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## Using Citizen Science to Examine the Range Expansion of Bewick's Wren and Lesser Goldfinch into Idaho

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# Using Citizen Science to Examine the Range Expansion of Bewick's Wren and Lesser Goldfinch Into Idaho



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## INTRODUCTION

- Bewick's Wren (*Thryomanes bewickii*; Below) and Lesser Goldfinch (*Spinus psaltria*; Right) are polytypic, primarily non-migratory passerines (Order: Passeriformes) whose historical range did not include Idaho.<sup>1</sup>
- Both species have distinct populations and have primarily seen expansion in the subspecies occurring in regions with cooler climates and lush vegetation.<sup>1</sup>
- Both species have expanded East from Oregon (Fig. 1 and 2) and more recently from the South and Southeast.<sup>1</sup>
- Both species have increased in relative abundance within Idaho throughout the last decade.
- Here we compare population growth data from eBird with climate data from NOAA to investigate correlation between shifts in Bewick's Wren and Lesser Goldfinch populations and potential causal factors such as climate change.

## Methods and Findings

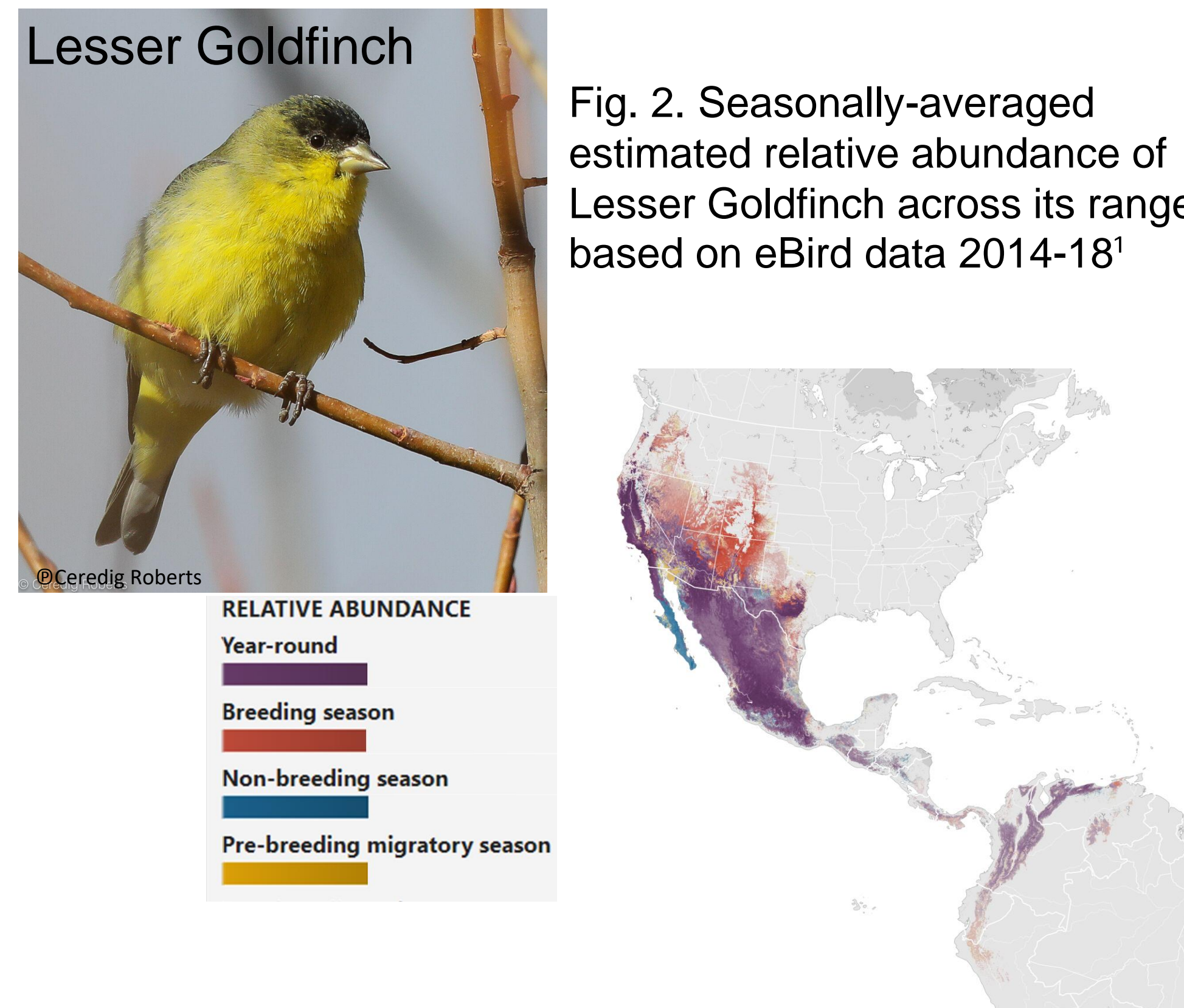


Fig. 2. Seasonally-averaged estimated relative abundance of Lesser Goldfinch across its range based on eBird data 2014-18<sup>1</sup>

## Methods

We calculated an index of relative abundance of Bewick's Wren and Lesser Goldfinch from the eBird Basic Dataset corrected for total effort data in Idaho from 1977 to present. We used exponential trendlines to visualize the rapid and exponential increase in abundance throughout the state.

eBird is the largest biodiversity-related citizen science project in the world with over 100 million sightings reported each year and is run by the Cornell Lab of Ornithology.

We then plotted historical climate data from the AgACIS database of NOAA Regional Climate Centers and the Boise Air Terminal including minimum, maximum, and average temperatures as well as yearly precipitation from 1976 to 2019.

We then visually compared trends in relative abundance to trends in climate data to investigate potential correlations.

## Results

- Both species populations have grown exponentially in Idaho since 1999 (Fig. 3).
- Climate data has shown only gradual change over the same period of time (Fig. 4, 5, and 6).

