipelines, and high-voltage power lines; mine sites; clear-cuts; and along the edges of logging roads (Peck and James 1983; Campbell *et al.* 1990; McDuffie unpubl. data).

On the wintering grounds, Lesser Yellowlegs seems to be somewhat adaptable, using human-constructed wetlands such as sewage lagoons (eBird 2018), impounded rice fields (those no longer in use as well as new ones converted from cattail marshes), farm water reservoirs (Rundle and Fredrickson 1981; Hicklin and Spaans 1993; Weber and Haig 1996; Clay *et al.* 2012), and other artificial wetlands (Wege *et al.* 2014).

## POPULATION SIZES AND TRENDS

### Sampling Effort and Methods

The North American Breeding Survey (BBS) provides limited coverage of the northern and eastern parts of Lesser Yellowlegs' range, but has fair sample sizes (at least 40 routes; Table 1) in Alberta, Yukon, and Alaska, among the jurisdictions supporting the most Lesser Yellowlegs. Overall, it is likely to be the most reliable source of trends specific to the Canadian population. Shorebird migration monitoring programs provide additional insight into trends for the North American population overall. Although interpretation relative to Canadian birds is complicated by the inclusion of Alaskan birds, these trends are likely to be largely reflective of the Canadian population, given that it accounts for 80% of the overall total. Provincial breeding bird atlases describe the distribution of Lesser Yellowlegs, and where efforts have been repeated, can be used to compare abundance over time. The Yukon Peregrine Falcon prey monitoring project also provides regionally relevant data on shorebird numbers.

**Table 1. Population trends for Lesser Yellowlegs over the most recent three generations (2007-2019) and long-term (1970-2019) in Canada and Alaska, based on Breeding Bird Survey data; bolded trends have 95% credible intervals that are entirely below zero, indicating a high probability of decline (A. Smith unpubl. data). Survey coverage in Nunavut, Ontario, Quebec, and Newfoundland and Labrador is insufficient to estimate trends, except as aggregated under Bird Conservation Region (BCR) 7.**

| Region | Annual % Rate of Change (95% Lower/Upper Credible Intervals) | Cumulative % Change (95% Lower/Upper Credible Intervals) | Probability of decline >30% | # routes | Reliability |
|---|---|---|---|---|---|
| **Short-term** | | | | | |
| Canada | -2.40 (-6.11, 1.76) | -25.3 (-53.1, 23.3) | 0.39 | 171 | Low |
| British Columbia | -2.54 (-8.22, 3.86) | -26.6 (-64.3, 57.6) | 0.45 | 4 | Low |
| Alberta | -1.53 (-6.40, 4.00) | -16.9 (-54.8, 60.1) | 0.29 | 61 | Low |
| Saskatchewan | 1.97 (-4.39, 9.72) | 26.3 (-41.6, 204.5) | 0.07 | 26 | Low |
| Manitoba | 2.22 (-6.44, 14.20) | 30.2 (-55.0, 391.8) | 0.13 | 25 | Low |
| Northwest Territories | -0.82 (-6.65, 5.06) | -9.5 (-56.2, 80.9) | 0.24 | 15 | Low |
| Yukon | **-5.14 (-8.72, -1.46)** | **-46.9 (-66.6, -16.1)** | 0.89 | 37 | Low |
| BCR 7 | -3.26 (-9.73, 2.98) | -32.8 (-70.7, 42.2) | 0.54 | 3 | Low |
| Alaska | **-5.66 (-9.29, -2.00)** | **-50.3 (-69.0, -21.5)** | 0.93 | 48 | Low |
| **Long-term** | | | | | |
| Canada | -2.36 (-5.27, 0.43) | -69.0 (-93.0, 23.5) | 0.88 | 203 | Medium |
| British Columbia | -0.80 (-4.72, 4.80) | -32.4 (-90.7, 895.8) | 0.52 | 4 | Low |
| Alberta | **-4.43 (-6.29, -2.61)** | **-89.2 (-95.9, -72.6)** | 1.00 | 72 | Medium |
| Saskatchewan | -1.08 (-3.76, 1.95) | -41.3 (-84.7, 158.1) | 0.70 | 39 | Medium |

| Region | Annual % Rate of Change (95% Lower/Upper Credible Intervals) | Cumulative % Change (95% Lower/Upper Credible Intervals) | Probability of decline >30% | # routes | Reliability |
|---|---|---|---|---|---|
| Manitoba | -0.49 (-4.72, 4.95) | -21.5 (-90.6, 969.1) | 0.46 | 25 | Low |
| Northwest Territories | -1.82 (-5.85, 3.01) | -59.3 (-94.8, 327.3) | 0.70 | 16 | Low |
| Yukon | -2.23 (-4.70, 0.64) | -66.8 (-90.6, 36.6) | 0.86 | 43 | Medium |
| BCR 7 | -2.41 (-6.22, 1.96) | -69.7 (-95.7, 158.8) | 0.80 | 4 | Low |
| Alaska | -2.52 (-4.79, 0.14) | -71.4 (-91.0, 7.3) | 0.92 | 58 | Medium |

The North American Breeding Bird Survey (BBS)

The North American Breeding Bird Survey (BBS) is a roadside survey of breeding bird populations in North America (Sauer *et al.* 2017). Data on the abundance of breeding birds are collected by volunteers along permanent 39.2 km routes consisting of 50 stops spaced 0.8 km apart; data are collected once annually within a 400-m radius of each stop (Government of Canada 2018). In Canada, the surveys are generally conducted in June or the first week of July, corresponding with the breeding season for most bird species. Each route is run starting one-half hour before sunrise and lasts approximately five hours. Since 2013, Canadian BBS data have been analyzed using hierarchical Bayesian models, which produce more precise estimates than previous methods. They are also less variable from year to year, better represent spatial variation in population status across Canada, and allow for more intuitive assessments of uncertainty (Smith *et al.* 2014).

The design of the BBS is not generally considered optimal for shorebirds, particularly those breeding in wetlands (Morrison *et al.* 2001; Gratto-Trevor *et al.* 2011). However, Lesser Yellowlegs tends to be highly vocal and is quite readily detected, although individuals can be missed when incubating (Johnston 2000). The greatest shortcoming of BBS relative to Lesser Yellowlegs is that it does not representatively sample the entire Canadian population, as there are fewer BBS routes in the northern boreal region where much of the breeding range is located and even in the southern part of the breeding range, roads are generally sited to avoid wetlands, or may cross wetlands that have been degraded by road development or associated development and disturbances (Sinclair *et al.* 2004). However, Northern BBS coverage has increased since the 1990s, providing greater power for recent trends.

Shorebird Migration Monitoring Programs

Lesser Yellowlegs is monitored by Manomet Center for Conservation Science's International Shorebird Survey (ISS) (Brown *et al.* 2001), which includes ECCC's Atlantic Canada Shorebird Survey (ACSS) (Donaldson *et al.* 2000) and Ontario Shorebird Survey (OSS) (Ross *et al.* 2003). These surveys monitor trends in the relative abundance of shorebirds during migration at regional and continental scales. Since 1974, over 100,000 surveys have been conducted by volunteers, with roughly 1300 surveys added each year. Surveyors are asked to census an area three times monthly using ISS guidelines during the

key migration periods in spring and/or fall. Because these birds are migrants, counts at a site vary dramatically over time, and the timing of peak passage varies among species; variability in length of stay can complicate analysis. Integrated analyses of these surveys produce trends and annual indices for 37 species of shorebirds, including Lesser Yellowlegs. In contrast to previous analyses based on mean peak counts, current analyses are based on raw counts during the peak of the species-specific migration period (P. Smith pers. comm. 2020).

Bart *et al.* (2007) used ACSS and other ISS data to estimate population trends for Lesser Yellowlegs during fall migration for 1974-1998. Most of the sites in their study were along the Atlantic Coast (81 sites from Newfoundland and Labrador to New Jersey), although 54 inland sites east of the 100$^{th}$ meridian were also covered.

Gratto-Trevor *et al.* (2011) used OSS data to determine fall trends in Ontario for 1976-1997; Ross *et al.* (2012) performed a similar analysis for 1974-2009. For Atlantic Canada, Gratto-Trevor *et al.* (2011) used ACSS data to estimate population trends for the species for 1970-2000. Finally, a recent analysis of shorebird migration monitoring data collected across North America between 1974 and 2016 was performed by Environment and Climate Change Canada (P. Smith and A. Smith unpubl. data).

Breeding Bird Atlases

Most Canadian breeding bird atlas projects provide little information on population trends for Lesser Yellowlegs, as they have only been carried out once (e.g., Manitoba; Artuso 2018), are not directly comparable to earlier efforts because of differences in methods (e.g., British Columbia; Burger 2015), or provide poor coverage of the breeding range (e.g., Quebec; Robert *et al.* 2019). The only exceptions are Ontario (Cadman *et al.* 2007) and Alberta (FAN 2007), although in both cases the most recent surveys were longer than three generations ago, therefore any changes observed are no longer directly applicable to current status.

Boreal Avian Modelling (BAM) Project

The Boreal Avian Modelling (BAM) Project is aimed at understanding the ecology of boreal birds and their habitats, and projecting impacts of climate change and industrial development on bird populations and distribution (Boreal Avian Modelling Project 2019). Analyses are based on a data set comprising tens of thousands of breeding bird point-counts that have been collated from government agencies, environmental organizations, industries, and academia, including the BBS and breeding bird atlases. BAM is most useful for studying patterns of relative abundance across the boreal forest and for investigating habitat relationships, but may not be as suitable for population trend analysis because data are less uniformly standardized than the BBS and are primarily more recent. BAM population estimates for Lesser Yellowlegs are likely overestimated, given that territorial birds tend to approach point count observers from considerable distances, resulting in an inflated number of individuals tallied within the radius of a point count. As with the BBS, there is also a potential source of bias in that most point counts in the database are conducted on or near roadsides, although BAM models account for this factor.

