

flgaCBC

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February 20, 2019

Introduction

CBC and BBS have become powerful tools for understanding large-scale patterns of population changes in North American birds, having been applied to guilds, and individual species.

Restrictions and major biases, however, do apply to these citizen science data (Dunn et al. 2005). How well do trends in local CBCs mirror larger trends? Can we use insights from long-term local participants to identify possible causes of some of these trends? What have local birders observed that might help explain declines and increases. Habitat loss, succession, climate, dog fennel, prairie regrowth, drought, cyclic changes of drying, Are there processes other than actual population changes creating apparent population changes (superior birding skills (Sauer et al. 1994; Dunn et al. 2005), more knowledge of where birds might be hiding? More competition among groups? More bird feeder watchers (Dunn et al. 2005)? Better techniques such as playbacks of mobbing or screech owls? Stable populations but decreases caused by an increasing count effort that can only count a fixed number of individuals? Declining birding skills as we get older?) Changes in effort over time (Butcher and McCulloch 1990)

On the CBC data

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The count format (broken up into 11 teams and all day counts) was instituted in 1972, so i think that would be a good time to begin. Therefore, we analze data from 1972 to 2018.

Group the species

In some portions, we present results in groups of species according to various hypotheses. Species groupings are as follows: Declining, Ag vics, Endemic, DDT vics, Feeder, Non-native, Urban adapters, North Florida winter center, Neotropical migrants, Short distance migrants, Sweetwater (see Table @ref(sppGroupTab)).

Table 1: Species groups for analysis

sppGroup	family	species
Declining	Columbidae	Common Ground-Dove
	Icteridae	Eastern Meadowlark
	Laniidae	Loggerhead Shrike
	Mimidae	Brown Thrasher
	Odontophoridae	Northern Bobwhite
	Passerellidae	Field Sparrow
		Grasshopper Sparrow
		Henslow's Sparrow
	Picidae	Northern Flicker
		Red-Headed Woodpecker
	Accipitridae	Northern Harrier
		Red-Tailed Hawk
	Charadriidae	Killdeer
	Columbidae	Common Ground-Dove
		Mourning Dove

Ag vics	Falconidae	American Kestrel Boat-Tailed Grackle
	Icteridae	Common Grackle Eastern Meadowlark Red-Winged Blackbird
	Laniidae	Loggerhead Shrike
	Mimidae	Brown Thrasher
	Motacillidae	Northern Mockingbird American Pipit
	Passerellidae	Field Sparrow Savannah Sparrow Vesper Sparrow
	Passeridae	House Sparrow
	Turdidae	Eastern Bluebird
	Tyrannidae	Eastern Phoebe
	Tytonidae	Barn Owl
Endemic	Passerellidae	Bachman's Sparrow
	Picidae	Red-Cockaded Woodpecker
	Sittidae	Brown-Headed Nuthatch
DDT vics		
	Accipitridae	Bald Eagle Cooper's Hawk Red-Shouldered Hawk Sharp-Shinned Hawk
	Falconidae	Merlin Peregrine Falcon
	Pandionidae	Osprey
	Phalacrocoracidae	Double-Crested Cormorant
Feeder	Accipitridae	Cooper's Hawk Sharp-Shinned Hawk Indigo Bunting
	Cardinalidae	Northern Cardinal Painted Bunting
	Columbidae	Mourning Dove
	Corvidae	American Crow Blue Jay
	Fringillidae	American Goldfinch House Finch Pine Siskin
	Icteridae	Baltimore Oriole Brown-Headed Cowbird
	Laridae	Ring-Billed Gull
	Paridae	Carolina Chickadee Tufted Titmouse
	Parulidae	Yellow-Throated Warbler
	Passerellidae	Chipping Sparrow
	Passeridae	House Sparrow
	Picidae	Red-Bellied Woodpecker
	Sittidae	Red-Breasted Nuthatch
	Troglodytidae	Carolina Wren
Non-native		
	Anatidae	Black-Bellied Whistling-Duck Egyptian Goose Mallard
	Columbidae	Eurasian Collared-Dove Mourning Dove
	Passeridae	Rock Dove
	Sturnidae	House Sparrow European Starling