## Data

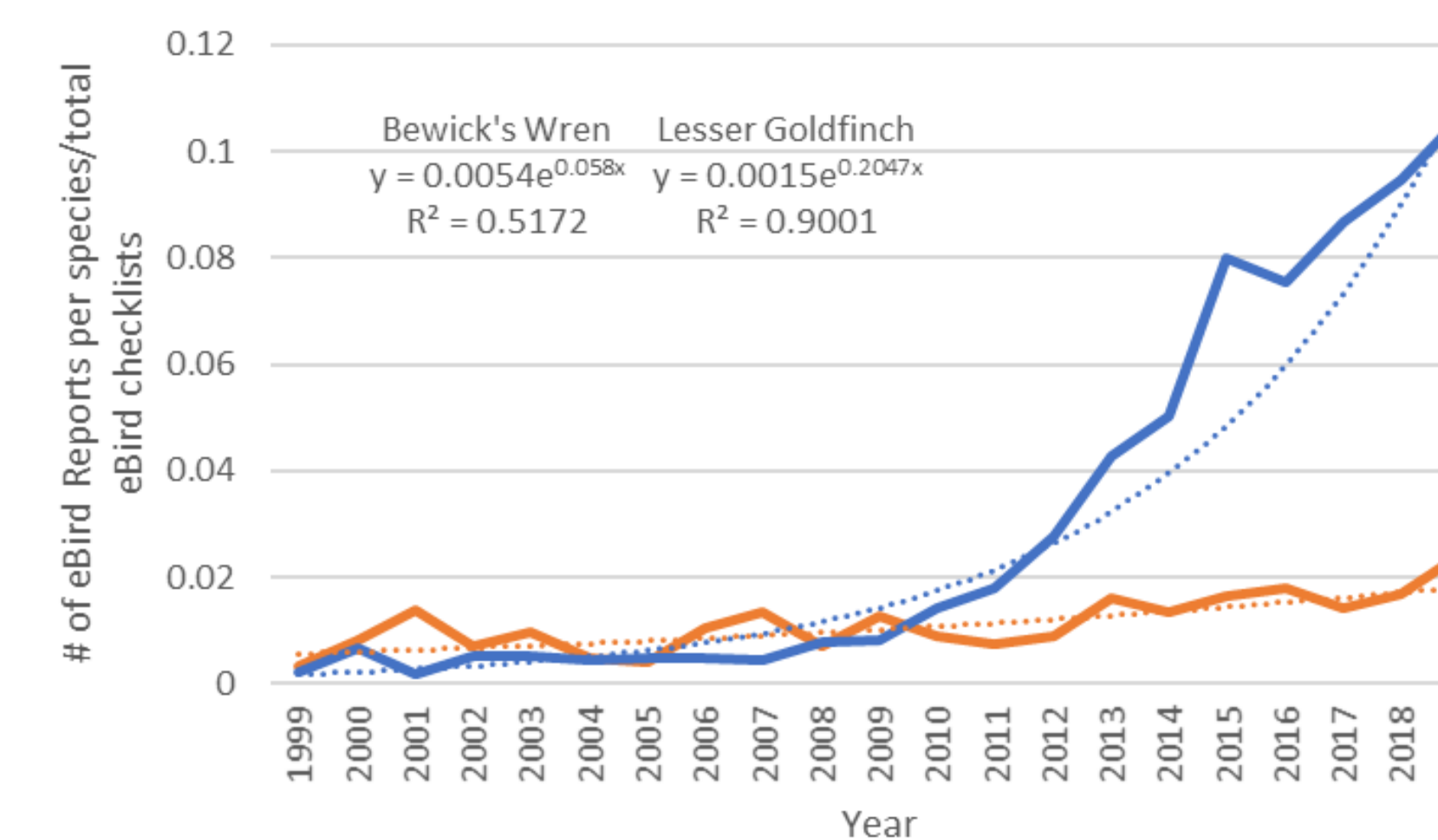


Fig. 3: Index of Bewick's Wren (orange) and Lesser Goldfinch (blue) abundance in Idaho. To correct for varying levels of annual effort, an index was calculated using the number of eBird reports for each species per the total number of eBird checklists submitted each year. Abundance of both species has increased exponentially in the state since the early 2000's. Lesser Goldfinch  $R^2=0.9001$ , Bewick's Wren  $R^2=0.5172$