Yukon Peregrine Falcon prey monitoring project

A Yukon wetland sampling group carried out standardized surveys of waterbirds annually in 30 wetlands in May between 1991 and 2018, as part of a secondary research project on the diet of the Peregrine Falcon (D. Mossop, unpubl. data). The wetlands surveyed were located along a corridor 150 km long, beginning near the territory's southern border and running northward. Surveyors conducted total counts of the birds present in these wetlands five times during each breeding season.

## Abundance

Abundance of Lesser Yellowlegs is generally thought to be most reliably estimated from counts at migration stopovers and wintering areas, rather than on the breeding grounds (Morrison and Ross 1994). Based on these non-breeding surveys and an extensive review of the literature and expert opinions, Andres *et al.* (2012) estimated the total population to be 660,000 mature individuals. This is larger than the previous estimate of 400,000 (range of 300,000 to 500,000) by Morrison *et al.* (2006), but the difference is not believed to reflect an increase in the population, and confidence in the accuracy of the estimate is low. Considering an average annual change of -2.78% in the continental population over the past three generations (see **Fluctuations and Trends**), an adjusted population estimate as of 2020 is approximately 527,000 mature individuals. Based on the extent of the breeding range, 80% of the Lesser Yellowlegs population (i.e., 422,000) is assumed to nest in Canada, with the remainder breeding in Alaska (Donaldson *et al.* 2000). BAM (2020) has estimated a much larger Canadian breeding population of 3.8 million males, corresponding to approximately 7.6 million mature individuals. The actual population size is likely between 422,000 and 7.6 million, but probably much closer to the low end of the range, considering that the counts underlying the BAM estimate are likely biased high.

BAM (2020) estimates that density is highest in the Taiga Shield (the western part of Bird Conservation Region (BCR) 7, in Northwest Territories, Nunavut, Alberta, Saskatchewan, and Manitoba), at 2.93 males (5.86 mature individuals) per $km^2$. This is comparable to the density of 2-3 pairs/$km^2$ in open Black Spruce forests and regenerating burns respectively along the Mackenzie Valley of the Northwest Territories, determined using territory mapping (Cooper *et al.* 2004). According to BAM (2020), the next highest density is in the Northwest Territories and Yukon portion of the Boreal Taiga Plains (BCR 6), at 1.49 males (2.98 mature individuals) per $km^2$. From Ontario eastward, the highest density is 0.34 males (0.68 mature individuals) per $km^2$ in the eastern part of BCR 7. Data collected from the second Ontario Breeding Bird Atlas suggest that the species is more abundant in the Hudson Bay Lowlands (3.1 individuals/25 point counts) than on the Northern Shield (0.04 individuals/25 point counts; Harris 2007).

## Fluctuations and Trends

North American Breeding Bird Survey (BBS)

In Canada, the long-term (1970-2019) average annual trend estimate from the BBS is -2.36% (95% credible interval [CI] -5.27%, 0.43%; n = 203 routes), amounting to a cumulative long-term change estimate of -69.0% (95% CI -93.0%, 23.5%; Table 1, A. Smith, unpubl. data). The probability that the long-term population decline is a reduction of >30% is 0.88 (Table 1). From 2007-2019 (the most recent three-generation period), the average annual trend estimate is -2.40% (95% CI -6.11%, 1.76%; n = 171), and the cumulative change is -25.3% (95% CI -53.1%, 23.3%; Table 1). Although the credible interval for the most recent three generations is broad and includes zero, the distribution indicates a higher likelihood of a negative trend, and the probability that the three-generation change is a reduction of >30% is 0.39 (Table 1, Figure 4). Declines are occurring throughout most of the breeding range (Figure 5).

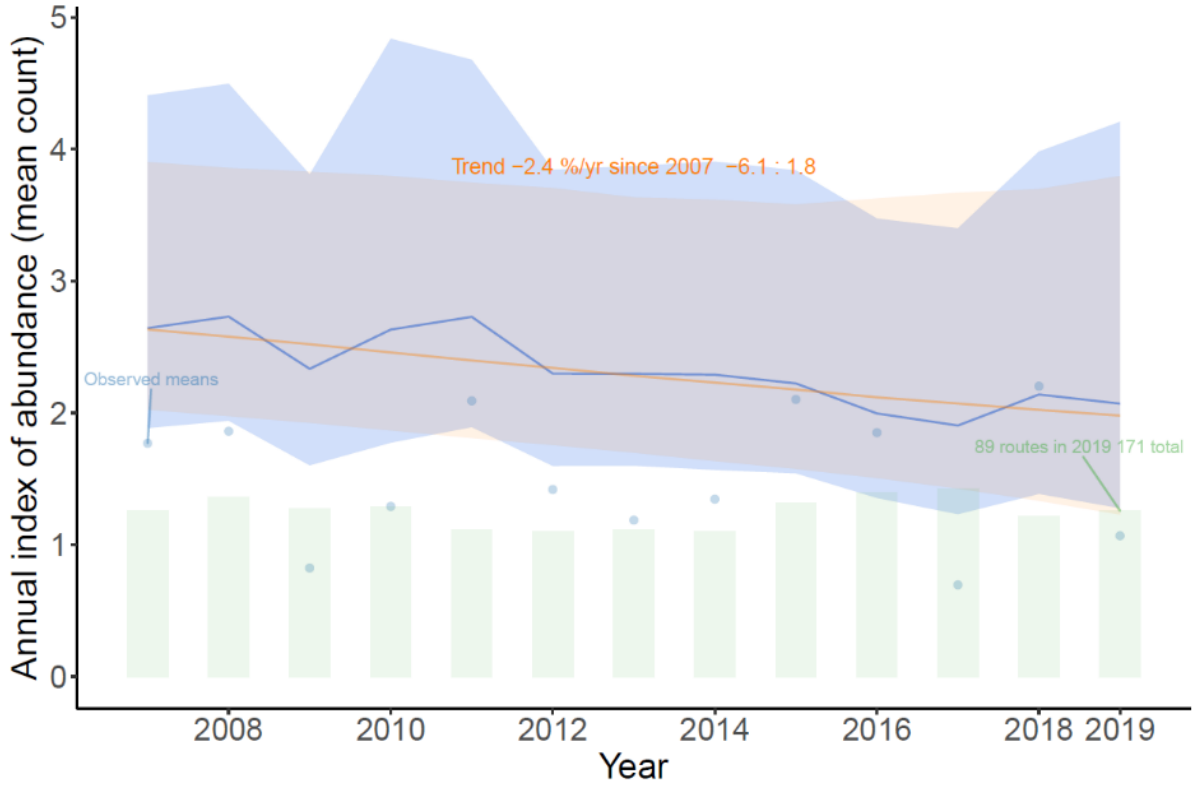


Figure 4. Annual index of population abundance for Lesser Yellowlegs in Canada over the past three generations (2007-2019), based on Breeding Bird Survey data (n=171 routes total; green bars indicate variability in the number of routes contributing data each year). The GAM (generalized additive model) trend in blue represents the best curvilinear fit of data, whereas the orange line is the corresponding best linear fit. Blue and orange shading, respectively, show 95% credible intervals for the estimated trends (A. Smith unpubl. data).

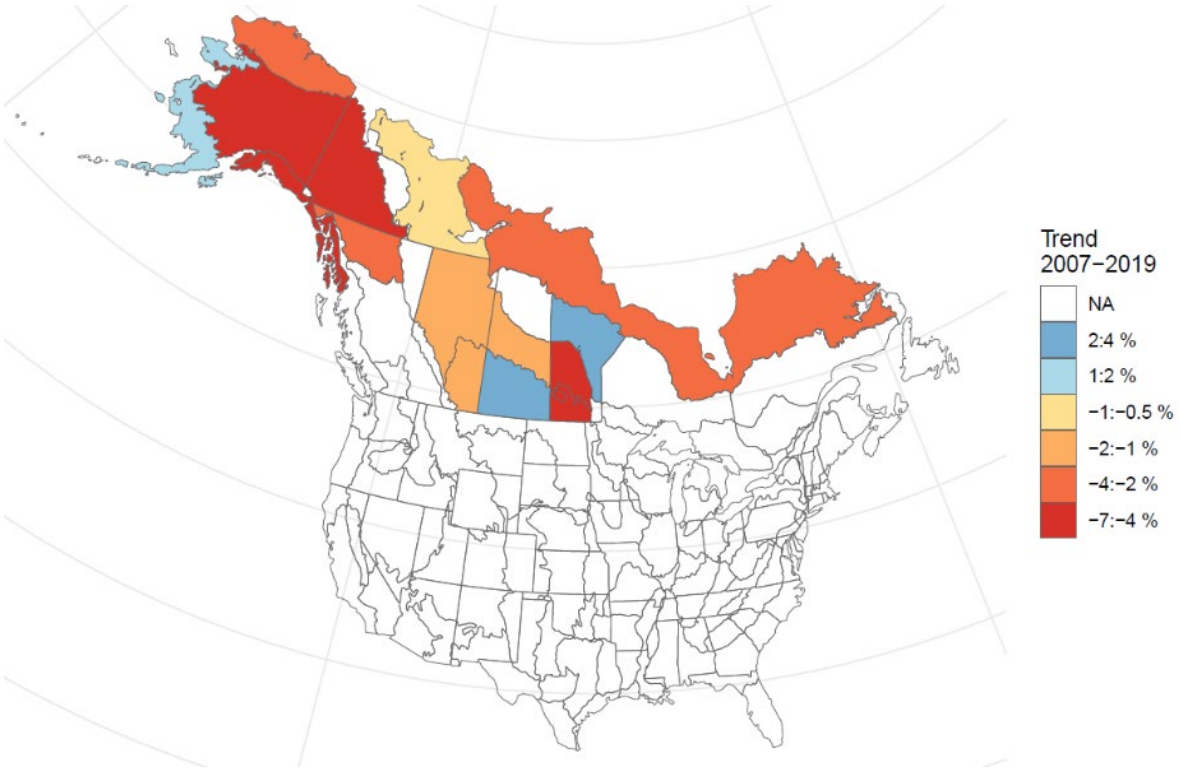


Figure 5. Annual percent population change for Lesser Yellowlegs by region over the latest three-generation period (2007-2019) based on North American Breeding Bird Survey data (A. Smith unpubl. data). Trends are mapped by Bird Conservation Regions within jurisdictional boundaries; areas shown in white are either outside the breeding range or had insufficient data to support estimation of trends.