Urban adapters	Accipitridae	Red-Shouldered Hawk Black-Bellied Whistling-Duck Egyptian Goose
	Anatidae	Mallard Canada Goose Hooded Merganser Wood Duck
	Cardinalidae	Northern Cardinal
	Cathartidae	Black Vulture Turkey Vulture
	Columbidae	Eurasian Collared-Dove Mourning Dove Rock Dove American Crow
	Corvidae	Blue Jay Fish Crow
	Fringillidae	House Finch Boat-Tailed Grackle
	Icteridae	Brown-Headed Cowbird Common Grackle
	Laridae	Ring-Billed Gull
	Mimidae	Brown Thrasher Northern Mockingbird
	Paridae	Carolina Chickadee Tufted Titmouse
	Passeridae	House Sparrow
	Picidae	Pileated Woodpecker
	Rallidae	Common Gallinule
	Strigidae	Eastern Screech-Owl Great Horned Owl
	Sturnidae	European Starling
	Threskiornithidae	White Ibis
	Troglodytidae	Carolina Wren House Wren
	Tytonidae	Barn Owl
	Alcedinidae	Belted Kingfisher
	Cardinalidae	Northern Cardinal
	Charadriidae	Killdeer
	Columbidae	Mourning Dove American Crow
	Corvidae	Blue Jay Fish Crow
	Fringillidae	American Goldfinch
	Icteridae	Brown-Headed Cowbird Brown Thrasher
	Mimidae	Gray Catbird Northern Mockingbird
	Paridae	Carolina Chickadee Tufted Titmouse Black-And-White Warbler Common Yellowthroat Orange-Crowned Warbler
	Parulidae	Palm Warbler Pine Warbler Yellow-Rumped Warbler Yellow-Throated Warbler Chipping Sparrow

North Florida winter center

	Passerellidae	Swamp Sparrow
		Downy Woodpecker
	Picidae	Red-Bellied Woodpecker
		Yellow-Bellied Sapsucker
	Polioptilidae	Blue-Gray Gnatcatcher
	Regulidae	Ruby-Crowned Kinglet
	Scolopacidae	Wilson's Snipe
		Carolina Wren
	Troglodytidae	House Wren
		Sedge Wren
	Turdidae	American Robin
		Eastern Bluebird
	Tyrannidae	Eastern Phoebe
	Vireonidae	Blue-Headed Vireo
		White-Eyed Vireo
Neotropical migrants	Apodidae	Vaux's Swift
	Caprimulgidae	Eastern Whip-Poor-Will
		Dickcissel
		Indigo Bunting
	Cardinalidae	Painted Bunting
		Rose-Breasted Grosbeak
		Summer Tanager
		Western Tanager
		Baltimore Oriole
	Icteridae	Bullock's Oriole
		Orchard Oriole
	Icteriidae	Yellow-Breasted Chat
		American Redstart
		Black-And-White Warbler
		Black-Throated Blue Warbler
		Black-Throated Green Warbler
		Blackburnian Warbler
		Blue-Winged Warbler
		Louisiana Waterthrush
	Parulidae	Magnolia Warbler
		Nashville Warbler
		Northern Parula
		Northern Waterthrush
		Ovenbird
		Prairie Warbler
		Tennessee Warbler
		Yellow Warbler
		Wilson's Warbler
	Trochilidae	Black-Chinned Hummingbird
		Ruby-Throated Hummingbird
		Rufous Hummingbird
	Turdidae	Wood Thrush
		Ash-Throated Flycatcher
		Brown-Crested Flycatcher
	Tyrannidae	Eastern Kingbird
		Least Flycatcher
		Western Kingbird
		Vermilion Flycatcher
	Vireonidae	Yellow-Throated Vireo
	Accipitridae	Northern Harrier
		Sharp-Shinned Hawk
	Certhiidae	Brown Creeper
		Pine Siskin

Short distance migrants	Fringillidae	Purple Finch
	Gruidae	Sandhill Crane
	Icteridae	Common Grackle
		Red-Winged Blackbird
		Rusty Blackbird
		Dark-Eyed Junco
	Passerellidae	Eastern Towhee
		Fox Sparrow
		Song Sparrow
		Vesper Sparrow
		White-Throated Sparrow
		White-Crowned Sparrow
		Golden-Crowned Kinglet
		American Woodcock
Sweetwater	Regulidae	Red-Breasted Nuthatch
	Scolopacidae	Winter Wren
	Sittidae	Hermit Thrush
	Troglodytidae	
	Turdidae	
	Accipitridae	Snail Kite
	Anatidae	Blue-Winged Teal
	Anhingidae	Anhinga
	Aramidae	Limpkin
	Ardeidae	American Bittern
		Least Bittern
		Great Blue Heron
		Little Blue Heron
		Tricolored Heron
		Green Heron
		Black-Crowned Night-Heron
		Yellow-Crowned Night-Heron
	Ciconiidae	Wood Stork
	Phalacrocoracidae	Double-Crested Cormorant
	Rallidae	King Rail
		Purple Gallinule
		Sora
		Virginia Rail
	Threskiornithidae	White Ibis
		Glossy Ibis
		White-Faced Ibis
	Troglodytidae	Marsh Wren

