flgaCBC

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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

Warning: Removed 3 rows containing missing values (geom_path).

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

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

	Falconidae	American Kestrel Boat-Tailed Grackle
	Icteridae	Common Grackle Eastern Meadowlark Red-Winged Blackbird
Ag vics	Laniidae	Loggerhead Shrike
	Mimidae	Brown Thrasher Northern Mockingbird
	Motacillidae	American Pipit
	Passerellidae	Field Sparrow Savannah Sparrow Vesper Sparrow
	Passeridae	House Sparrow
	Turdidae	Eastern Bluebird
	Tyrannidae Tytonidae	Eastern Phoebe Barn Owl
	Passerellidae	
Endemic	Passeremaae Picidae	Bachman's Sparrow Red-Cockaded Woodpecker
Endenne	Sittidae	Brown-Headed Nuthatch
		Bald Eagle
	Accipitridae	Cooper's Hawk
	Accipitificae	Red-Shouldered Hawk
DDT vics		Sharp-Shinned Hawk Merlin
	Falconidae	Peregrine Falcon
	Pandionidae	Osprey
	Phalacrocoracidae	Double-Crested Cormorant
	Accipitridae	Cooper's Hawk Sharp-Shinned Hawk
	Cardinalidae	Indigo Bunting Northern Cardinal Painted Bunting
	Columbidae	Mourning Dove
	Corvidae	American Crow
		Blue Jay American Goldfinch
	Fringillidae	House Finch
Feeder	11gaac	Pine Siskin
	Icteridae	Baltimore Oriole
		Brown-Headed Cowbird
	Laridae	Ring-Billed Gull Carolina Chickadee
	Paridae	Tufted Titmouse
	Parulidae	Yellow-Throated Warbler
	Passerellidae	Chipping Sparrow
	Passeridae Picidae	House Sparrow
	Picidae Sittidae	Red-Bellied Woodpecker Red-Breasted Nuthatch
	Troglodytidae	Carolina Wren
	Anatidae	Black-Bellied Whistling-Duck Egyptian Goose Mallard
Non-native		Eurasian Collared-Dove
Non-native	Columbidae	Mourning Dove
	Passeridae	Rock Dove
	Passeridae Sturnidae	House Sparrow European Starling
	Starmae	Daropean Starting

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$\begin{array}{c} \textbf{Brown Thrasher} \\ \textbf{Mimidae} & \textbf{Gray Catbird} \\ \textbf{Northern Mockingbird} \\ \textbf{Paridae} & \textbf{Carolina Chickadee} \\ \textbf{Tufted Titmouse} \\ \textbf{Black-And-White Warble} \\ \textbf{Common Yellowthroat} \\ \textbf{Orange-Crowned Warbler} \\ \textbf{Parulidae} & \textbf{Palm Warbler} \\ \textbf{Pine Warbler} \\ \textbf{Yellow-Rumped Warbler} \end{array}$			American Goldfinch
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ParulidaePalm WarblerPine WarblerYellow-Rumped Warbler		Paridae	Tufted Titmouse Black-And-White Warbler Common Yellowthroat
Chipping Sparrow		Parulidae	Palm Warbler Pine Warbler Yellow-Rumped Warbler Yellow-Throated Warbler

	Passerellidae	Swamp Sparrow
	Picidae	Downy Woodpecker Red-Bellied Woodpecker Yellow-Bellied Sapsucker
	Polioptilidae	Blue-Gray Gnatcatcher
	Regulidae	Ruby-Crowned Kinglet
	Scolopacidae	Wilson's Snipe
	_	Carolina Wren
	${f Troglodytidae}$	House Wren
		Sedge Wren
	Turdidae	American Robin
	Turuidae	Eastern Bluebird
	Tyrannidae	Eastern Phoebe
	Vireonidae	Blue-Headed Vireo
	v ii eomuae	White-Eyed Vireo
	Apodidae	Vaux's Swift
	Caprimulgidae	Eastern Whip-Poor-Will
		Dickcissel
		Indigo Bunting
	G 11 11 1	Painted Bunting
	Cardinalidae	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
Neotropical migrants	Parulidae	Magnolia Warbler
		Nashville Warbler
		Northern Parula
		Northern Waterthrush
		Ovenbird
		Prairie Warbler Tennessee Warbler
		Yellow Warbler
		Wilson's Warbler
		Black-Chinned Hummingbird
	Trochilidae	Ruby-Throated Hummingbird
		Rufous Hummingbird
	Turdidae	Wood Thrush
		Ash-Throated Flycatcher
		Brown-Crested Flycatcher
	Tyrannidae	Eastern Kingbird
	ı yı ammae	Least Flycatcher
		Western Kingbird
		Vermilion Flycatcher
	Vireonidae	Yellow-Throated Vireo
	Agginitridas	Northern Harrier
	Accipitridae	Sharp-Shinned Hawk
	Certhiidae	Brown Creeper
		Pine Siskin

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

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

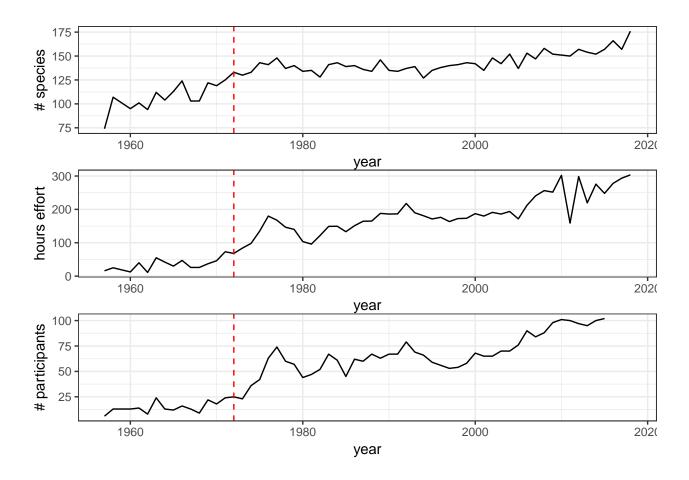


Figure 1: Annual effort and species richness for the FLGA CBC circle. Dashed line indicates year we begin analyses.

- 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 linearally, therefore we did not fit a smooth to the hours effort (see @ref(fig:effortPlots)).
- We controlled for temporal autocorrelation by taking first, second, adn 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 preditor(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"

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

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	n
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

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