Rolling three-generation trends illustrate patterns in the rate of population change, with the value plotted for each year representing the difference relative to 12 years earlier. The three-generation rate of decline in Canada has been slowly but steadily accelerating over the past decade, reaching -25% in 2018 (Figure 6). Although credible intervals are broad at an annual scale, the median estimate for the 12-year trend has consistently declined since 2006, and has ranged between -17% and -32% annually since 1982.

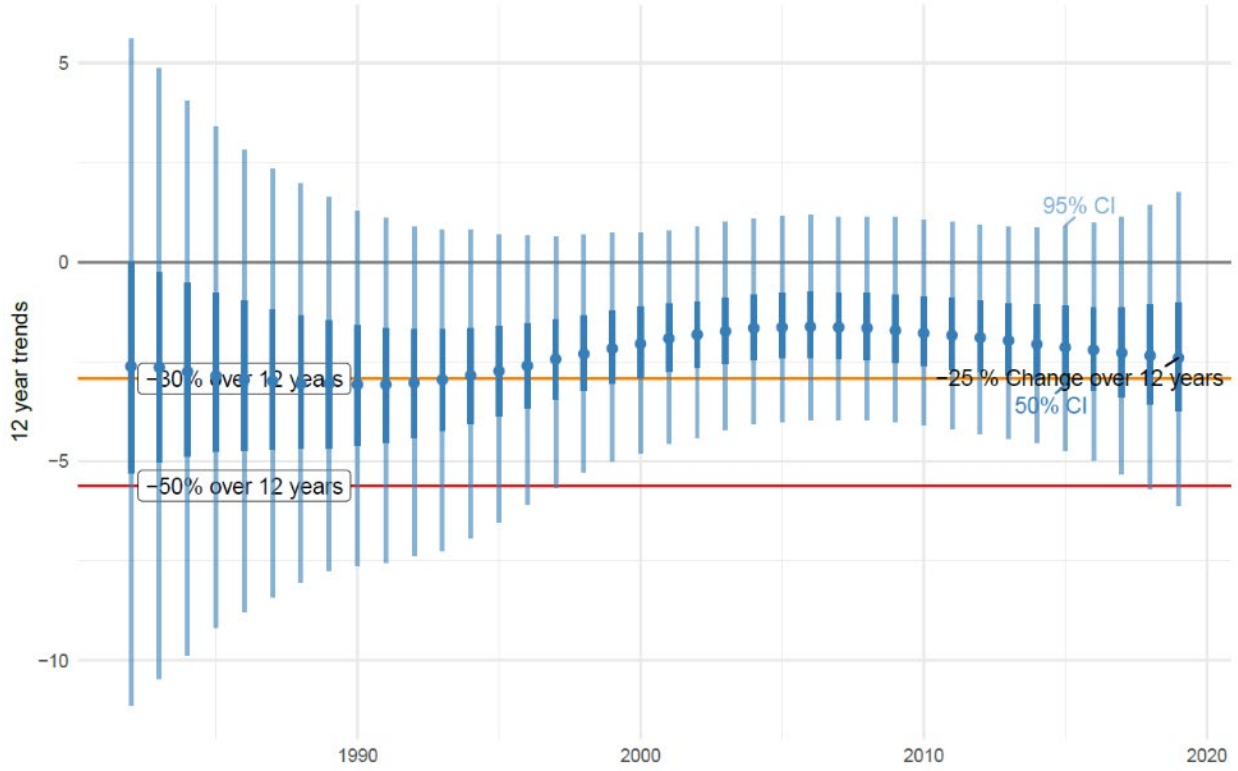


Figure 6. Rolling three-generation (12-year) trends for Lesser Yellowlegs in Canada, based on Breeding Bird Survey data (A. Smith unpubl. data). The horizontal axis represents the last year of the 12-year rolling trend (e.g., 2019 is the trend for 2007-2019). Thick and thin blue vertical error bars depict 50% and 95% credible intervals, respectively. Orange and red horizontal lines depict 30% and 50% cumulative short-term decline rates, which represent COSEWIC thresholds for listing a species as Threatened and Endangered, respectively.

In Alaska, there is a long-term (1970-2019) trend of -2.52%/year (95% CI -4.79%, 0.14%; n = 58). The three-generation trend (2007-2019) is a substantial accelerating decline, at -5.66%/year (95% CI -9.29%, -2.00%; n = 48; A. Smith, unpubl. data).

Shorebird Migration Monitoring

The most recent analysis of ISS data indicates that Lesser Yellowlegs experienced a significant decline of -2.75% per year in North America (90% credible interval [CI]: -4.98, -0.92) during the period 1974-2016, corresponding to an overall decline of about 69% over 42 years (P. Smith and A. Smith unpubl. data). The decline is steeper for the most recently available ten-year period (2006-2016), at -7.28% per year (90% CI: -9.72%, -5.32%), equivalent to -53% over this period (P. Smith and A. Smith unpubl. data; Figure 7).

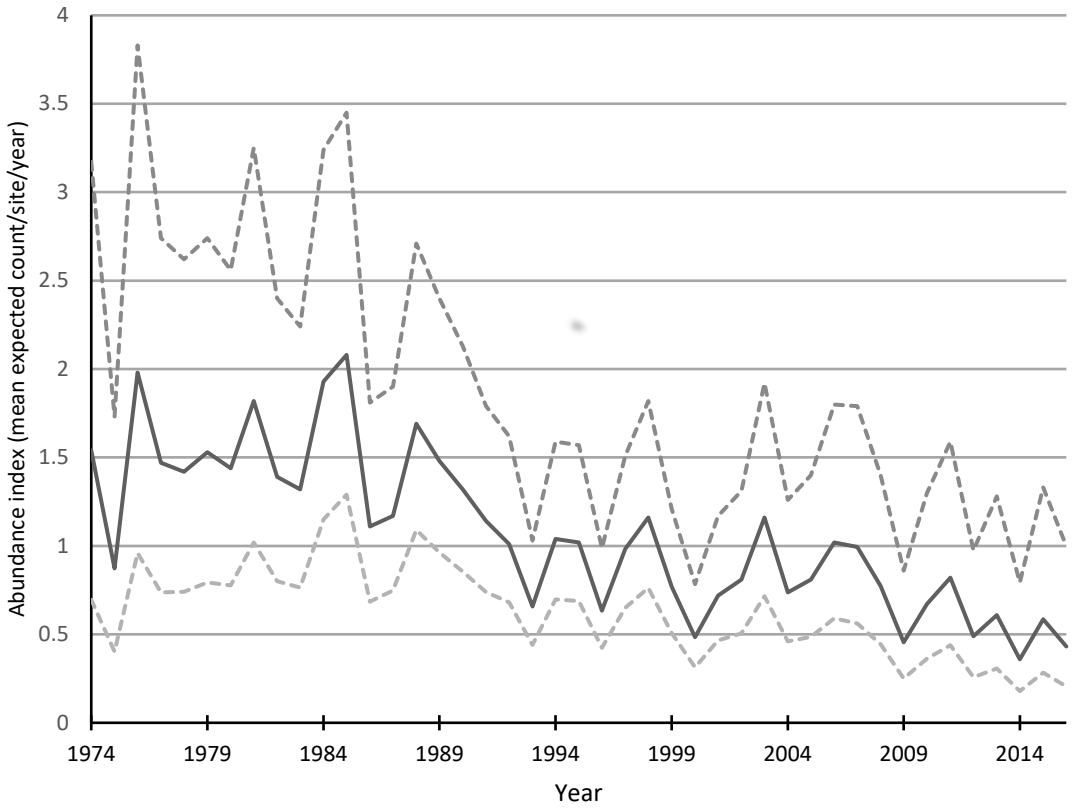


Figure 7. Long-term trends in the abundance index for Lesser Yellowlegs (solid line) with a 95% confidence interval (dashed lines) in North America, based on International Shorebird Survey migration monitoring data (P. Smith and A. Smith unpubl. data 2019).

Bart *et al.* (2007) estimated that the Atlantic Coast and mid-continental migrant populations respectively declined by 4% and 1% annually between 1974 and 1998, based on ACSS and ISS data, amounting to cumulative decreases of 62% and 21%. Gratto-Trevor *et al.* (2011) reported a significant ($p<0.05$) decline of 5%/year in Atlantic Coast migrants between 1970 and 2000, amounting to a total decrease of 81%.

Gratto-Trevor *et al.* (2011) found that numbers of Lesser Yellowlegs recorded on fall migration experienced a non-significant decline of -7.1%/year in Ontario between 1976 and 1997, a cumulative decline of 79%. Over the period of 1974-2009, Ross *et al.* (2012) found a significant ($p<0.01$) decline of -6.9%/year, amounting to an overall decrease of 92%.

