

# Population increases of large birds in N. America: challenges for aviation safety



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12-15 August 2019, Halifax, NS, Canada**

# Acknowledgements

U.S. Department of Agriculture, Wildlife Services

U.S. Federal Aviation Administration



**Findings and recommendations expressed in this presentation do not necessarily represent the position of the U.S. Federal Aviation Administration**

**25 June 1969, Cleveland, Ohio**



# 1969: Dawn of environmental movement

- 1970 – Earth Day (Sen. Gaylord Nelson)
- 1970 – Environmental Protection Agency
- 1970 – Clean Air Act
- 1971 – National Wildlife Refuge System expanded
- 1972 – Clean Water Act
- 1972 – Migratory Bird Treaty Act expanded
- 1972 – DDT banned by EPA
- 1972 – Marine Protection & Sanctuaries Act
- 1973 – Endangered Species Act

**8 March 2013 (Federal Register)**

**Notice of New Task Assignment for the  
Aviation Rulemaking Advisory Committee (ARAC)\***

1. Evaluate the core ingestion element of small and **medium** bird requirements. Consider the threat from **large flocking** bird species.
2. Evaluate **large flocking** bird requirements, to determine the need for new requirements, or advisory material, or both, for Class D engines.
3. Identify any deficiencies of current rules, and provide the FAA with recommendations for changes as appropriate.

\*Assignment given to Engine  
Harmonization Working Group (EHWG)



**19 Feb 2015:**

**Engine Harmonization Working Group (EHWG)  
submitted its report to FAA:**

## **Turbofan Bird Ingestion Regulation**

**The EHWG of the ARAC recommended changes to testing regarding medium (2.5-lb) birds ...  
but left unchanged the tests for large ( $\geq 4$  lbs) birds**

**For the large-bird test, the engine does not have to keep operating after the ingestion to pass these standards; rather, the engine must:**

- \*contain the damage,**
- \*not catch fire, and**
- \*be capable of shut-down.**

**My objective is to provide:**

**Baseline and trend data on “large” & “medium” bird species in North America from 1990-2018:**

- 1) The National Wildlife Strike Database, and**
- 2) Population data from the biological literature and various biological databases.**

Dolbeer, R. A. and P. Eschenfelder. 2003. **Amplified bird-strike risks related to population increases of large birds in North America.** Pages 49-67 *in* Proceedings of the 26<sup>th</sup> International Bird Strike Committee meeting (Volume 1), Warsaw, Poland.

Dolbeer, R. A., and M. J. Begier. 2013. **Population trends for large bird species in North America in relation to aircraft engine standards.** Special report for the Aviation Rulemaking Advisory Committee (ARAC)

- **Partners in Flight. 2019.** Population Estimates Database, version 3.0. Available at <http://pif.birdconservancy.org/PopEstimates>. Accessed on 8 March 2019.
- **Sauer, J. R. et al. 2017.** The North American Breeding Bird Survey, Results and Analysis 1966 - 2015. Version 2.07.2017 USGS Patuxent Wildlife Research Center, Laurel, Maryland, USA.
- **U.S. Fish and Wildlife Service. 2018.** Waterfowl population status, 2019. U.S. Department of the Interior, Washington, D.C. USA. 76 pages.
- **Kushlan, J. A. et al. 2002.** Waterbird Conservation for the Americas: The North American Waterbird Conservation Plan, Version 1. Waterbird Conservation for the Americas, Washington, DC, USA, 78 pages.
- **Dubovsky, J. A. 2018.** Status and harvests of sandhill cranes: Mid-Continent, Rocky Mountain, Lower Colorado River Valley and Eastern Populations. Administrative Report, U.S. Fish and Wildlife Service, Lakewood, Colorado. 15 pages.

## **The questions:**

- 1) How many “large” & “medium” bird species in NA were struck by civil aircraft, 1990-2018?**
- 2) What are the population numbers and trends of these species, 1990-2018?**
- 3) What are the trends in strikes & multi-bird strikes by these species, 1990-2018?**

## **The answers provide advice/guidance to:**

- 1) ARAC & aircraft/engine manufacturers regarding bird-resistance designs/ requirements.**
- 2) FAA regarding bird-strike mitigation priorities.**

# What do we mean by “Large” and “Medium” birds?

**Large birds =  
≥4 lb (≥1.8 kg)**

**Snow geese (6.1 lb)**



**Sandhill cranes (10.6 lb)**



**Medium birds =  
2.5 - 3.9 lb (1.1 - 1.7 kg)**

**Red-tailed hawk  
(2.7 lb)**



**Brant (3.0 lb)**



# Large birds

Bird size class	Species struck by civil aircraft (1990-2018)		
	$\geq 20$ strikes	$< 20$ strikes	Total
$\geq 4$ lbs	<b>20 species</b>	<b>16 species</b>	<b>36 species</b>



**Brown pelican (8.2 lb)**

Strike statistics: birds with body masses  $\geq 4$  lbs struck by civil aircraft  $\geq 20$  times, USA, 1990 – 2018 (page 1 of 2)

Rank	Species	Mass (lbs) <sup>a</sup>	Total K	Dam K	Flocking behavior <sup>b</sup>
1	Canada goose	9.2	1,775	866	Strong
2	Turkey vulture	4.4	817	409	Limited
3	Black vulture	4.8	213	132	Limited
4	Snow goose	6.1	173	126	Strong
5	Bald eagle	11.8	289	106	Limited
6	Great blue heron	5.5	463	87	Limited
7	Sandhill crane	10.6	158	61	Strong
8	D-crested cormorant	4.6	166	54	Intermediate
9	Gr w-fronted goose	6.6	71	47	Strong
10	Brown pelican	8.2	76	32	Intermediate

Strike statistics: birds with body masses  $\geq 4$  lbs struck by civil aircraft  $\geq 20$  times, USA, 1990 – 2018 (page 2 of 2)

Rank	Species	Mass (lbs) <sup>a</sup>	Total K	Dam K	Flocking behavior <sup>b</sup>
11	Wild turkey	17.2	84	25	Strong
12	Snowy owl	5.03	309	24	Limited
13	Common loon	12.04	42	23	Limited
14	Tundra swan	15.88	23	17	Strong
15	A. white pelican	13.96	23	15	Limited
16	Gr blk-backed gull	4.03	128	12	Limited
17	Greater sage-grouse	7.03	41	12	Strong
18	Wood stork	5.96	21	6	Intermediate
19	Golden eagle	10.2	25	6	Strong
20	Glaucous gull	4.09	40	4	Intermediate
	<b>Total</b>		<b>4,936</b>	<b>2,064</b>	<b>12 of 20 S or I</b>