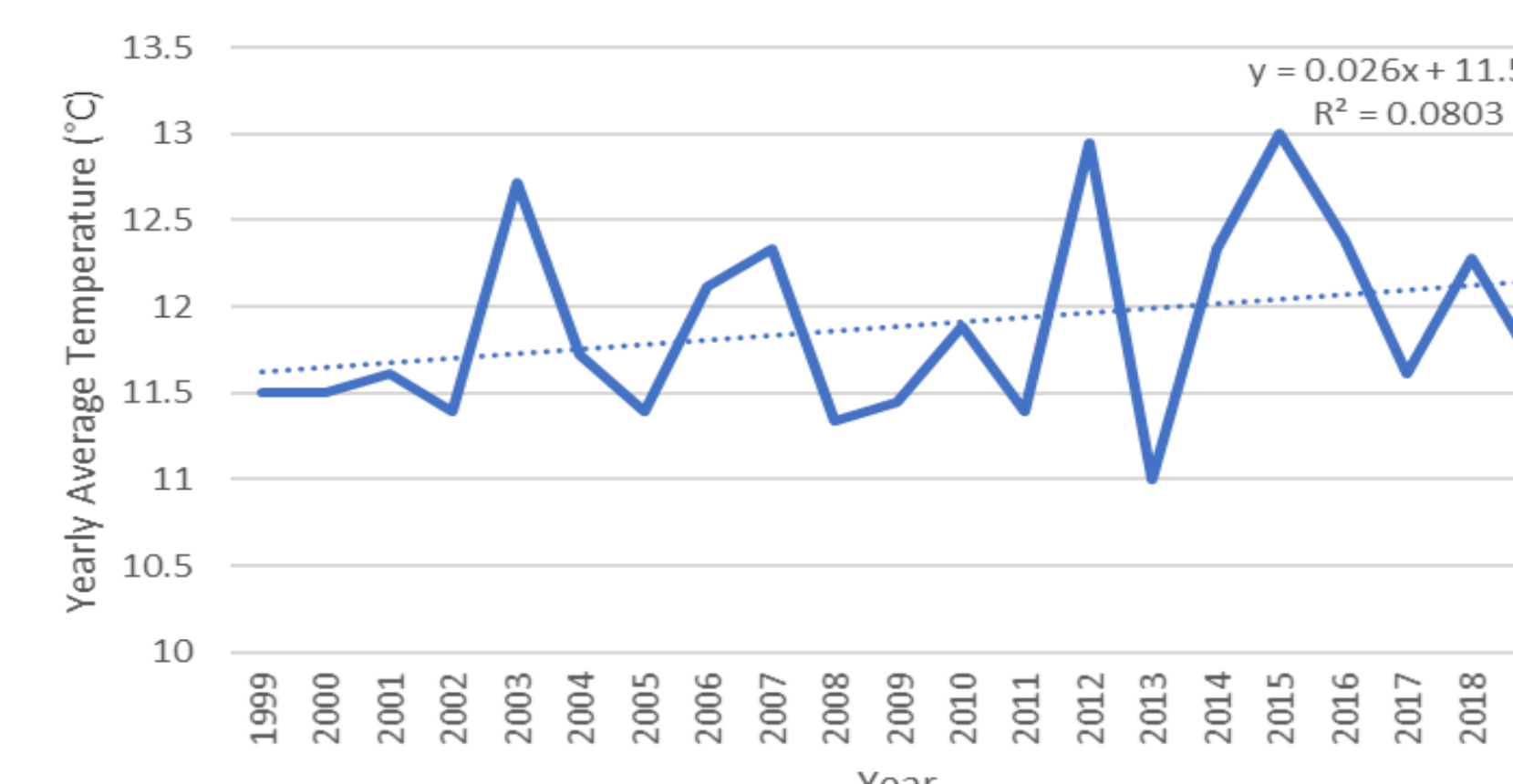


Fig. 4: Yearly average temperature (°C) measured at the Boise Air Terminal NOAA Regional Climate Center between 1999 and 2019. The 20 year trend shows a weak ( $R^2=0.0803$ ) increase in maximum temperature