Breeding Bird Atlases

In Ontario, no difference was found in the probability of observation within a 10 x 10-km square in the early 1980s versus early 2000s (Harris 2007). However, the increased effort in northern Ontario during the second atlas may have confounded comparison to some extent. In Alberta, the relative abundance of Lesser Yellowlegs was described as lower in the boreal forest and parkland regions in 2001-2005 than it was in 1987-1991, although the difference was not quantified (FAN 2007).

Yukon Peregrine Falcon prey monitoring project

The number of breeding Lesser Yellowlegs observed at 30 monitored wetlands in Yukon declined 92% from 88 in 1991 to seven in 2018 (D. Mossop unpubl. data). The decline was most notable in the 1990s, with only 10-20 individuals most years in the 2000s, and a range of 7-16 annually in the 2010s.

Winter Monitoring

Surveys of Lesser Yellowlegs in Suriname, one of the species' most important wintering areas, indicates a steep 80% decline in numbers from 2002 to 2008 (Ottema and Ramcharan 2009). Other surveys (aerial and on the ground) carried out in 2008 over a more extensive area along the coast of Suriname suggest that the decline observed is probably not localized, but rather representative of the entire coastline of this country. A subsequent survey targeting Semipalmated Sandpiper along coastal French Guiana, Suriname, and Guyana (Morrison *et al.* 2012) reported substantial declines in many species of shorebirds compared to the 1980s, including Lesser Yellowlegs. Substantial population declines have also been reported in other wintering areas, notably on the southwest coast of Ecuador where mean monthly maximum counts declined from about 250 birds in 1992 to about 20 birds in 2011 (Clay *et al.* 2012) and Mar Chiquita Lake in central Argentina where Nores (2011) reported a decrease from 15,000 individuals in 1973 to only 32 birds in 2010. However, there are no comprehensive surveys throughout the wintering range, and it is possible that observed declines at monitored sites have at least to some degree been offset by increases at unsurveyed areas.

Population Trend Summary

Although there is considerable uncertainty surrounding individual estimates, there is a general pattern in data from the breeding range, migratory routes, and wintering range indicating a substantial ongoing decline of Lesser Yellowlegs that appears to be accelerating. The BBS offers the most extensive and standardized assessment of trends specific to the Canadian population. Although BBS coverage is more heavily weighted to the western part of the breeding range, this corresponds with the regions that support the greatest abundance of Lesser Yellowlegs. Observations at key wintering areas and at migratory stopover sites over the past three generations suggest that the rate of decline during this period might be considerably greater than the 30% estimated by the BBS, although search effort is not standardized, and these surveys include Lesser Yellowlegs

from Alaska, where BBS results indicate a recent decline more than twice as rapid as in Canada. Only the Ontario Breeding Bird Atlas suggested little change in population, but more than three generations have passed since the most recent data were collected, and the overall patterns of decline observed, including during migration in Ontario, are likely more reliable.

## Rescue Effect

Only ~20% of the Lesser Yellowlegs' breeding range is outside Canada, all in Alaska (Donaldson *et al.* 2000), where the species is considered of high conservation concern (Alaska Shorebird Group 2019), and is declining more rapidly than in Canada (see Fluctuations and Trends). Birds that breed in Alaska likely migrate along the same north-south routes as birds from western Canada (McDuffie unpubl. data), and presumably the two groups intermingle during migration and on the wintering grounds. Exchange of individuals between U.S. and Canadian breeding areas is undocumented, and may not be frequent given apparently high site fidelity, but is certainly possible, given shared migratory routes. Any individuals dispersing into Canada from the Alaskan breeding grounds would be well adapted to survive and reproduce in western Canada because environmental conditions are similar.

# THREATS AND LIMITING FACTORS

## Threats

Lesser Yellowlegs is vulnerable to the cumulative effects of various threats, especially biological resource use, habitat loss and degradation, and climate change and severe weather. Threats are summarized in **Appendix 1** following the IUCN-CMP (International Union for the Conservation of Nature–Conservation Measures Partnership) unified threat classification system, based on the standard lexicon for biodiversity conservation (Salafsky *et al.* 2008). The overall threat impact for Lesser Yellowlegs is considered to be medium to high, corresponding to an anticipated further population decline of between 3 and 70% over the next three generations. The seven IUCN threats categories relevant to Lesser Yellowlegs are described below. Timing of all threats is high (continuing).

<u>IUCN 5, Biological resource use (low to medium impact threat)</u>

*IUCN 5.1, Hunting and collecting terrestrial animals (low to medium impact threat)*

Description of threat:

Beginning in the 19th century, Lesser Yellowlegs and many other shorebirds were intensively hunted along the coasts of North and South America during fall migration and on their wintering grounds (Tibbitts and Moskoff 2014; Wege *et al*. 2014; AFSIHWG 2017). Hunting of Lesser Yellowlegs in North America is now limited to Indigenous communities and is likely negligible, but it continues for sport, commerce, and subsistence in the Caribbean and in northern South America (Bayney and Da Silva 2005; Moore and Andres 2018).

Hunting clubs were established in Barbados starting in the 1850s, focusing on artificially created marshes known as shooting swamps (Hutt 1991; Wege *et al.* 2014). Lesser Yellowlegs is most often hunted there between July and October; between 1988 and 2010, the annual harvest ranged from 5,700 to 19,900 individuals (Wege *et al.* 2014), corresponding to as much as 3% of the estimated population. However, sport hunting in Barbados declined between 2000 and 2015 because of declining interest, rising costs of ammunition and maintaining hunting ponds, new restrictions on possession of firearms, and the desire of local governments to increase the number of wildlife preserves closed to hunting (Andres 2016). Additionally, in 2008, BirdLife International collaborated with the Barbados Wildfowlers Association, CWS, and USWFS to introduce conservation measures to ensure that shorebird harvest in Barbados is sustainable. A proposal was made to limit the harvest of Lesser Yellowlegs to 1,250 birds at each of eight shooting swamps, for a total annual harvest of 10,000 birds (Wege *et al.* 2014).

In Guadeloupe, Lesser Yellowlegs is the most frequently hunted shorebird (ONF 2017), with an estimated 8,000 individuals harvested annually (Watts *et al.* 2015). However, conservation efforts undertaken since 2016, including monitoring of important wetlands, assessment of hunting pressure, hunting regulation, shorebird habitat mapping, creation of wildlife reserves, and wetland restoration may cause this number to decline (ONF 2017).

Hunting in the Caribbean may have a greater impact on Lesser Yellowlegs that breed in eastern North America. Stable isotype analyses of Lesser Yellowlegs harvested in Barbados have shown that birds hunted there most likely come from the James Bay area, corresponding with GPS tracking showing the link between these areas (Friis 2018; Reed *et al*. 2018).

Hunting also occurs in a number of countries in South America, particularly French Guiana and Suriname, which are important wintering areas for the species (Ottema and Ramcharan 2009; Andres 2017). In French Guiana and Suriname, hunting is undertaken for subsistence and commercial selling in local markets, as well as for sport, making it difficult to estimate extent of take (Bayney and Da Silva 2005; Andres 2016, 2017; Moore and Andres 2018). Efforts to reduce illegal hunting in these two countries include a conservation awareness campaign in schools, interviews with hunters, and law enforcement (New Jersey Audubon Society 2016).

Scope:

Scope is considered large given the proportion of the population that likely passes through areas where hunting remains frequent.

Severity:

Watts *et al.* (2015) developed a potential biological removal model for Lesser Yellowlegs and estimated that an annual harvest of 79,000 individuals would not jeopardize the population. However, Watts and Turrin (2016) speculated that current hunting pressure

may exceed this threshold, considering the large numbers reported from certain Caribbean islands, and the substantial but unquantified harvest in northern South America (Ottema and Spaans 2008). Therefore, despite some recent evidence of declines in hunting pressure and ongoing efforts to reduce it further, severity may range from slight to moderate.

*IUCN 5.3, Logging and wood harvesting (low impact threat)*

Description of threat: There is potential for some logging of breeding habitat, but there is generally little forestry interest in the treed bogs and fens preferred by Lesser Yellowlegs, and the species may occupy recently cut areas, suggesting there may be little impact on the population (Hansen pers. comm. 2019). Large-scale forestry practices in the Paraná delta in Argentina pose a threat to the Lesser Yellowlegs wintering there (Wetlands International 2015).

Scope:

Scope is small, as this threat is largely limited to parts of western Canada where forestry activities may extend into treed wetlands, and a small portion of the wintering range.

Severity:

Severity is likely toward the lower end of slight, given that there is evidence of recently logged areas being used by Lesser Yellowlegs.

IUCN 2, Agriculture and aquaculture (low impact threat)

*IUCN 2.1, Annual and perennial non-timber crops (low impact threat)*

Description of threat:

The loss or degradation of stopover sites used by Lesser Yellowlegs during migration may have a negative impact on individuals, especially in spring when they depend on them to arrive on the breeding grounds in good condition (Gratto-Trevor *et al*. 2011). Agricultural conversion has been a significant factor in the loss and degradation of migratory stopover sites and wintering grounds (Isacch and Martinez 2003; Shepherd *et al.* 2003; Watmough and Schmoll 2007; Bartzen *et al*. 2010; Gratto-Trevor *et al.* 2011; Watmough *et al*. 2017). For example, an estimated 350,000 ha of wetlands have been drained for agricultural purposes in southern Saskatchewan and Manitoba since 1950 (Badiou 2013). In some watersheds in Manitoba and Saskatchewan, wetland losses or degradation exceeded 90% between 1974 and 2002. In Alberta, wetland losses of 80–90% are estimated to have occurred near urban centres and continue at an annual rate of about 0.5% (Badiou 2013). Shorebirds like Lesser Yellowlegs that use migration routes through the interior of the continent (as opposed to transoceanic or coastal routes) are at greater risk of population declines due to the loss and degradation of interior wetlands (Thomas *et al.* 2006; Bart *et*

*al.* 2007). Recent and ongoing large-scale conversion of the Argentinian Pampas to annual crops may have a greater current and future impact (Miñarro and Bilenca 2008; Brandolin *et al.* 2013), considering this is among the most important wintering regions for Lesser Yellowlegs (Fink *et al.* 2020).