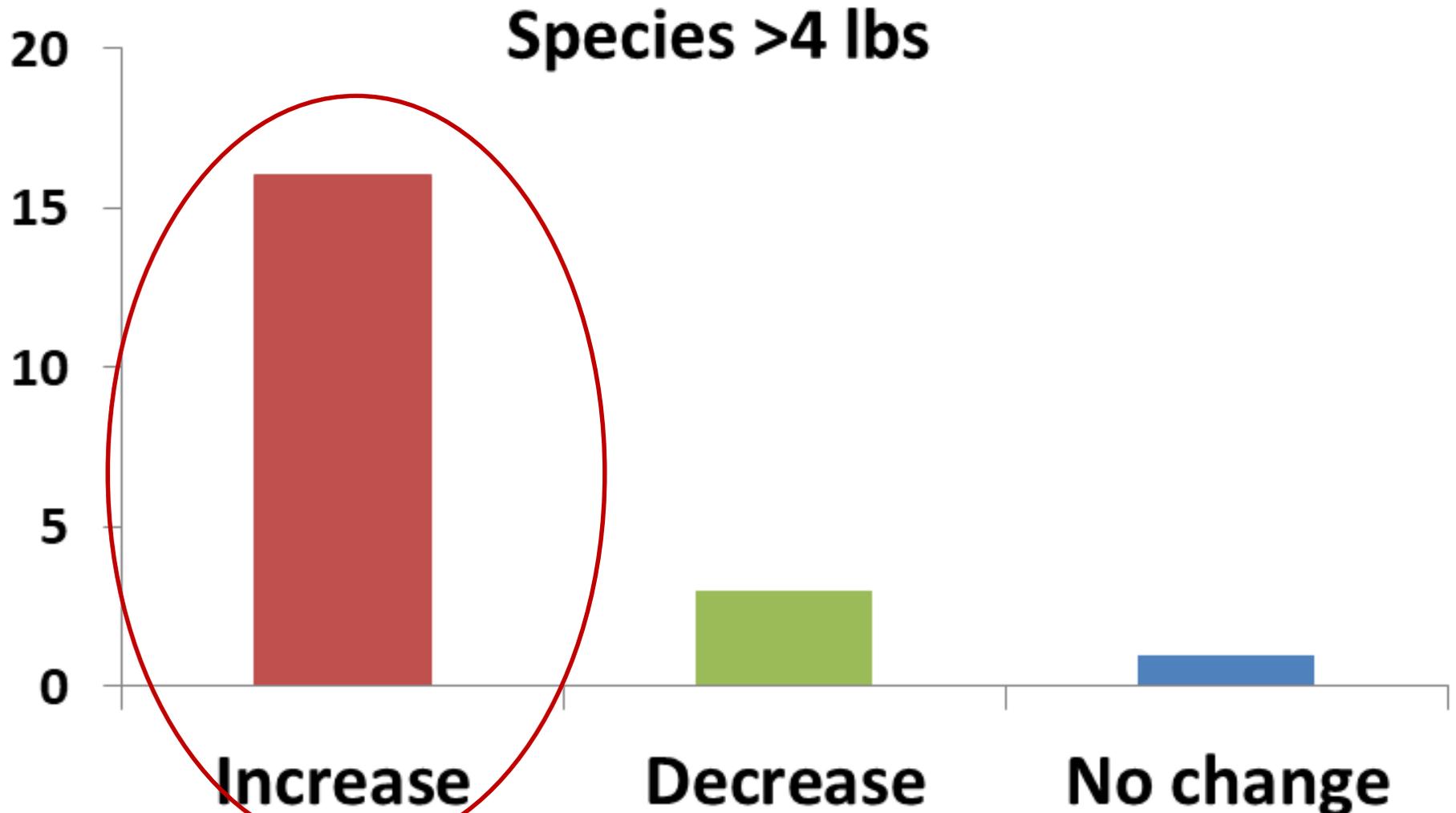
Population statistics: birds with body masses  $\geq 4$  lbs struck by civil aircraft  $\geq 20$  times, USA, 1990 – 2018 (page 1 of 2)

Rank	Species	1990	2018	Net change	PCR
1	Snow goose	4,270,000	15,120,000	10,850,000	3.54
2	Turkey vulture	4,807,000	10,469,000	5,662,000	2.18
3	Canada goose	3,112,000	7,499,000	4,387,000	2.41
4	Wild turkey	3,900,000	6,200,000	2,300,000	1.59
5	Black vulture	616,000	2,756,000	2,140,000	4.47
6	D.-cr cormorant	460,000	2,259,000	1,799,000	4.91
7	Gr w-f goose	1,023,000	1,587,000	564,000	1.55
8	A. white pelican	53,000	567,000	514,000	10.69
9	Brown pelican	107,000	423,000	316,000	3.96
10	Bald eagle	35,000	230,000	195,000	6.56

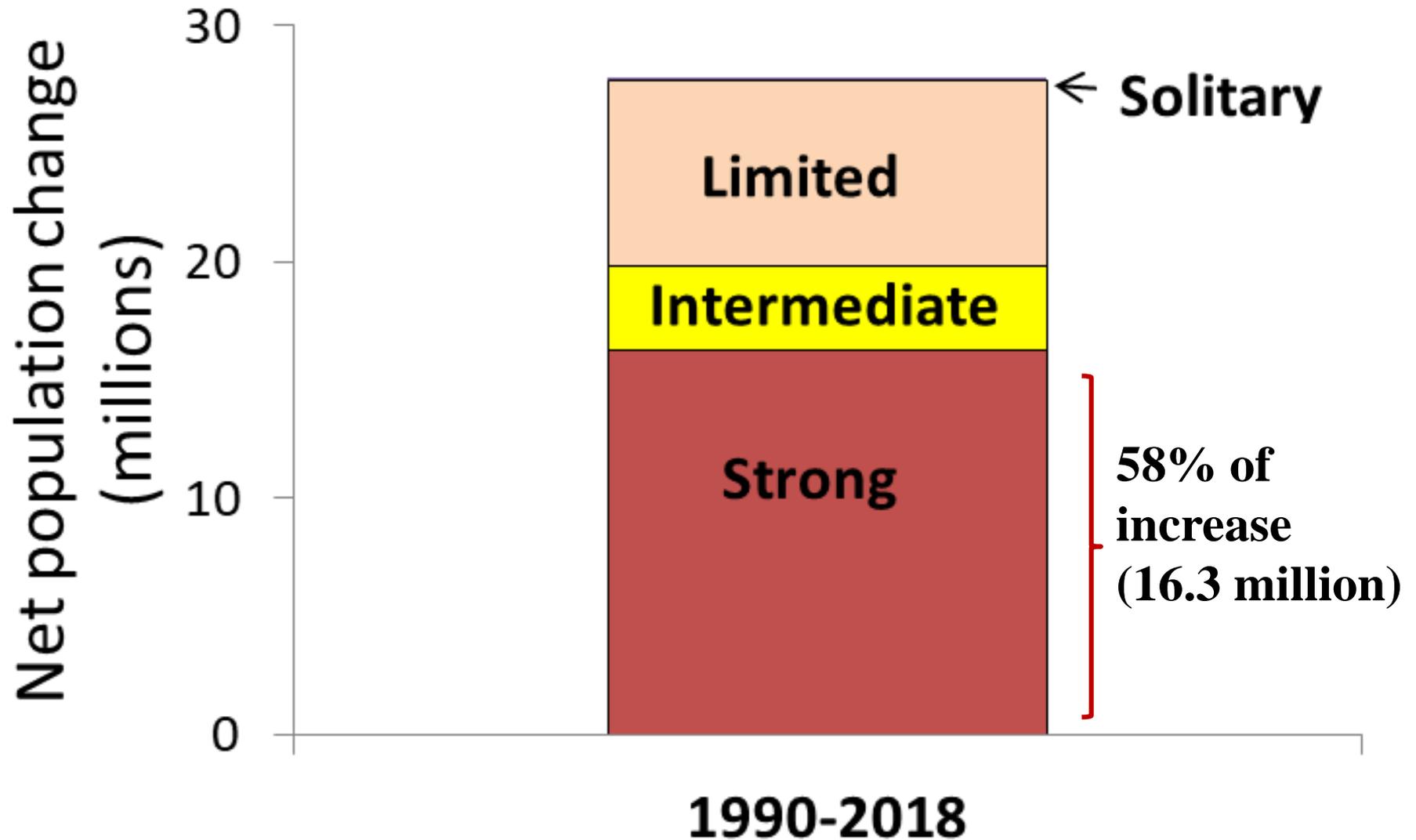
Population statistics: birds with body masses  $\geq 4$  lbs struck by civil aircraft  $\geq 20$  times, USA, 1990 – 2018 (page 2 of 2)