Statistical analysis of population trends

Model structure

We estimated species population trends in the Gainesville, Florida Christmas Bird Count (CBC; National Audubon Society REF) circle (FLGA) for the period of 1972 to 2015 using generalized additive models (GAMs, Hastie and Tibshirani 1990; Wood 2006). GAMs are a flexible implementation of generalized linear models in cases where species' populations exhibit non-linear trends. GAMs optimize the predictability of the relationship between the response and predictor variable(s) while accounting for the noise associated with year-to-year fluctuations in species counts. We analyzed individual species' trends using the a generalized additive model:

$$g(E(y_i)) = \beta_0 f(year_i) + \epsilon_i, y_i \text{ some exp. distribution} \quad (1)$$

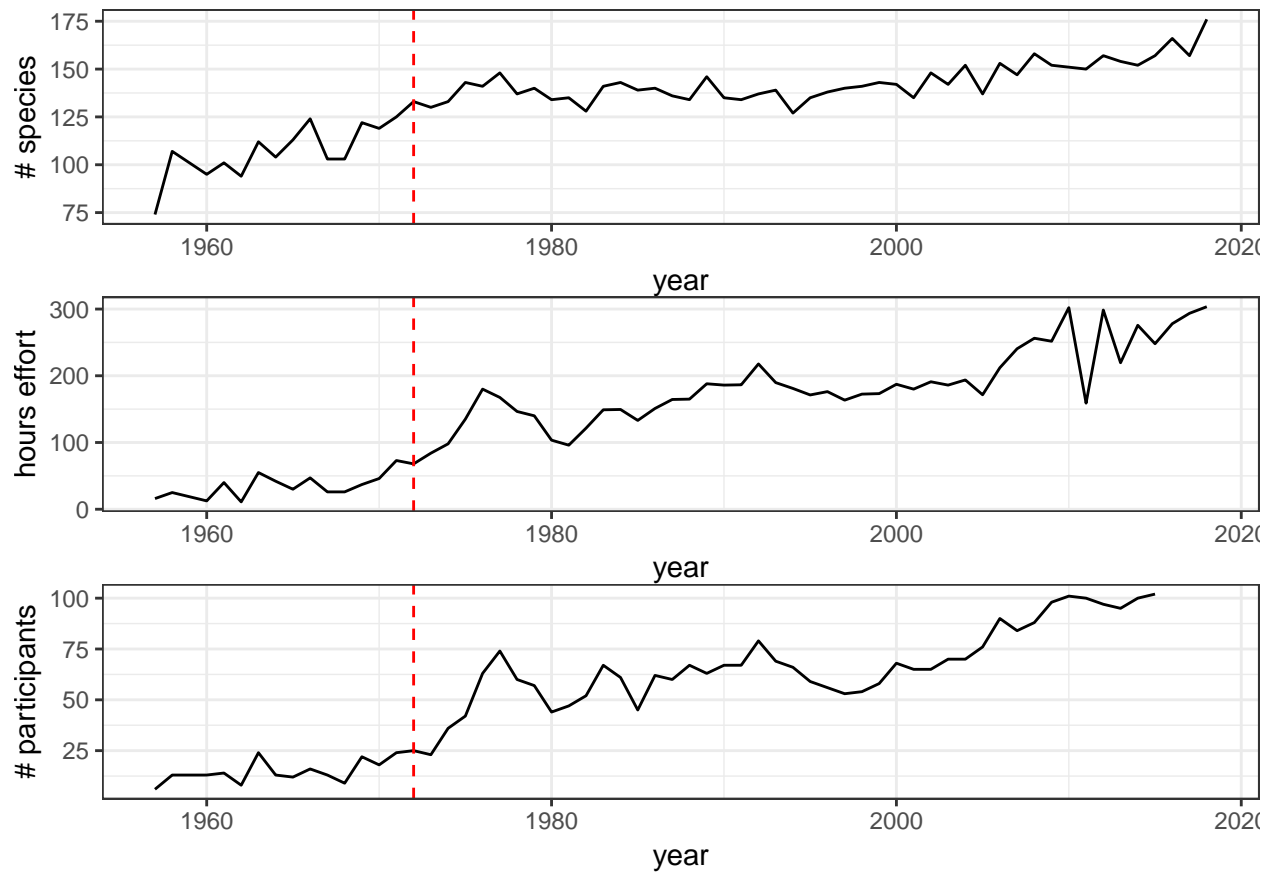


Figure 1: Annual effort and species richness for the FLGA CBC circle. Dashed line indicates year we begin analyses.

- Most species trends were non-linear over the study period. GAM optimizes the residuals by fitting knots in the model (count, response value), so if the trend is linear, it will fit it.
- Around 1980 the hours effort and number of participants increased linearly, therefore we did not fit a smooth to the hours effort (see @ref(fig:effortPlots)).
- We controlled for temporal autocorrelation by taking first, second, and third differences (AR1, AR2, and AR3). We chose the best fitting model for each species by running likelihood ratios
- A GAM basically a GLM where the linear predictor(s) are influenced by some unknown smooth function, and a GAMM is a GLMM where “...”
- “for a Poisson model the expected value after log transformation is modelled to be linearly dependent on the explanatory variables”
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Analysis results

We controlled for stationarity by taking second differences (i.e., using an AR model with lag = 2).

Table 2: Species with sufficient data for analysis

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Wood Duck