Scope:

Much of the loss of habitat to agriculture in North America occurred in the past and ongoing wetland drainage may not be as significant a factor over the next three generations. However, scope is considered to be restricted based on exposure to areas experiencing ongoing conversion to soy or rice crops in the South American wintering range.

Severity:

The severity of further loss of habitat to agriculture is expected to be slight on average, but may be greater in some regions.

IUCN 3, Energy production and mining (low impact threat)

*IUCN 3.1, Oil and gas drilling (low impact threat)*

Description of threat:

Oil and gas development and extraction may pose a threat to Lesser Yellowlegs through displacement from key habitats, and the risk of oiling and mortality of birds that land on tailing ponds (USDI 2009; Timoney and Ronconi 2010; Van Wilgenburg *et al.* 2013). Oil sands mining affects not only the areas with deposits, but also the surrounding habitat and underlying aquifer, due to the practice of pumping water for mining, and to build roads, pipelines and seismic lines (Rooney *et al.* 2012).

Scope:

Scope is restricted, as slightly over 10% of the Canadian breeding range overlaps areas of oil and gas development, primarily in northwestern Canada (Wells 2011), and some additional individuals may be exposed there or elsewhere during migration.

Severity:

Severity is considered slight, given widespread availability of habitat and some evidence of Lesser Yellowlegs using landscapes disturbed by oil and gas development.

*IUCN 3.2, Mining and quarrying (low impact threat)*

Description of threat:

Peat mining and mineral quarrying may displace Lesser Yellowlegs from breeding habitat.

Scope:

Scope is small, as most mining and quarrying sites are scattered within the breeding range and would be considered negligible, but peat mining is somewhat more extensive, especially in Manitoba.

Severity:

Severity is considered slight given the widespread availability of habitat and a degree of tolerance for disturbance. Especially in eastern Canada, Lesser Yellowlegs sometimes stop over at ponds in quarries during migration.

IUCN 7, Natural system modifications (low impact threat)

*IUCN 7.3, Other ecosystem modifications (low impact threat)*

Description of threat:

Shoreline hardening (the addition of concrete structures to reduce erosion) along coastal migratory stopover sites and on wintering grounds is a concern because it can reduce the extent and quality of mudflats and shores available as foraging or roosting sites (Seitz *et al.* 2006). In the eastern United States, shoreline hardening has already been linked to contraction of intertidal zones and wetlands, and if the current trend continues, one-third of the Atlantic coast will be transformed by 2100 (Gittman *et al.* 2015). Potential expansion of Guyana's existing seawall and planting of mangroves may further reduce the availability of mudflats along the northern coast of South America.

Scope:

The scope is likely restricted, considering that most Lesser Yellowlegs stop along either the US Atlantic coast or the northern coast of South America, but only a relatively small proportion of them would occur in areas where shoreline changes may take place over the next decade.

Severity:

Severity is scored as slight to moderate, as the implications of shoreline hardening for Lesser Yellowlegs are uncertain, and may vary depending on extent of change, and the relative importance of sites to the species.

IUCN 8, Invasive and other problematic species and genes (low impact threat)

*IUCN 8.2, Problematic native species/diseases (low impact threat)*

Description of threat:

A meta-analysis of 111 shorebird species at different latitudes over 70 years suggested that most shorebirds breeding in subarctic and Arctic environments face increased nest predation rates, likely linked to climate change (Kubelka *et al*. 2018). This was refuted by Bulla *et al*. (2019), who noted that the results were biased by changes in research methods over time, and concluded there is no credible evidence that climate change has affected nest predation. However, some generalist predators such as Red Fox and Coyote have expanded their distribution in boreal and Arctic regions (Blois *et al*. 2013; Hody and Kays 2018), and may present somewhat increased predation pressure for some Lesser Yellowlegs.

Increasing populations of raptors may also pose a heightened mortality risk to Lesser Yellowlegs. For example, on its breeding grounds in Alaska, Lesser Yellowlegs makes up to 22% of the prey taken by Peregrine Falcons (White *et al*. 2002) and this falcon is also thought to be a major predator of Lesser Yellowlegs in Yukon (D. Mossop pers. comm.). During migration and on coastal wintering grounds, Peregrine Falcon is a key predator of shorebirds, including Lesser Yellowlegs (White *et al*. 2002). The presence of avian predators can also affect the energy budget of shorebirds by causing disturbance and forcing them to move more (Piersma *et al*. 2003; Ydenberg *et al*. 2004; Cresswell and Whitfield 2008).

Scope:

The scope of this threat is large, given that many Lesser Yellowlegs are likely to be exposed to increased predation pressure during at least one portion of their life cycle.

Severity:

The cumulative severity of year-round increases in predator abundance is considered to be slight, given that these are generally incremental increases to existing pressures and there is no evidence to indicate a notable impact on Lesser Yellowlegs.

IUCN 9, Pollution (low impact threat)

*IUCN 9.2, Industrial and military effluents (low impact threat)*

Description of threat:

Lesser Yellowlegs is at potential risk of coastal oil spills during migration and on the wintering grounds. For example, in the St. Lawrence River corridor and in Atlantic Canada,

many important migratory stopover sites for Lesser Yellowlegs are vulnerable to oil spills, due to the proximity of several major ports, heavy oil tanker traffic, and offshore oil extraction (Roberge and Chapdeleine 2000; Aubry and Cotter 2007; Buidin *et al*. 2010). A major oil spill extending along more than 2000 km of Brazil's coastline in August 2019 affected part of the wintering range of Lesser Yellowlegs. This threat is also present along the Gulf of Mexico, which is an important staging area for the species in fall and spring and where the explosion of the offshore drill rig Deepwater Horizon caused an unprecedented oil spill in the region in 2010.

On the breeding grounds, significant sources of contamination in aquatic environments where Lesser Yellowlegs forage during the breeding season include the atmospheric deposition of mercury from industrial activities (DesGranges *et al.* 1998; Fitzgerald *et al.* 1998; Wiener *et al.* 2003), and the release of methylmercury from melting permafrost in the boreal forest due to climate change (Edmonds *et al.* 2010). Exposure to mercury can reduce birds' breeding success by altering their immune responses and can also cause behavioural and physiological problems (Scheuhammer *et al.* 2007). Although no specific data are available on the effects of mercury concentrations on the health of Lesser Yellowlegs during the breeding season, other species of shorebirds breeding in boreal wetlands in Alaska have been shown to have elevated concentrations of mercury in their blood and feathers (Perkins *et al.* 2016). Studies carried out elsewhere in the boreal forest have revealed high mercury concentrations in aquatic invertebrates (Greenberg and Matsuoka 2010), as well as in the blood of Rusty Blackbird (*Euphagus carolinus*; Matsuoka *et al.* 2008; Edmonds *et al.* 2010), a species that forages in the same habitat as, and has a similar diet to, Lesser Yellowlegs.

Scope:

Pervasive, as most Lesser Yellowlegs are at risk of exposure to mercury or oil contamination at some point in their life cycle.

Severity:

Severity is considered slight given the lack of demonstrated effects on Lesser Yellowlegs, but remains poorly understood.

*IUCN 9.3, Agricultural and forestry effluents (low impact threat)*

Description of threat:

The large-scale use of neonicotinoid insecticides on cultivated land across the North American Prairies (Mineau and Palmer 2013; Ertl *et al.* 2018) and pesticides associated with soybean production in the South American Pampas (Miñarro and Bilenca 2008; Brandolin *et al.* 2013; Hunt *et al*. 2017) is known to reduce aquatic invertebrate abundance in freshwater ponds and may adversely affect migratory birds such as Lesser Yellowlegs that feed on invertebrates contaminated with these products. On the wintering grounds, where Lesser Yellowlegs uses flooded rice fields extensively, particularly in Suriname, the

species has also been exposed to many insecticides, molluscicides, and herbicides used to treat fields and which may pose a serious risk to the population overwintering there (Hicklin and Spaans 1993). Tissue samples taken in Central and South America showed high levels of organochlorine compounds (DDE, Fyfe *et al.* 1991).

Scope:

The scope of this threat is pervasive as it is associated with most of the migratory route and wintering grounds.

Severity:

Severity is considered to be slight, as evidence is lacking for substantial mortality or other effects arising from exposure to these contaminants.

*IUCN 9.1, Domestic and urban waste water (unknown impact threat)*

Description of threat:

During migration and on the wintering grounds, and particularly in the estuaries that they use extensively for foraging, Lesser Yellowlegs may be exposed to various contaminants including runoff from urban areas and sewage lagoons (Aubry and Cotter 2007; Tibbitts and Moskoff 2014). In addition, mortalities have been reported in Texas from selenium, a heavy metal recognized to have lethal effects on waterbirds (White *et al.* 2002; Tibbitts and Moskoff 2014).

Scope:

The scope of this threat is pervasive as it is associated with most of the migratory routes and wintering grounds.