Rank	Species	1990	2018	Net change	PCR
11	Common loon	548,000	698,000	150,000	1.27
12	Sandhill crane	473,000	609,000	136,000	1.29
13	Tundra swan	196,000	248,000	52,000	1.26
14	Wood stork	16,000	56,000	40,000	3.53
15	Great blue heron	74,000	96,000	22,000	1.30
16	Golden eagle	57,000	64,000	7,000	1.12
17	Snowy owl	30,000	30,000	0	1.00
18	Gr bl-backed gull	252,000	83,000	-169,000	0.33
19	Gr sage-grouse	652,000	409,000	-243,000	0.63
20	Glaucous gull	940,000	45,000	-895,000	0.05
	<b>Total</b>	<b>21,621,000</b>	<b>49,448,000</b>	<b>27,827,000</b>	<b>2.29</b>

**16 of the 20 “Large-bird” species showed significant population increases, 1990-2018**



The 20 large bird species had a net population change of **27.8 million birds, 1990-2018**



# Medium birds

Bird size class	Number of species struck by civil aircraft (1990-2018)		
	$\geq 20$ strikes	$< 20$ strikes	Total
2.5–3.9 lbs	16 species	15 species	31 species

Red-tailed hawk (2.7 lb)



Strike statistics: birds with body masses 2.5-3.9 lbs struck by civil aircraft  $\geq 20$  times, USA, 1990 – 2018 (page 1 of 2)

Rank	Species	Mass (lbs) <sup>a</sup>	Total K	Dam K	Flocking behavior <sup>b</sup>
1	Red-tailed hawk	2.7	2,944	404	Limited
2	Mallard	2.8	1,063	216	Strong
3	Herring gull	2.5	1,442	130	Intermediate
4	Osprey	3.5	427	99	Limited
5	Great horned owl	3.4	299	39	Solitary
6	Gl-winged gull	2.6	138	26	Intermediate
7	Swainson's hawk	2.5	175	23	Limited
8	Anhinga	2.7	45	22	Intermediate
9	R-necked pheasant	2.9	95	18	Limited
10	Western gull	2.5	157	18	Limited

Strike statistics: birds with body masses 2.5-3.9 lbs struck by civil aircraft  $\geq 20$  times, USA, 1990 – 2018 (page 2 of 2)

Rank	Species	Mass (lbs) <sup>a</sup>	Total K	Dam K	Flocking behavior <sup>b</sup>
11	Brant	3.0	51	16	Strong
12	Western grebe	3.2	48	15	Strong
13	Canvasback	2.8	27	14	Strong
14	Am black duck	3.1	69	8	Strong
15	Crested caracara	2.7	23	6	Limited
16	Ferruginous hawk	3.9	44	5	Solitary
	<b>Total</b>		<b>7,047</b>	<b>1,059</b>	<b>8 of 16 S or I</b>

Population statistics: 2.5-3.9 lb birds struck by civil aircraft  
 $\geq 20$  times, USA, 1990–2018 (page 1 of 2)

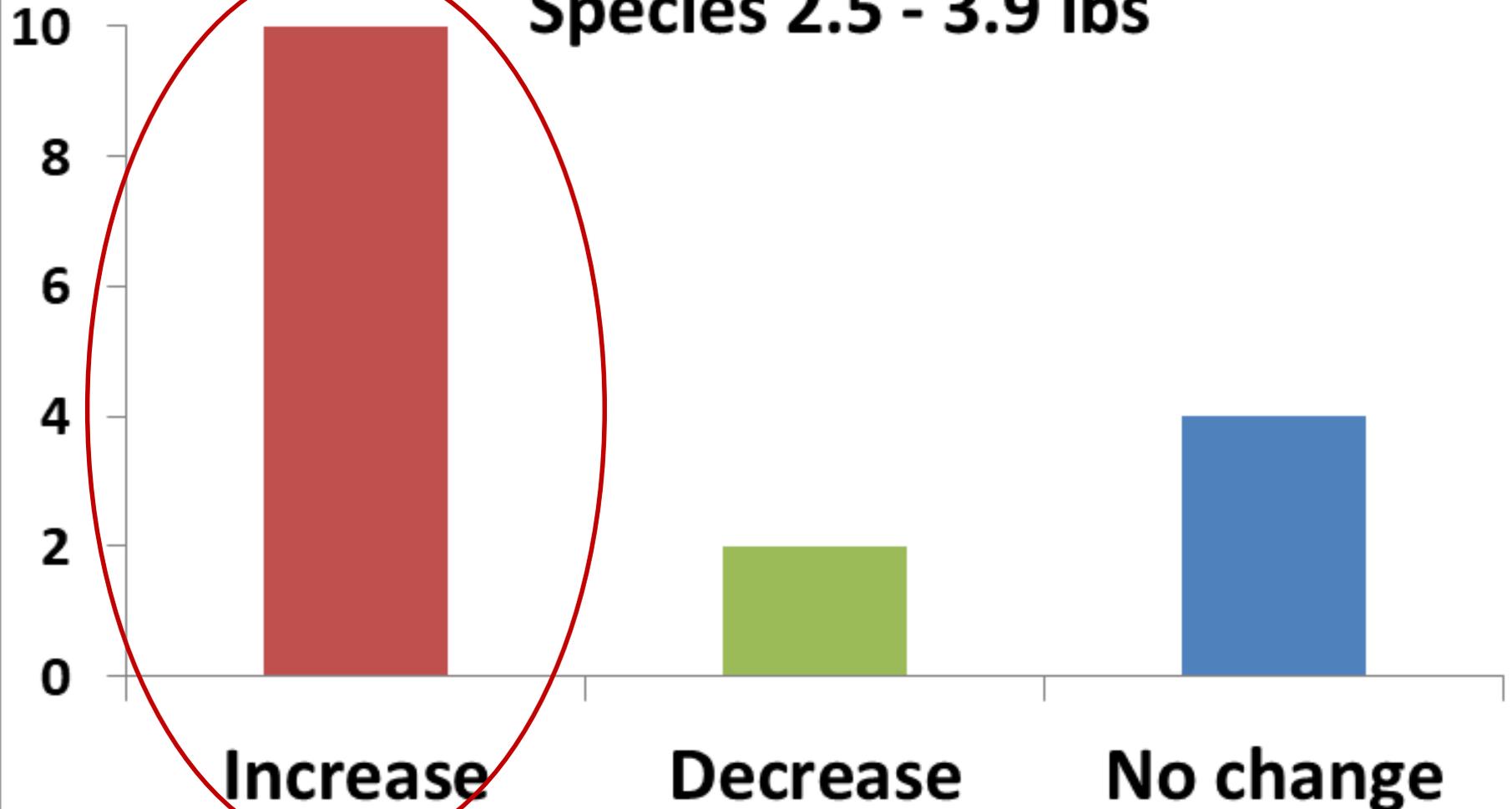
Rank	Species	1990	2018	Net change	PCR
1	Mallard	6,689,000	11,598,000	4,909,000	1.73
2	Red-tailed hawk	1,960,000	3,065,000	1,105,000	1.56
3	Osprey	194,000	547,000	353,000	2.83
4	Swainson's hawk	646,000	861,000	215,000	1.33
5	Canvasback	503,000	718,000	215,000	1.43
6	Crested caracara	28,000	163,000	135,000	5.85
7	R-neck pheasant	17,397,000	17,499,000	102,000	1.01
8	Western grebe	101,000	137,000	36,000	1.36
9	Anhinga	21,000	54,000	33,000	2.50
10	Ferruginous hawk	89,000	117,000	28,000	1.32