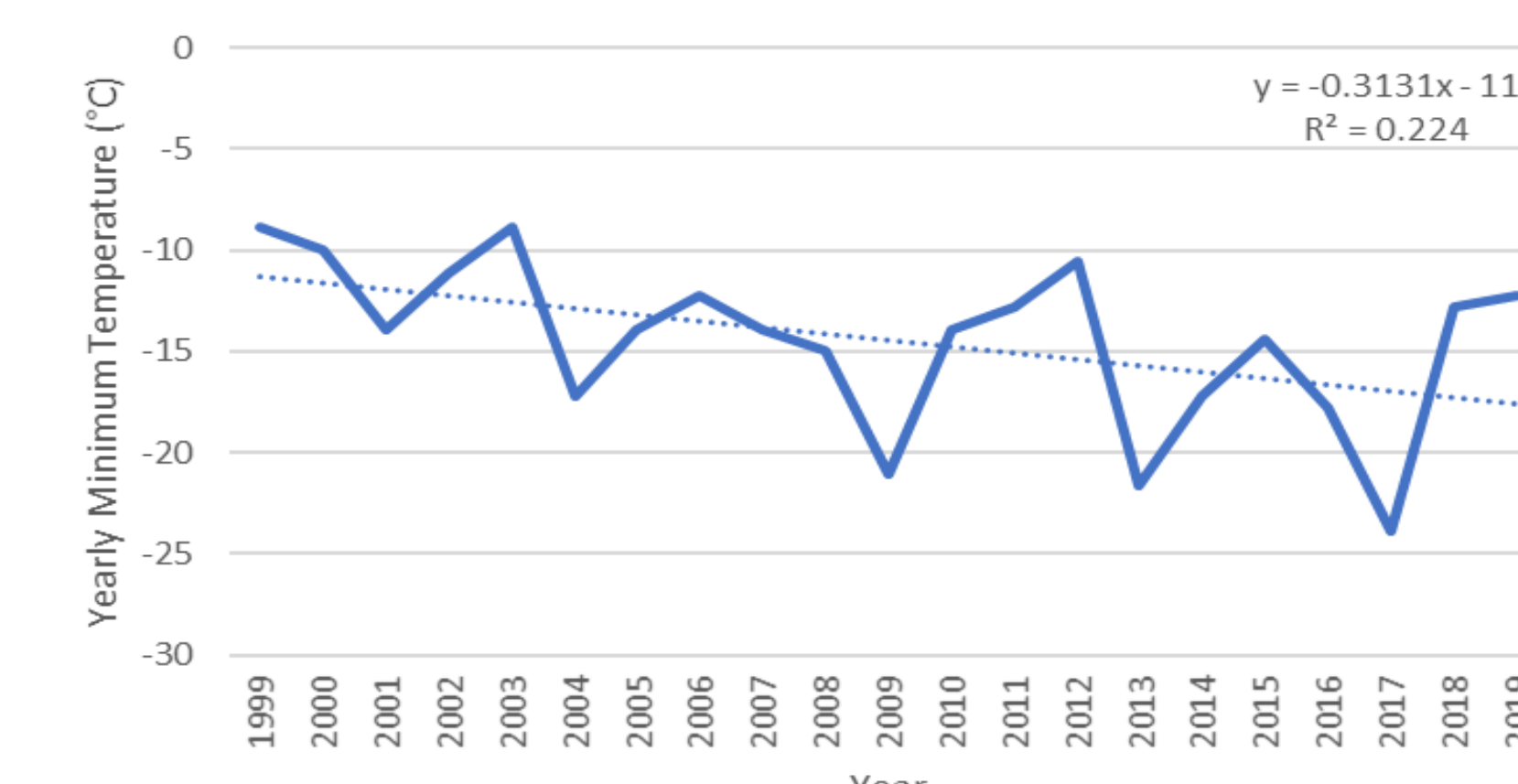


Fig. 5: Yearly minimum temperature (°C) measured at the Boise Air Terminal NOAA Regional Climate Center between 1999 and 2019. The 20 year trend shows a moderate ( $R^2=0.224$ ) decrease in minimum temperature.

## CONCLUSIONS

- Although both average temperature and total annual precipitation have increased in Idaho (Fig. 4 and 6), these changes are more gradual and do not appear to explain changes in species abundance.
- In support of our preliminary investigation, previous research on a species with similar population changes, Anna's Hummingbirds (*Calypte anna*), also found that climate change alone was not enough to explain the rate of range expansion<sup>2</sup>. Greig et al. found that Anna's range expansion is likely due to a combination of climate change, urbanization, and supplemental feeding<sup>2</sup>.
- Further investigations should include analysis of changes in habitat and realized niche within the expanded range.
- eBird and other citizen science projects such as Project Feederwatch allow us to examine trends in avian species that would be otherwise impossible.<sup>3</sup>