Severity:

Severity is unknown, as there may be negative consequences for some individuals, but sewage lagoons are also known to provide important feeding habitat along migration routes.

IUCN 11, Climate change and severe weather (low impact threat)

*IUCN 11.4, Storms and flooding (low impact threat)*

Description of threat:

Climate change is expected to result in flooding that reduces availability of intertidal habitat by 20-70% over the next century at five major stopover sites in the U.S., including 60% at Delaware Bay (Galbraith *et al*. 2002). Over time, these areas may be able to support a reduced number of shorebirds, including Lesser Yellowlegs.

A sizable increase in the number and strength of hurricanes has been recently observed around the world, including the Atlantic (Webster *et al*. 2005), during periods and in regions where Lesser Yellowlegs may be present. Wege *et al*. (2014) relate cases of thousands of shorebirds, including Lesser Yellowlegs, being forced down from transoceanic flights over the Caribbean after strong storms at sea, resulting in huge fallouts in coastal villages in Barbados and other islands in the area. It is not known how these storms actually affect Lesser Yellowlegs, but the increase in the number of severe weather events in the Atlantic during southward migration certainly poses an increased risk to the species, which may be exacerbated over time with the anticipated warming of the climate and the oceans. In addition to direct risks posed by storms, local shorebird hunters in Barbados, Guadeloupe, and Martinique report that the large fallouts of shorebirds arising from storms are seen as important hunting opportunities (Aubry pers. comm. 2019).

Furthermore, the slowing of the jet stream due to climate change is keeping weather systems in place for abnormally long periods. This is causing an increasing number of cold episodes at the beginning of the Lesser Yellowlegs' breeding season, just when the species has returned to the breeding grounds (Clark 2009). This can cause delays in nesting (McDuffie unpubl. data) or outright breeding failure, as has been seen in many Arctic shorebird species breeding in Alaska, Greenland, and Siberia (Ackerman 2018).

Scope:

Scope is pervasive, as most individuals are likely to be affected during one or more parts of their life cycle.

Severity:

Severity over the next three generations is currently believed to be slight, but more research is warranted.

*IUCN 11.1, Habitat shifting and alteration (unknown impact threat)*

Description of threat:

An increase in annual average temperatures of more than 1.5°C has already been recorded in the boreal forest, where Lesser Yellowlegs breeds, and temperatures are expected to rise even more according to various Intergovernmental Panel on Climate Change (IPCC) scenarios (Gauthier *et al*. 2015). The drying and degradation of wetlands in a large part of the boreal forest—caused by the lowering of the water table, in turn linked to permafrost melting and increased evapotranspiration—have already been observed (Riordan *et al*. 2006; Carroll *et al*. 2011). The surface area of shallow lakes and ponds in Canada's boreal, subarctic, and Arctic zones decreased by 6,700 $km^2$ between 2000 and 2009 (Carroll *et al*. 2011). Along with the direct loss of wetland habitats, the drying of boreal wetlands will likely cause changes in aquatic invertebrate communities, including a potential reduction in the biomass of food resources that are important for Lesser Yellowlegs.

In recent years, increased temperatures and earlier snow melt in Canada's subarctic and Arctic regions have caused a mismatch between the peak period for insect hatching and the brood-rearing period of many nesting shorebird species, which used to be closely synchronized (Tulp and Schekkerman 2008; Galbraith *et al*. 2014; Senner *et al*. 2017; Kwon *et al*. 2019). If Lesser Yellowlegs is repeatedly affected by this threat, nestling survival could be compromised, as could populations over the long term, as with other Arctic-breeding shorebird species (Galbraith *et al*. 2014). Currently, it is impossible to predict whether migration strategies can be adjusted to arrive on the breeding grounds earlier in response to earlier snow melt (Gratto-Trevor *et al*. 2011).

Scope:

Pervasive, as most of the population is likely to be affected.

Severity:

Unknown, as it depends in part on whether suitable habitat shifts north, or availability is reduced; more research is needed.

*IUCN 11.2, Droughts (unknown impact threat)*

Description of threat:

Drought on the Canadian Prairies is a natural occurrence that takes place many times a century, typically affecting large areas that can include all of southeastern Alberta, southern Saskatchewan, and southwestern Manitoba (Johnston *et al.* 2005; Fang and Pomeroy 2008), where many important migratory stopovers for Lesser Yellowlegs are located (Friis 2018; McDuffie unpubl. data). A drought event may last several years, sometimes completely drying up the water table that supplies thousands of small and

medium-sized wetlands (Fang and Pomeroy 2008). A number of studies have suggested that drought and drying of wetlands could become more frequent on the North American Prairies due to increased temperatures (Johnston *et al.* 2005; Werner *et al.* 2013; Galbraith *et al.* 2014). Given that Lesser Yellowlegs relies on a few important migratory stopovers in the Prairies and there is thought to be a strong association between these wetlands and the species' reproductive success and survival (Krapu *et al.* 2006, Morrison *et al.* 2006; McDuffie unpubl. data), an increased number of drought events could reduce the availability of foraging habitat for Lesser Yellowlegs and impair reproductive success.

Scope:

Scope of this threat is pervasive, as most of the population depends on Canadian Prairies as stopover during migration.

Severity:

Unknown, as more research is needed.

*IUCN 11.3, Temperature extremes (unknown impact threat)*

Description of threat:

One of the effects of global warming in Canada's subarctic regions is an increase in the frequency and severity of forest fires, as well as a longer fire season in the country's boreal forest (Price *et al.* 2013). Between 1980 and 2007, there were seven years when >3 million ha of boreal forest was burned, compared with no years with such totals between 1920 and 1980 (Soja *et al.* 2006). Although Lesser Yellowlegs can nest in burns as long as wetlands are present, the increased severity and size of fires may result in the destruction of larger areas of breeding habitat during the breeding season (i.e., May-July). In Alberta, the decline in the species' relative abundance has been attributed to drier climatic conditions in the early 2000s compared to the 1980s (FAN 2007).

Scope:

Scope is pervasive, as most of the population will be exposed to this threat during the breeding season.

*Severity:*

Unknown, as more research is needed.

*IUCN 11.5, Other impacts (unknown impact threat)*

Description of threat:

Climate change may also produce changes in the direction and strength of the prevailing winds, directly affecting migrants such as Lesser Yellowlegs that undertake long marine crossings (Shamoun-Baranes *et al.* 2010; Sutherland *et al.* 2012). This may increase energy demand and thus affect birds' ability to migrate between key stopover sites, and ultimately to reach the wintering grounds (Shamoun-Baranes *et al.* 2010).

Scope:

Scope is pervasive, as most of the population is at risk of exposure during migration.

Severity:

Unknown, as more research is needed.

## Limiting Factors

As a long-distance migrant, Lesser Yellowlegs is exposed to pressures throughout its life cycle. It lays a maximum clutch of four eggs, and is only present on its breeding grounds for a short period each year; it therefore has a limited reproductive output and may be particularly vulnerable to environmental changes that impair physical condition or reduce reproductive fitness.

## Number of Locations

The number of locations for Lesser Yellowlegs is currently unknown. However, as hunting is believed to be the threat with the greatest impact, and it occurs widely throughout the Caribbean and South America, the number of locations is at minimum likely to correspond to the number of countries in which the species occurs, and is certain to be far more than 10.

# PROTECTION, STATUS AND RANKS

## Legal Protection and Status

Lesser Yellowlegs is protected in Canada under the *Migratory Birds Convention Act, 1994* (Government of Canada 2017), and in the United States and Mexico under similar legislation. Lesser Yellowlegs was assessed as Special Concern in November 2020 by COSEWIC.

Since 2012, efforts by CWS and the USFWS have led to the adoption of policies to regulate hunting and harvests in Barbados, Guadeloupe, Saint Martin, Martinique, and

French Guiana, in order to reduce mortality of Lesser Yellowlegs and other shorebird species from sport and subsistence hunting (Andres 2017). For example, in Barbados, hunting clubs have established stricter bag limits for Lesser Yellowlegs (1250 birds per hunting pond per year in the eight ponds still operating), and in 2015 the Government of Guyana introduced regulations on firearms possession and hunting licences (Andres 2017). French Guiana implemented a mandatory hunting permit in January 2020, requiring a training course on security, shorebird conservation, and identification of species that may be harvested (Aubry pers. comm. 2019).

## Non-Legal Status and Ranks

IUCN considers Lesser Yellowlegs to be of Least Concern, and NatureServe (2018) assigns Lesser Yellowlegs a global status of G5 (Secure) due to its large breeding range and population size, although some evidence suggests that its abundance is declining and more detailed information on trends and threats is needed. In Canada it is considered N4N5 (Apparently Secure to Secure), whereas in the United States it is ranked N5 (Secure). At a more regional scale the species is S5 (Secure) in three provinces, S4 or S4S5 (Apparently Secure to Secure) in three provinces and territories, and S3 or S3S4 (Vulnerable to Apparently Secure) in seven provinces and territories (NatureServe 2018; Yukon Conservation Data Centre 2020; Table 2).