Population statistics: 2.5-3.9 lbs birds struck by civil aircraft  
≥20 times, USA, 1990 – 2018 (page 2 of 2)

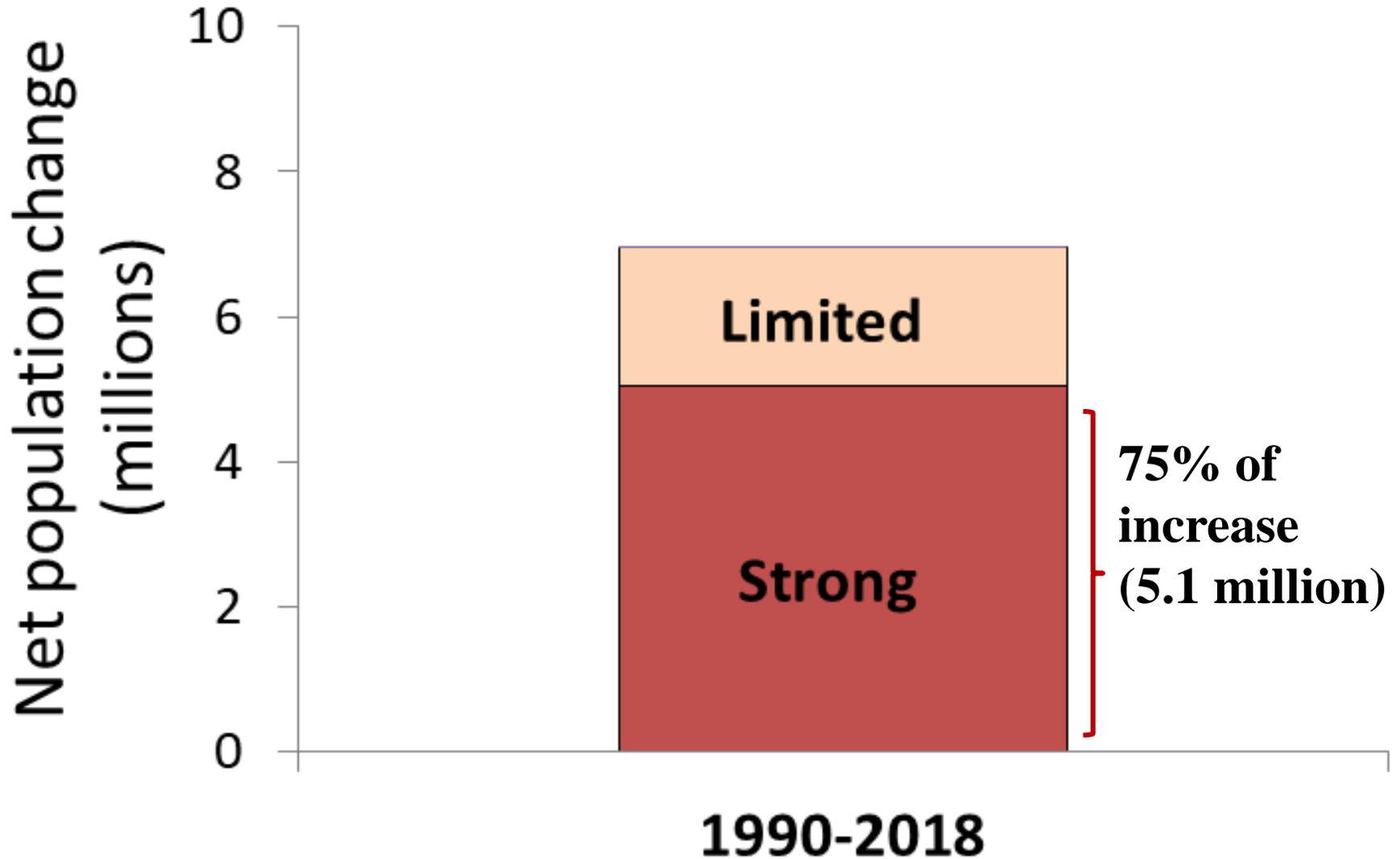
Rank	Species	1990	2018	Net change	PCR
11	Brant	280,000	303,000	23,000	1.08
12	Western gull	84,000	92,000	8,000	1.10
13	Great horned owl	4,011,000	3,997,000	-14,000	1.00
14	Gl-winged gull	392,000	358,000	-34,000	0.91
15	Am black duck	970,000	816,000	-154,000	0.84
16	Herring gull	431,000	183,000	-248,000	0.42
	<b>Total</b>	<b>33,796,000</b>	<b>40,508,000</b>	<b>6,712,000</b>	<b>1.20</b>