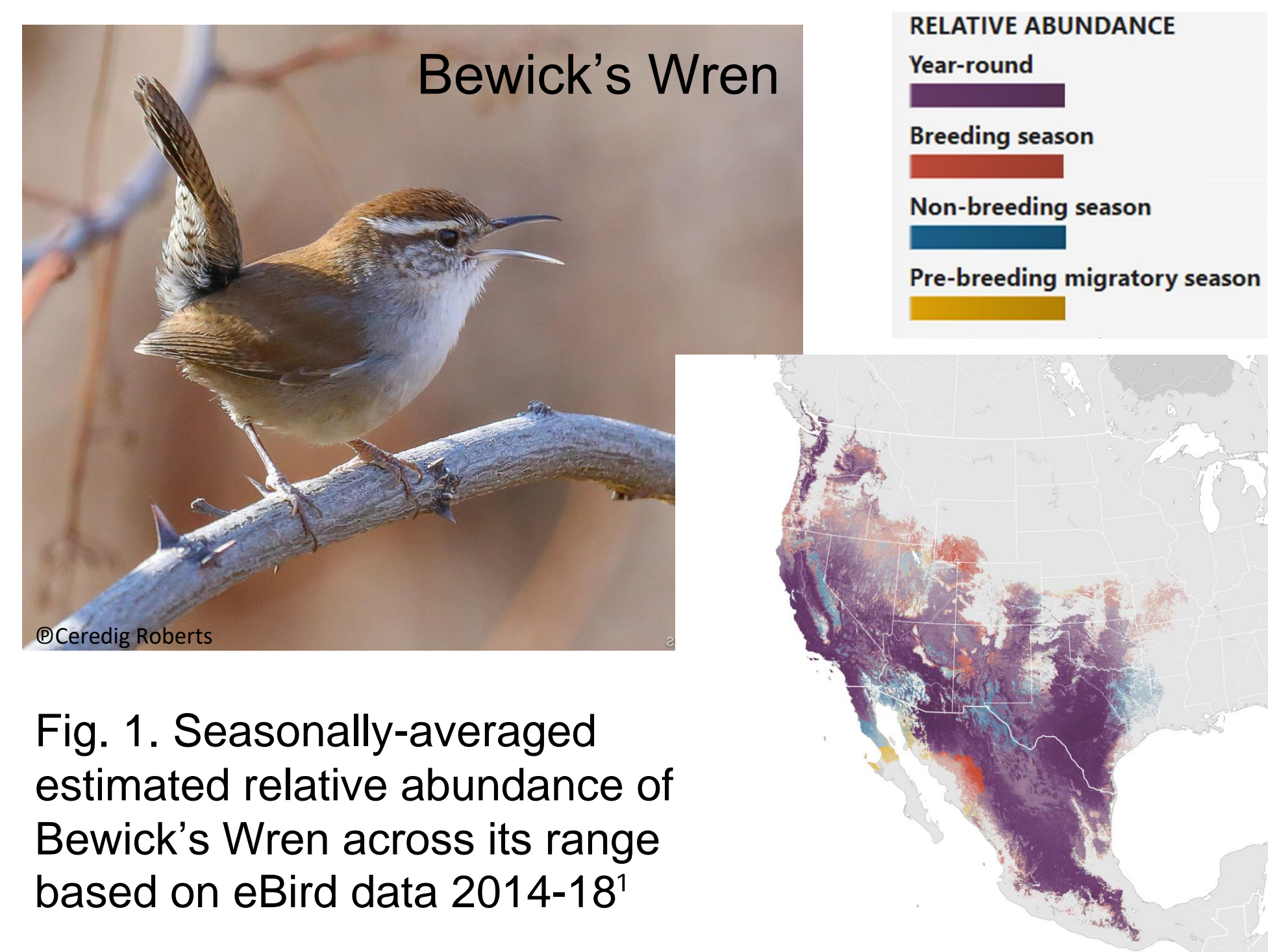


Fig. 1. Seasonally-averaged estimated relative abundance of Bewick's Wren across its range based on eBird data 2014-18<sup>1</sup>