**Table 2. Conservation status ranks assigned to Lesser Yellowlegs according to NatureServe (2018) and Yukon Conservation Data Centre (2020).**

| Region | NatureServe Rank* | Definition |
|---|---|---|
| Global | G5 | Secure |
| United States | N5 | Secure |
| Canada | N4N5 | Apparently Secure to Secure |
| British Columbia | S4S5B | Apparently Secure to Secure |
| Alberta | S5B | Secure |
| Saskatchewan | S5B, S5M | Secure |
| Manitoba | S4B | Apparently Secure |
| Ontario | S4B, S4N | Apparently Secure |
| Quebec | S3B | Vulnerable |
| Newfoundland & Labrador | S3M | Vulnerable |
| New Brunswick | S4M | Apparently Secure |
| Nova Scotia | S3M | Vulnerable |
| Prince Edward Island | S3M | Vulnerable |
| Yukon | S3B | Vulnerable |
| Northwest Territories | S2S4B | Imperilled to Apparently Secure |
| Nunavut | S3B, S3M | Vulnerable |

* – G = Global; N (at start of rank) = National; S = Subnational; B = Breeding; N (at end of rank) = Non-breeding; M = Migrating. 3 = Vulnerable; 4 = Apparently Secure; 5 = Secure.

Donaldson *et al.* (2001) considered Lesser Yellowlegs to be of low conservation concern in Canada, but an updated review by Hope *et al.* (2019) found the species to be highly imperilled. It is also considered a high-priority shorebird under the boreal conservation categories established by Sinclair *et al.* (2004), and has been identified as a priority for conservation or stewardship in five Bird Conservation Regions and three marine biogeographic units (Government of Canada 2019).

The USFWS considers Lesser Yellowlegs to be a species of national interest (Clay *et al.* 2012). Under the Alaska Shorebird Conservation Plan (Alaska Shorebird Group 2019), Lesser Yellowlegs is deemed a species of high conservation concern because of its declining population size and threats faced outside the breeding season.

## Habitat Protection and Ownership

In Canada, suitable breeding habitat for Lesser Yellowlegs is found primarily on public and Indigenous lands in the boreal forest. Lesser Yellowlegs occurs in 14 protected areas managed by the Parks Canada Agency (Parks Canada 2019), including 12 national parks where the species is considered a breeding bird. During migration, Lesser Yellowlegs is particularly abundant in the Mingan Archipelago National Park Reserve (Buidin *et al.* 2010). It also occurs on many other federal lands administered by other departments and Aboriginal governments, as well as in numerous provincial parks and ecological reserves and other kinds of nature reserves and conservation areas. The designation and protection of critical habitat for the Woodland Caribou (*Rangifer tarandus*) in Canada could help to protect a significant proportion of Lesser Yellowlegs habitat (Environment Canada 2012).

A number of initiatives aim to conserve and protect shorebirds in the Americas, including Lesser Yellowlegs, such as the North American Bird Conservation Initiative (NABCI), the Western Hemisphere Shorebird Reserve Network (WHSRN) (Morrison *et al.* 1994), the Eastern Habitat Joint Venture (EHJV) and the Important Bird Area (IBA) program (Aubry and Cotter 2007). The objectives of these initiatives include identifying, protecting, restoring, and designating important shorebird breeding areas and migratory stopover sites in the Americas, particularly wetlands, but they do not in themselves offer legal protection.

Migratory stopover habitat is mainly protected under WHSRN, which aims to designate and protect migratory stopover sites deemed of international importance in the Americas, although it offers no legal protection (Clay *et al.* 2012). The only WHSRN site in Canada supporting a large number of Lesser Yellowlegs is Quill Lakes, Saskatchewan, with a high count of 13,600 individuals. However, the suitability of this area for Lesser Yellowlegs has deteriorated as a consequence of elevated water levels from unregulated and unlicensed drainage of wetlands (WHSRN 2019). One other site in Canada, Sounding Lake, Alberta, has a similarly large maximum count (11,480) and is recognized as an IBA (Clay *et al.* 2012). Globally, 14 other sites have recorded peak counts of >5000 Lesser Yellowlegs, in Argentina (2), Barbados (2), French Guiana (3), Suriname (4), Trinidad and Tobago (1), and the United States (2); half of them are WHSRN sites, and all but one of the others are IBAs (Clay *et al.* 2012). In 2016, a 2400 $km^2$ portion of the Paraná delta in

Argentina, an important wintering site for the species, was designated as a Ramsar site which includes two national parks totalling 65 $km^2$ (Ramsar 2016).

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Carl Savignac is director of Dendroica Environnement et Faune, an environmental consulting firm specializing in avian ecology, particularly the conservation of species at risk, wetlands conservation and assessment of impacts of industrial development projects on birds and species at risk. Carl has been studying birds for over 25 years and has conducted numerous field studies in several Canadian provinces and territories, notably in the breeding range of Lesser Yellowlegs. He is currently leading a conservation project on Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark (*Sturnella magna*) in southern Quebec, and a habitat modelling project on Canada Warbler (*Cardellina canadensis*) using LIDAR technology. He has written over one hundred scientific reports and publications, including fifteen status reports on bird species in Canada and Quebec, many of them for COSEWIC.

## Appendix 1: Threats Assessment Worksheet for the Lesser Yellowlegs.

| | | | | |
|---|---|---|---|---|
| **Species or Ecosystem Scientific Name** | Lesser Yellowlegs (*Tringa flavipes*) | | | |
| **Element ID** | | **Elcode** | | |
| **Date (Ctrl + ";" for today's date):** | 2019-09-05 | | | |
| **Assessor(s):** | Carl Savignac (report writer), Marcel Gahbauer (co-chair), Dwayne Lepitzki (facilitator), Marie-France Noel (COSEWIC Secretariat), Brad Andres, Christian Artuso, Louise Blight, Mike Burrell, Marc-Andre Cyr, Scott Flemming, Frankie-Jean Gagnon, Inge-Jean Hansen, Laura McDuffie, Rosemin Nathoo. | | | |
| **References:** | | | | |
| **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 | 2 | 0 |
| | D | Low | 5 | 7 |
| **Calculated Overall Threat Impact:** | | | High | Medium |
| **Assigned Overall Threat Impact:** | | | **BC = Medium to High** | |
| **Impact Adjustment Reasons:** | | | | |
| **Overall Threat Comments** | Generation length of 4 years, i.e., time frame for severity and timing is 12 years into the future. Although most scored threats are considered to have a low impact, the cumulative impact of threats from seven categories plus uncertainty about aspects of climate change justify an overall impact range of medium to high. | | | |