**10 of the 16 “medium-bird” species showed significant population increases, 1990-2018**

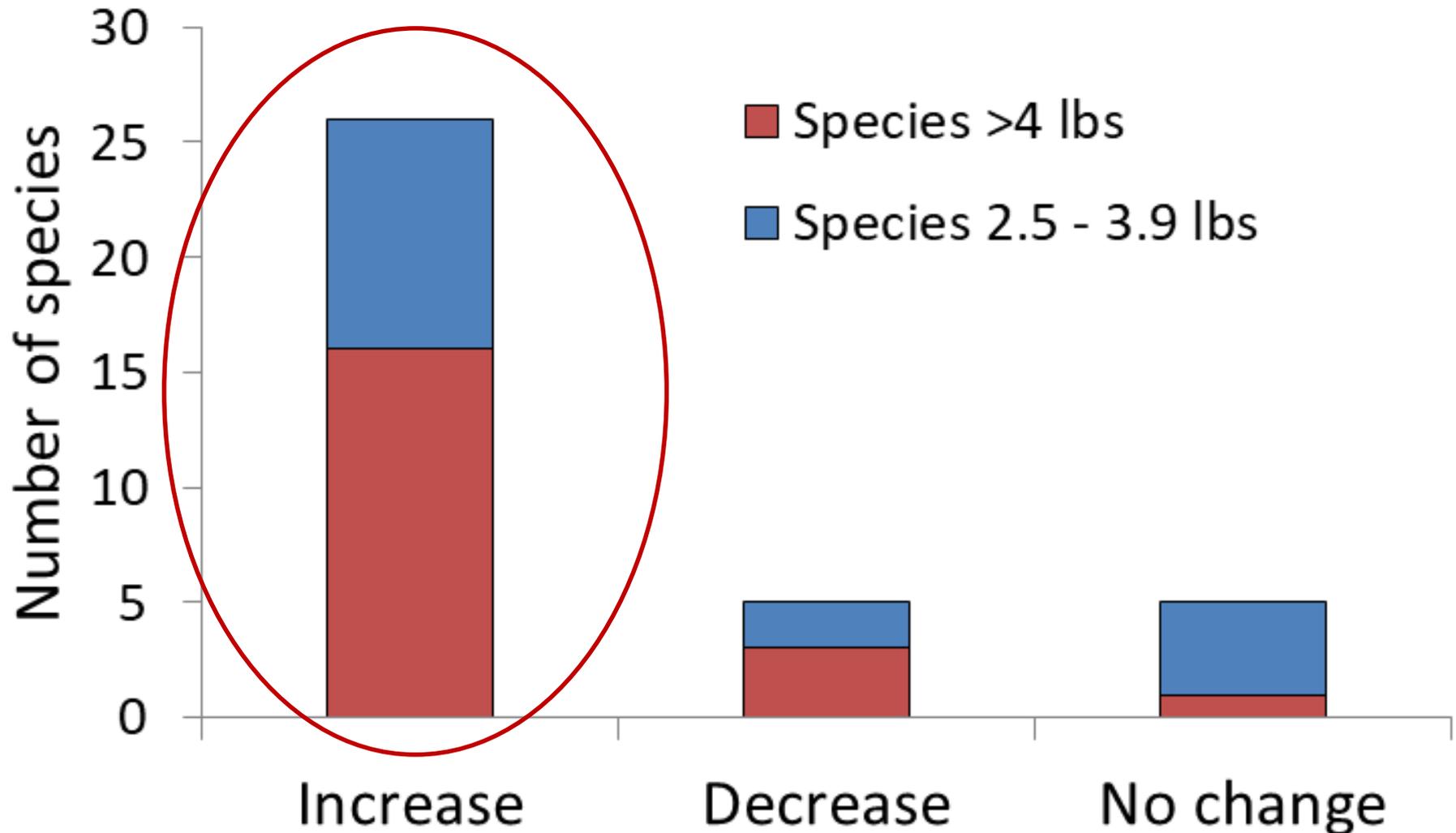
**Species 2.5 - 3.9 lbs**



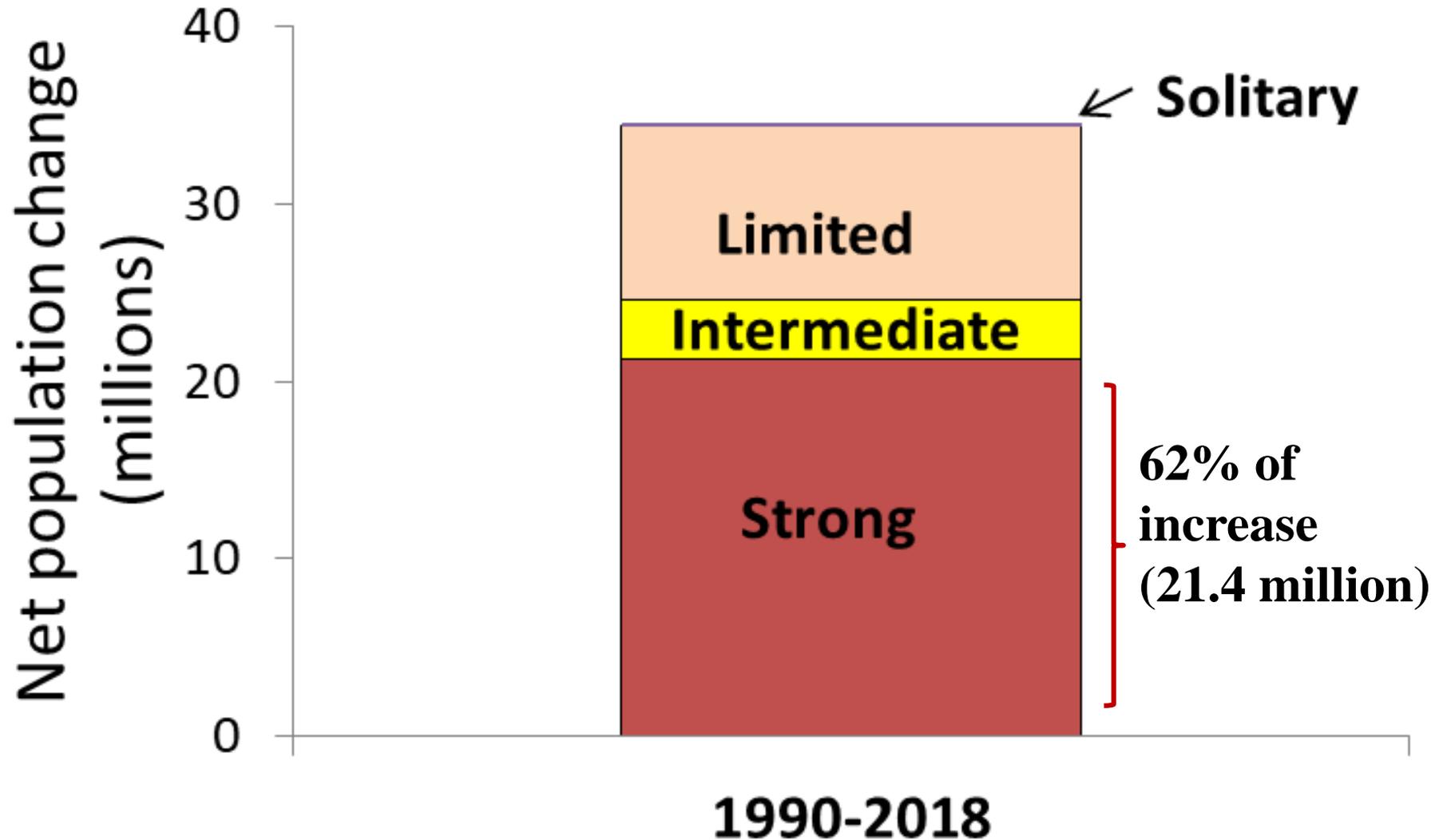
The 16 medium bird species had a net population change of **6.7 million birds, 1990-2018**