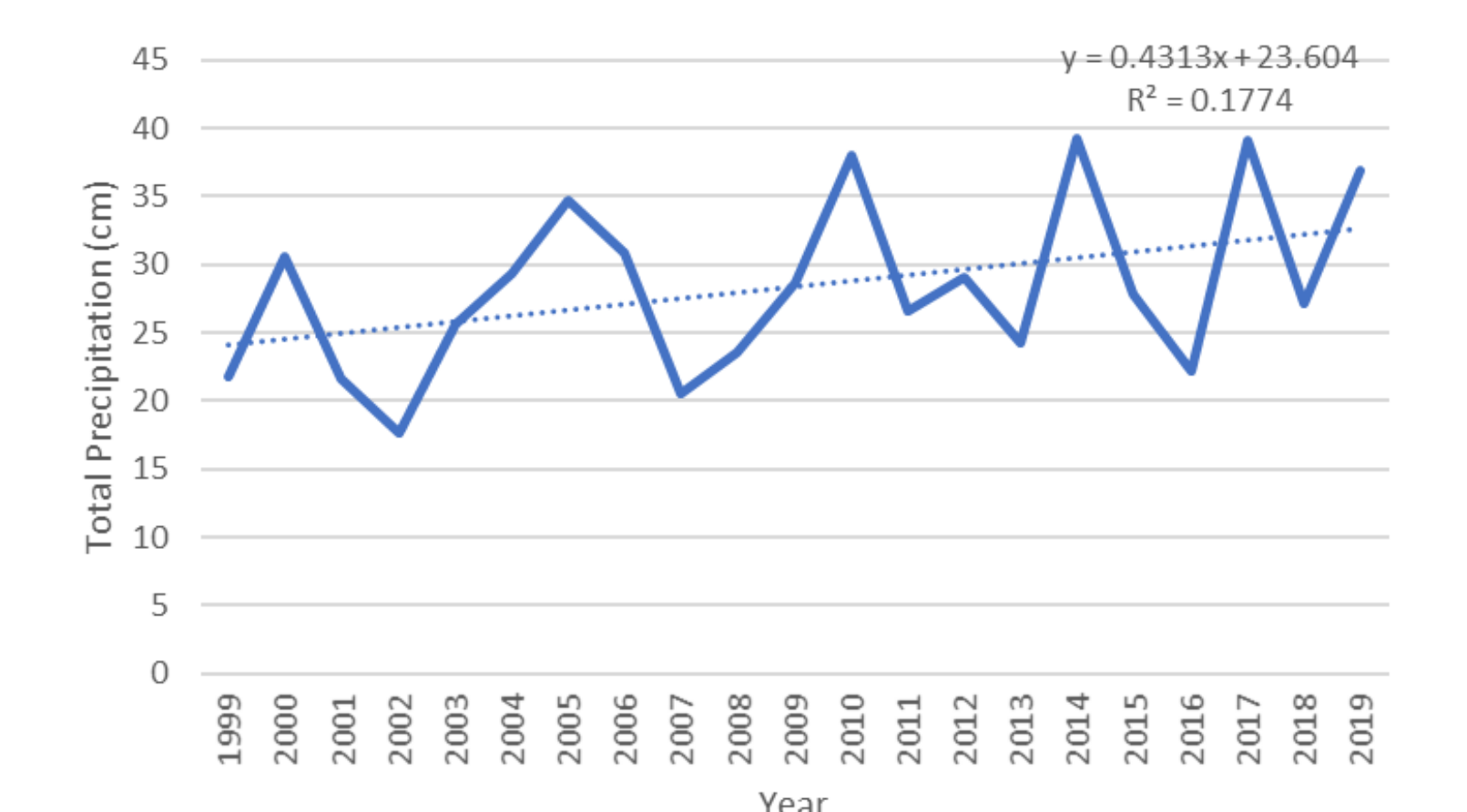


Fig. 6: Total Precipitation (cm) measured at the Boise Air Terminal NOAA Regional Climate Center between 1999 and 2019. The 20 year trend shows a slight ( $R^2=0.1774$ ) increase in total precipitation

### Literature Cited:

1. S. M. Billerman, B. K. Keeney, P. G. Rodewald, and T. S. Schulenberg (Editors) (2020). Birds of the World. Cornell Laboratory of Ornithology, Ithaca, NY, USA. <https://birdsoftheworld.org/bow/home>
2. Greig E.I., Wood E.M., Bonter D.N. (2017). Winter range expansion of a hummingbird is associated with urbanization and supplementary feeding. Proc. R. Soc. B

3. Job, J., and Radakoff, D.A. (2014). Wrens on the edge: feeders predict Carolina wren *Thryomanes bewickii* abundance at the northern edge. Journal of Avian Biology, 42: 16-21. doi:10.1111/j.1690-049X.2010.05242.x