| **Threat** | | **Impact (calculated)** | **Scope (next 10 Yrs)** | **Severity (10 Yrs or 3 Gen.)** | **Timing** | **Comments** |
|---|---|---|---|---|---|---|
| 1 | Residential & commercial development | Negligible | Small (1-10%) | Negligible (<1%) | High (Continuing) | This threat applies overwhelmingly to migration routes and wintering grounds. It has occurred extensively in the past, but likely continues only to a limited extent. |
| 1.1 | Housing & urban areas | Negligible | Small (1-10%) | Negligible (<1%) | High (Continuing) | Most coastal areas suitable for development have already been converted. This species is less strictly coastal than some other shorebirds and may be affected by changes to wetlands within 50 km of the coast, but the scope of development in these areas is likely small overall, and given the plasticity in movement and habitat selection by Lesser Yellowlegs, severity is considered negligible. |
| 1.2 | Commercial & industrial areas | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | Similar to above, but scope is even smaller as most commercial and industrial developments are outside coastal/wetland habitat, aside from some shipyard development in South America. |
| 1.3 | Tourism & recreation areas | Negligible | Small (1-10%) | Negligible (<1%) | High (Continuing) | Mostly related to development of coastal resorts and related tourism. Particularly notable in Yucatán and parts of coastal South America, but scope is likely small overall, and severity negligible, as above. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 2 | Agriculture & aquaculture | D | Low | Restricted (11-30%) | Slight (1-10%) | High (Continuing) | This threat applies almost entirely to migration routes and wintering grounds. In North America, most agricultural conversion was in the past, but it is still occurring quite widely in Central and South America. |
| 2.1 | Annual & perennial non-timber crops | D | Low | Restricted (11-30%) | Slight (1-10%) | High (Continuing) | Conversion of wetlands and grasslands to soy or rice crops is ongoing in South America, especially in southern Brazil. The proportion of Lesser Yellowlegs exposed to this at some point is likely near the high end of restricted. Although rice fields can be neutral to beneficial for Lesser Yellowlegs, the overall effect of all agricultural crops is likely slightly negative. |
| 2.2 | Wood & pulp plantations | | | | | | Not applicable (generally outside the range of wood/pulp plantations) |
| 2.3 | Livestock farming & ranching | | Negligible | Negligible (<1%) | Slight (1-10%) | High (Continuing) | Negligible exposure within the breeding range, although in northern British Columbia there is some overlap, with potential effects likely slight at most, but poorly understood. Land conversion to ranching is more prevalent in Central and South America, but likely overlaps little with Lesser Yellowlegs wintering habitat except in parts of the Paraná delta (Wetlands International 2015). Trampling of nests and loss of habitat may collectively be of slight severity. |
| 2.4 | Marine & freshwater aquaculture | | Negligible | Negligible (<1%) | Slight (1-10%) | High (Continuing) | Conversion of coastal wetlands to shrimp farming impoundments has been recognized as a concern (Sebastiani *et al.* 1994), and is expanding in Brazil and Mexico (including Gulf Coast) and possibly elsewhere in wintering grounds too. However, the footprint of this industry relative to Lesser Yellowlegs range is negligible, and some continued use of these areas may be possible, so the severity is likely only slight. |
| 3 | Energy production & mining | D | Low | Restricted (11-30%) | Slight (1-10%) | High (Continuing) | |
| 3.1 | Oil & gas drilling | D | Low | Restricted (11-30%) | Slight (1-10%) | High (Continuing) | Lesser Yellowlegs population density is highest in the western boreal, so it is likely that a restricted portion of the Canadian population is exposed to some aspect of oil and gas development. However, severity may only be slight given the widespread availability of habitat, and documented use of disturbed landscapes. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 3.2 | Mining & quarrying | D | Low | Small (1-10%) | Slight (1-10%) | High (Continuing) | Mining and quarrying are more localized than oil and gas development, and likely affect only a small part of the population. Peat mining may be responsible for range contraction at the south end of the species' Manitoba range. Fracking on migration routes may affect water supply, but potential implications for Lesser Yellowlegs are unclear. Overall severity is likely slight, although Lesser Yellowlegs may benefit from stopping over at ponds in quarries during migration, especially in eastern Canada. |
| 3.3 | Renewable energy | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | Migrants crossing the St. Lawrence River corridor may be at risk of collision with wind turbines along the south shore (Aubry and Cotter 2007); wind farm development is also increasing along the central migration corridor (Fargione *et al.* 2012) and in northeastern Brazil. It is estimated that a restricted portion of the population would encounter wind farms. There is potential for collisions, but no evidence to date of a population impact from this threat. |
| 4 | Transportation & service corridors | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | |
| 4.1 | Roads & railroads | | Negligible | Small (1-10%) | Negligible (<1%) | High (Continuing) | Lesser Yellowlegs have little exposure to roads in any season; a small number nest near roads (especially oil/gas and forestry roads in the west) but appear fairly tolerant of disturbance. |
| 4.2 | Utility & service lines | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | Lesser Yellowlegs are more likely to encounter transmission lines than roads, but severity is likely negligible given the limited likelihood of collisions having a population level impact. |
| 4.3 | Shipping lanes | | | | | | |
| 4.4 | Flight paths | | | | | | |
| 5 | Biological resource use | C D | Medium - Low | Large (31-70%) | Moderate - Slight (1-30%) | High (Continuing) | |
| 5.1 | Hunting & collecting terrestrial animals | C D | Medium - Low | Large (31-70%) | Moderate - Slight (1-30%) | High (Continuing) | Hunting has historically had a substantial impact on Lesser Yellowlegs. Pressure has abated in parts of the Caribbean with more sustainable quotas (e.g., Barbados, Guadeloupe, Martinique), but there is concern that the harvest in Suriname and Brazil is much higher than previously thought, and is ongoing. Modeling by Watts *et al.* (2015) suggests an annual harvest of up to 79,000 individuals is sustainable, but it is possible that annual take exceeds this level. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 5.2 | Gathering terrestrial plants | | | | | | |
| 5.3 | Logging & wood harvesting | D | Low | Small (1-10%) | Slight (1-10%) | High (Continuing) | There is some logging pressure in western Canada, notably in northeastern British Columbia. Although this may result in some loss of nesting habitat, Lesser Yellowlegs sometimes occupy recently cut areas for short periods. Severity is therefore likely near the lower end of the slight range. |
| 5.4 | Fishing & harvesting aquatic resources | | | | | | |
| 6 | Human intrusions & disturbance | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | |
| 6.1 | Recreational activities | | Negligible | Restricted (11-30%) | Negligible (<1%) | High (Continuing) | A restricted portion of the population is likely to experience some disturbance from recreational activities, primarily on beaches (ATV use, kite surfing, walking). However, as Lesser Yellowlegs is less dependent on shorelines than other shorebirds, disturbance is likely limited, and severity is likely to be negligible. |
| 6.2 | War, civil unrest & military exercises | | | | | | |
| 6.3 | Work & other activities | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | Some Lesser Yellowlegs are handled for research, but this involves a negligible portion of the population, and has negligible impact |
| 7 | Natural system modifications | D | Low | Restricted (11-30% | Moderate - Slight (1-30%) | High (Continuing) | |
| 7.1 | Fire & fire suppression | | Neutral or potential benefit | Large (31-70%) | Neutral or potential benefit | High (Continuing) | A large portion of the breeding range is reasonably at risk of forest fires. However, Lesser Yellowlegs is found in regenerating burns, suggesting that the effect is neutral or potentially even beneficial in areas where pre-existing forest may have been too dense to be suitable for the species. |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 7.2 | Dams & water management/ use | | Negligible | Negligible (<1%) | Slight (1-10%) | High (Continuing) | Reservoirs created for hydroelectricity in boreal forest and taiga regions have resulted in loss of breeding and staging habitat loss for Lesser Yellowlegs, notably in Quebec east of James Bay (Aubry and Cotter 2007). Downstream areas can also be affected by sediment discharge and salinity from upstream dams, reducing the abundance of aquatic invertebrates in estuaries (Aubry and Cotter 2007). However, foreseeable future projects would affect a negligible part of the population. Water diversion and increasing battles over water rights have potential to affect habitat availability on some migration and wintering grounds, but Lesser Yellowlegs is sufficiently flexible in habitat selection that the impact at any given site is likely only slight. |
| 7.3 | Other ecosystem modifications | C D | Medium - Low | Restricted (11-30%) | Moderate - Slight (1-30%) | High (Continuing) | Along the northern coast of South America, expansion of sea walls and planting of mangroves may reduce both the extent of mudflats and the availability of prey for Lesser Yellowlegs. However, there is uncertainty about the severity of these changes. |
| 8 | Invasive & other problematic species & genes | D | Low | Large (31-70%) | Slight (1-10%) | High (Continuing) | |
| 8.1 | Invasive non-native/alien species/diseases | | Negligible | Negligible (<1%) | Negligible (<1%) | High (Continuing) | There are isolated cases of predation by domestic cats, but both the scope and severity of this are negligible. |
| 8.2 | Problematic native species/diseases | D | Low | Large (31-70%) | Slight (1-10%) | High (Continuing) | Fox and Coyote populations continue to increase and expand northward through more of the breeding range. On migration and during winter, the increase in raptor numbers (especially Peregrine Falcon) poses a heightened mortality risk and can also affect energetics. However, the cumulative severity of these predator increases is likely only slight, as they are incremental changes to existing population limitations. |
| 8.3 | Introduced genetic material | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 8.4 | Problematic species/diseases of unknown origin | | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | Avian botulism caused by *Clostridium botulinum* is a major threat to waterbirds worldwide (Rockle and Bollinger 2007), with Type C occasionally causing mass mortality events at sites along the central North American migration route (Adams *et al.* 2003). A large part of the Lesser Yellowlegs population is therefore potentially vulnerable to exposure, and individuals are susceptible to ingesting the bacterium, but documented mortality rates for the species are negligible (Adams *et al.* 2003). |
| 8.5 | Viral/prion-induced diseases | | | | | | |
| 8.6 | Diseases of unknown cause | | | | | | |
| 9 | Pollution | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | |
| 9.1 | Domestic & urban waste water | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Most Lesser Yellowlegs are exposed to coastal runoff and/or sewage lagoons. There is potential for negative effects from exposure to contaminants, but in some areas sewage lagoons provide important habitat; on balance the overall severity and impact are unknown. |
| 9.2 | Industrial & military effluents | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | Most Lesser Yellowlegs are likely to be exposed to mercury contamination during either the breeding season, or in winter (especially in Brazil). There is also the risk of oil spills along any coastal habitat. Effects are not well understood, but severity may be toward the higher end of slight. |
| 9.3 | Agricultural & forestry effluents | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | Pesticides are widely used throughout much of the migratory and wintering range of Lesser Yellowlegs, and there may be some mortality from high exposure in rice fields. |
| 9.4 | Garbage & solid waste | | Negligible | Large (31-70%) | Negligible (<1%) | High (Continuing) | Primarily a concern in parts of the wintering grounds in South America where garbage is dumped within Lesser Yellowlegs habitat, and some is burned on beaches, but severity is likely negligible. |
| 9.5 | Air-borne pollutants | | Negligible | Pervasive (71-100%) | Negligible (<1%) | High (Continuing) | Almost all Lesser Yellowlegs are likely exposed to acidification of wetlands and smoke from forest fires, but there is no evidence of more than negligible severity. |
| 9.6 | Excess energy | | | | | | |
| 10 | Geological events | | | | | | |
| 10.1 | Volcanoes | | | | | | |

| Threat | | Impact (calculated) | | Scope (next 10 Yrs) | Severity (10 Yrs or 3 Gen.) | Timing | Comments |
|---|---|---|---|---|---|---|---|
| 10.2 | Earthquakes / tsunamis | | | | | | |
| 10.3 | Avalanches / landslides | | | | | | |
| 11 | Climate change & severe weather | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | Scope is considered pervasive for all aspects of climate change, as it is likely to be relevant throughout the breeding range of Lesser Yellowlegs. |
| 11.1 | Habitat shifting & alteration | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Drying of wetlands has already been observed in Alaska and Yukon and is likely ongoing elsewhere. Mismatch between timing of Lesser Yellowlegs migration and insect hatches is an increasing concern, but more research is needed to understand severity. |
| 11.2 | Droughts | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Increasingly severe droughts may limit the availability of staging sites in the Prairies and US Midwest in particular, but severity is unknown at this point. |
| 11.3 | Temperature extremes | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Temperature increases are particularly notable in the north, and among the potential consequences of this are cold episodes in spring and the potential for increased forest fire frequency and intensity, but the severity of impacts on Lesser Yellowlegs is not yet understood. |
| 11.4 | Storms & flooding | D | Low | Pervasive (71-100%) | Slight (1-10%) | High (Continuing) | Flooding of coastal migration and wintering habitat may affect availability of foraging and roosting areas. Increasing frequency and severity of hurricanes could affect survival of fall migrants. Severity is likely to be at least slight, but more research is warranted. |
| 11.5 | Other impacts | | Unknown | Pervasive (71-100%) | Unknown | High (Continuing) | Changes in wind pattern during migration may influence survival, but requires further study. |
| Classification of Threats adopted from IUCN-CMP, Salafsky *et al*. (2008). | | | | | | | |