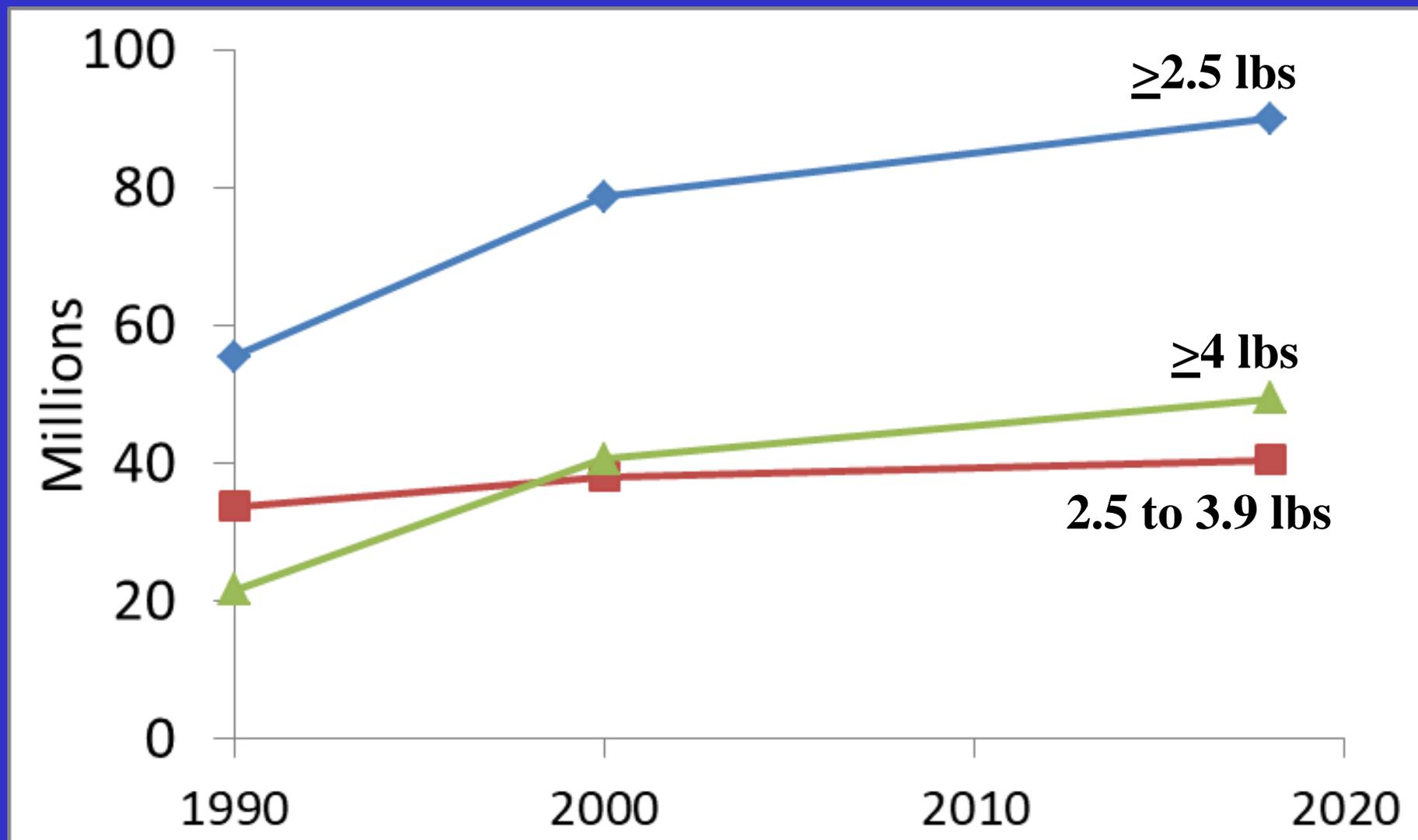
**26 of the 36 species  $\geq 2.5$  lbs showed significant population increases, 1990-2018**



The 36 bird species >2.5 lbs had a net population change of **34.5 million birds**, 1990-2018



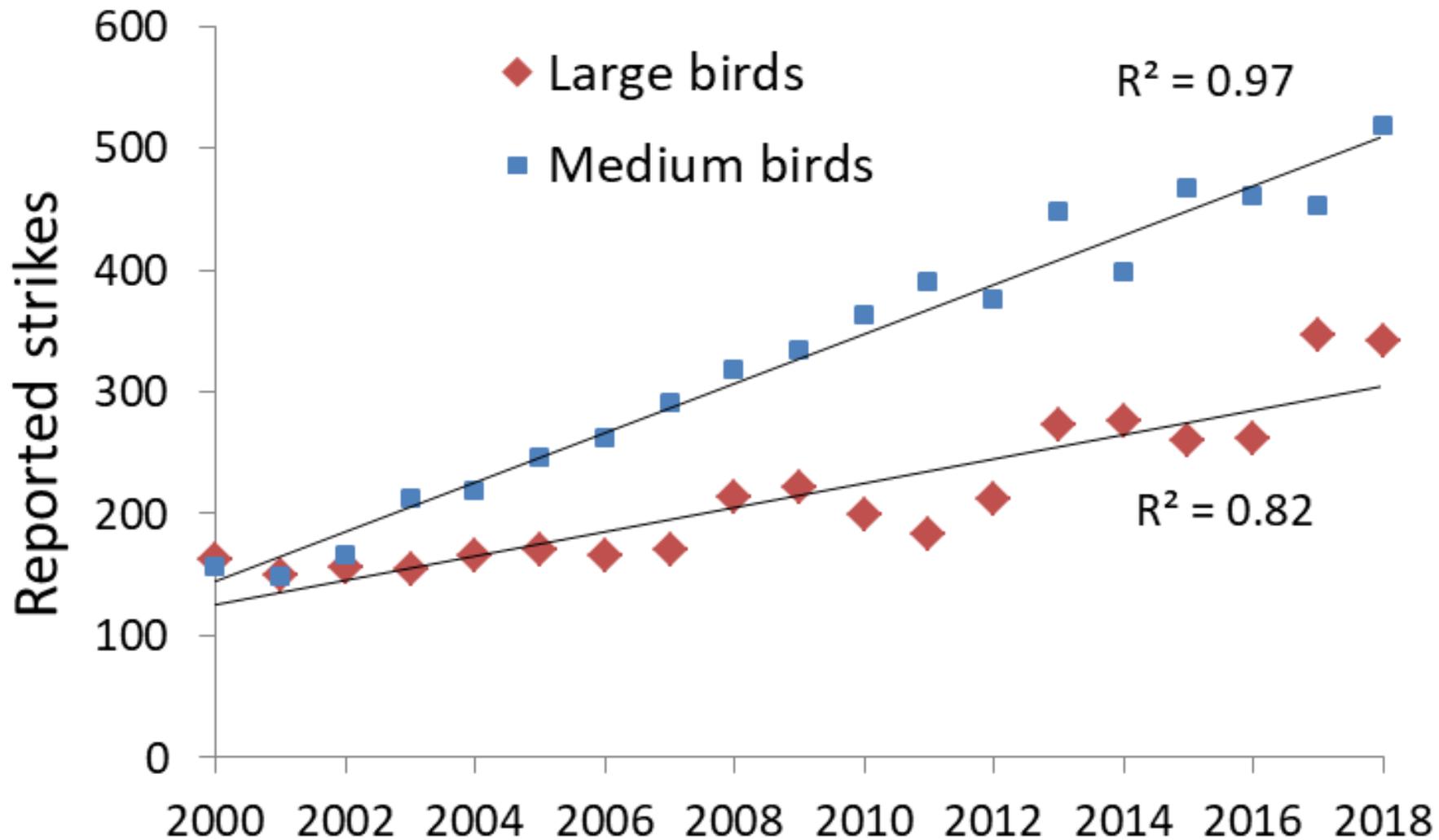
# >2.5 lbs: population gain of 34.5 million, 1990-2018