Mallard
Blue-Winged Teal
Hooded Merganser
Northern Bobwhite
Double-Crested Cormorant
Anhinga
Great Blue Heron
Little Blue Heron
Tricolored Heron
Green Heron
Black-Crowned Night-Heron
White Ibis
Glossy Ibis
Black Vulture
Turkey Vulture
Osprey
Northern Harrier
Sharp-Shinned Hawk
Cooper’s Hawk
Bald Eagle
Red-Shouldered Hawk
Red-Tailed Hawk
King Rail
Virginia Rail
Sora
Sandhill Crane
Killdeer
Wilson’s Snipe
American Woodcock
Ring-Billed Gull
Rock Dove

Mourning Dove
Eastern Screech-Owl
Great Horned Owl

Belted Kingfisher
Red-Headed Woodpecker
Red-Bellied Woodpecker
Yellow-Bellied Sapsucker
Downy Woodpecker

Northern Flicker
Pileated Woodpecker
American Kestrel
Eastern Phoebe
Loggerhead Shrike

White-Eyed Vireo
Blue-Headed Vireo
Blue Jay
American Crow
Fish Crow

Carolina Chickadee
Tufted Titmouse
Brown-Headed Nuthatch
House Wren
Sedge Wren

Marsh Wren
Carolina Wren
Blue-Gray Gnatcatcher
Ruby-Crowned Kinglet
Eastern Bluebird

Hermit Thrush
American Robin
Gray Catbird
Northern Mockingbird
Brown Thrasher

European Starling
American Pipit
Ovenbird
Black-And-White Warbler
Orange-Crowned Warbler

Common Yellowthroat
Palm Warbler
Pine Warbler
Yellow-Rumped Warbler
Yellow-Throated Warbler

Eastern Towhee
Chipping Sparrow
Field Sparrow
Vesper Sparrow
Savannah Sparrow

Song Sparrow
Swamp Sparrow
White-Throated Sparrow
Northern Cardinal
Red-Winged Blackbird
Eastern Meadowlark

Common Grackle
Boat-Tailed Grackle
Brown-Headed Cowbird
Baltimore Oriole

American Goldfinch
House Sparrow

References not yet defined in .bib

Fewster, Rachel M., et al. "Analysis of population trends for farmland birds using generalized additive models." *Ecology* 81.7 (2000): 1970-1984. Hastie, Trevor J., and Robert J. Tibshirani. *Generalized additive models*. Vol. 43. CRC Press, 1990. R Core Team (2015). *R: A language and environment for statistical computing*. R Founding for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>. Wood, S.N. (2006) *Generalized Additive Models: An Introduction with R*. Chapman and Hall/CRC.