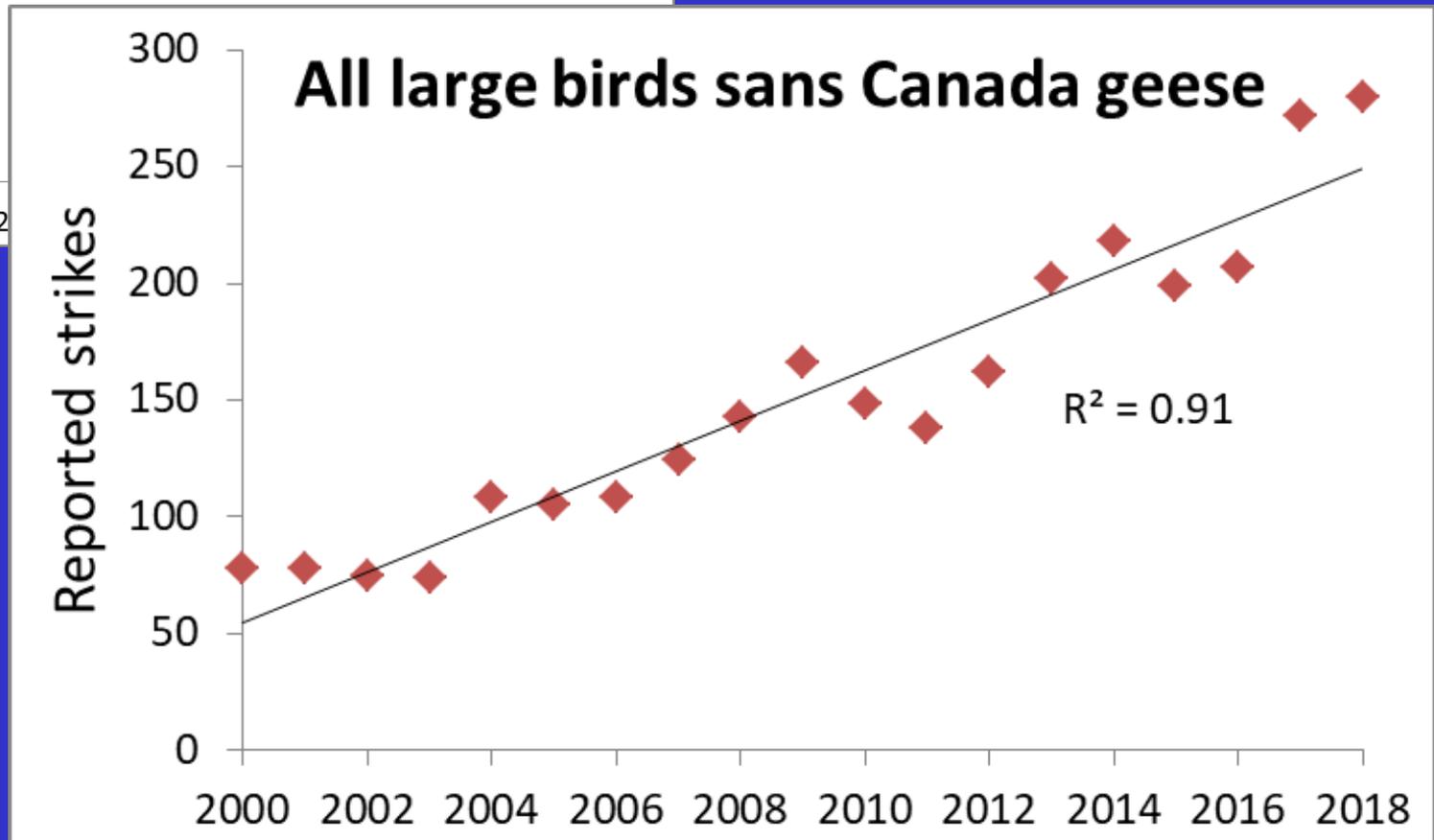
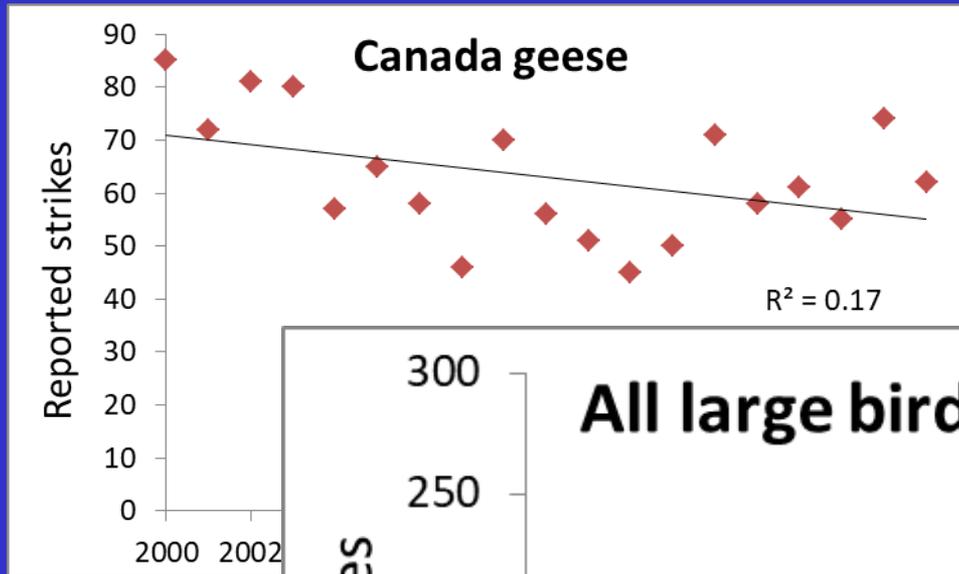
# What are trends in strikes for medium and large birds, 2000-2018?



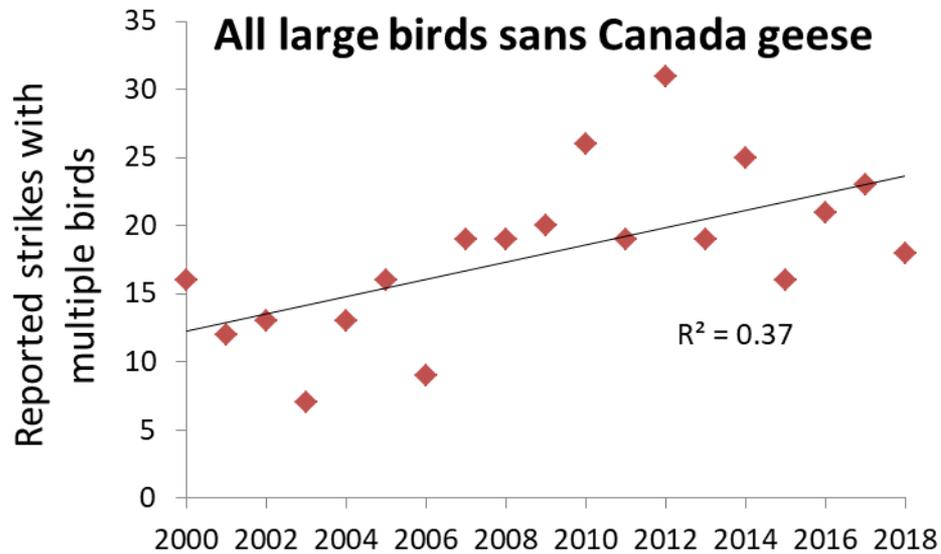
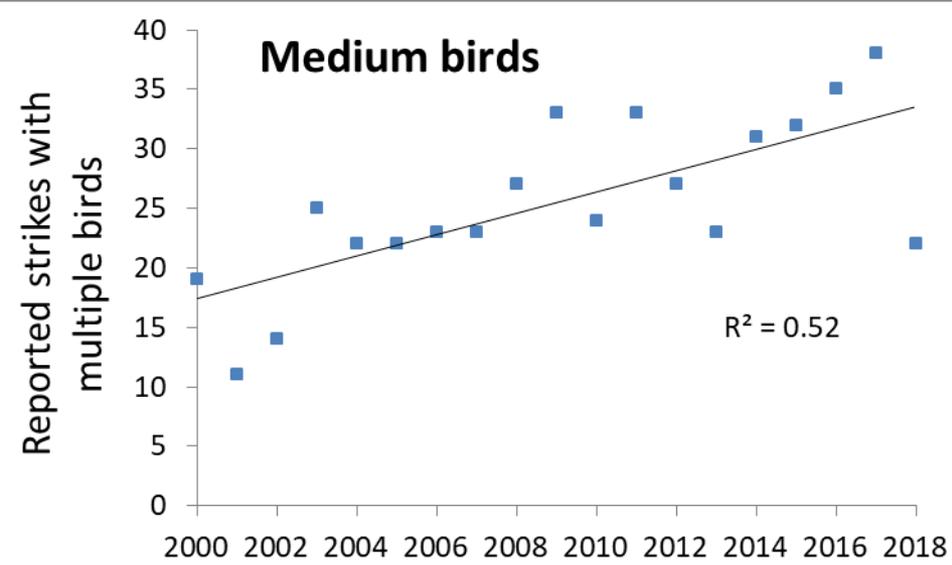
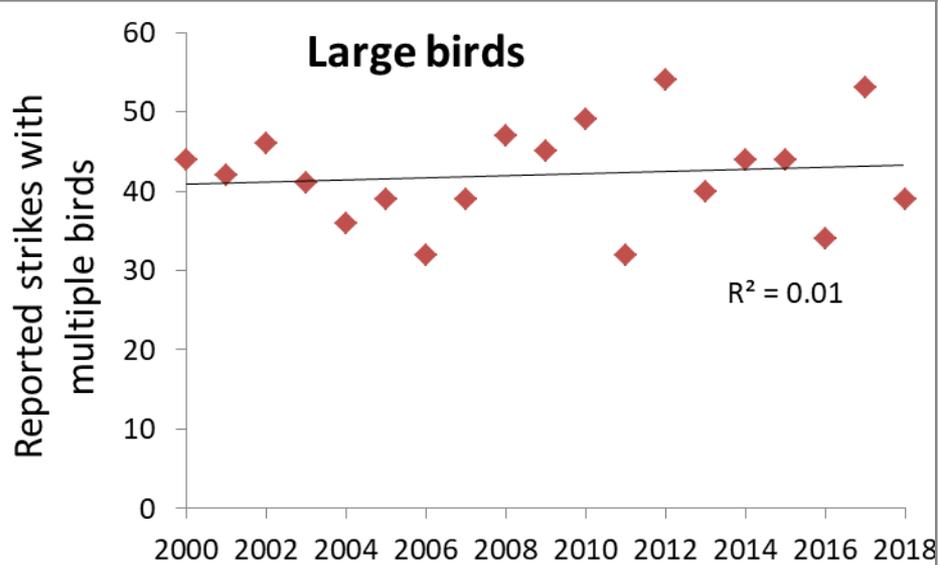
# Trend in strikes with Large and Medium birds



# Trend in strikes with large birds



# Multiple-bird strikes with large & medium birds



# Conclusions

## Large & medium bird species, 1990-2018

- **20 large species** = net gain of 27.8 million birds.
- **58% of increase** = strongly flocking species.
- **16 medium species** = net gain of 6.7 million birds.
- **75% of increase** = strongly flocking species.
- **# Strikes (Large & Medium)** = strong increases.

# Recommendations: large & medium birds

- 1) Management actions to reduce populations of resident Canada geese around airports should be continued and strongly supported by the aviation industry.



# Recommendations: large & medium birds

2) Wildlife management actions at airports are limited for many of the other  $\geq 4$ -lb species; therefore:

Efforts to separate these large birds from aircraft (e.g., radar, ATC, enhanced aircraft visibility) are critical initiatives.



**Scientific American, Aug 2019**

**Ultraviolet illumination helps birds avoid power lines**

**“Over a 38-night period, sandhill crane collisions decreased 98% when the lights were on”**

# Recommendations: large & medium birds

## 3) FAA and ARAC need to consider the following:

- There are a lot more large & medium birds, especially large-flocking birds, today than 30 years ago,
- The overall trend of increase has not abated, and
- Traditional wildlife management actions to abate risks are limited for many of these species.
- These facts should be considered in standards and advisory material for the design and certification of aircraft components and engines.



**Our Goal:**

**Safer Skies for all who fly ....**

**Birds *and* People!**



**Questions?**