

---

# Continued Decline, 2016-2020, in an Adirondack Breeding Population of Purple Finches (*Haemorhous purpureus*) Attributable to Further Climate Change.

Robert P. Yunick  
1527 Myron Street  
Schenectady, NY 12309-4223  
Email: anneboby@aol.com

## ABSTRACT

A previous paper (Yunick 2018) described the decline in an Adirondack breeding population of Purple Finches (*Haemorhous purpureus*) over the period 1971-2015 attributable to climate change. An additional five years of capture data, 2016-2020, have been added showing continued decline most notably in annual numbers of immatures banded, down 93.3% from 1971-1975 to 2016-2020. Nearby National Weather data documented a mean annual temperature change of +1.49° F during the 1971-2015 period. Adding the 2016-2020 data to that of the 1971-2015 period causes that mean annual temperature change to rise to +2.61° F indicating an acceleration in warming. These 2016-2020 data extend the scope of this study out to an unprecedented total of 50 years.

## INTRODUCTION

A previous paper (Yunick 2018) addressed the breeding status of the Purple Finch in New York state as a species preferring cool, moist forest habitats. Based on banding data gathered beginning in 1970 at my banding station at Jenny Lake near Corinth, New York, in the Adirondack State Park, a downward change in abundance began in the early 1990s. This decline coincided with a positive change in the National Oceanic and Atmospheric Administration's (NOAA) National Temperature Index. That Index tracks what is known as the Average Temperature Anomaly wherein a negative anomaly is indicative of cooler than normal climate while a positive anomaly indicates warmer than normal climate, as is the case here.

The Average Temperature Anomaly at the beginning of this study for the breeding season of Apr-Sep in 1971-1975 was -1.19° F rising to +0.89° F by 2011-2015, a change of +2.08° F. The anomaly went from negative (cooler) to positive

(warmer) in the time period 1986-1990 and remained positive through 2011-2015, coinciding with a decline of 52.1% in the annual number of Purple Finches banded at Jenny Lake from 1971-1990 to 1991-2015. Five additional years of banding data, 2016-2020, are reported here to extend the duration of the study over a span of 50 years.

## METHODS

Banding was conducted at Jenny Lake, 7 km west of the Village of Corinth, Saratoga County, New York, at 43°16'13.55" N, 73°54'36.54" W at an elevation of about 370 m (1270 ft) in lakeside forest dominated by white pine (*Pinus strobus*), Eastern hemlock (*Tsuga canadensis*), sugar maple (*Acer saccharum*) and lesser amounts of oak (*Quercus* spp.), American beech (*Fagus grandifolia*) and much lesser spruce (*Picea* spp.). Birds attracted to three sunflower seed feeders, one each on the east, north and west sides of the camp dwelling were captured in five 12-m and one 6-m mist nets set near the feeders.

Capture sessions of 2 hr (or more if birds were abundant) were conducted typically three to five times per month during the breeding season. While the metric of birds captured per net-hour of operation is a standard measure to assess bird abundance at migration stations, it was not deemed appropriate at this bird feeding operation where an incoming Mourning Dove (*Zenaidura macroura*) or screaming Blue Jay (*Cyanocitta cristata*) could scatter birds assembled at the feeders. Instead, finch abundance for the 2016-2020 period was measured, as done previously (Yunick 2018), by selecting the two dates per year of maximum number of finches banded, then adding those two-day annual totals for the five-year period creating what was termed the Capture Index.

Local climate data were accessed on line from the nearest National Weather Service station at Warren

County Airport, Glens Falls, New York, 26 km (16 mi) ENE of Jenny Lake at 43.34° N, 76.61° W at an elevation of 101 m (333 ft) available at weather.gov. The National Temperature Index data were available from National Oceanic and Atmospheric Administration (NOAA 2022). Average Temperature Anomaly assessments are based on NOAA data dating back to 1895.

## RESULTS

**Table 1** summarizes the 2016-2020 Purple Finch capture data by age and sex for newly banded finches as well as return captures (birds banded in previous years). Age/sex classes are defined as follows:

ASY/M = After-Second-Year/M, a male in adult rosy plumage prior to the next pre-basic molt.

SY/M = Second Year/M, a brown-plumaged male with a cloacal protuberance.

AHY = After-Hatching-Year, a rosy late-season male having completed pre-basic molt, or brown-plumaged female (F) with a brood patch, or brown early-season bird of unknown sex (no cloacal protuberance or brood patch).

U = Unknown age or sex.

HY = Hatching-Year, a juvenile brown bird in unworn plumage with juvenile pointed rectrices prior to 31 Dec.

**Table 2** is an addendum to the prior Table 2 (Yunick 2018), years 1971-2015, showing monthly bandings for the most recent years 2016-2020. Jun and Jul are typically months of peak capture activity as nestlings fledge; that activity declining in Aug as finches disperse from the area.

**Table 3** summarizes the number of monthly banding sessions conducted during the Mar-Oct breeding season for the years 2016-2020.

**Table 4** represents regression analysis data on Mean Annual Temperature, Minimum Annual Temperature, and Maximum Annual Temperature recorded by the nearest National Weather Service at Warren County Airport, Glens Falls, New York. For each parameter, data are presented for the previously reported 1971-2015 period (Yunick 2018) as well as for the combination of those data with 2016-2020 data for a 1971-2020 composite. Overall, the climate data indicate that over the 50 years the Maximum Annual Temperature barely

changed while the Min. Ann. Temp. increased substantially by +7.52° F. This increase in the Min. Ann. Temp. impacted the Mean Ann. Temp. contributing to its increase of +2.61° F creating an unfavorable breeding habitat for Purple Finches at this location.

**Table 5** summarizes the total numbers of immature (HY) finches banded during the breeding seasons of the ten five-year periods, 1971-1975 through 2016-2020 converted to annual averages by dividing the total of each five-year period by five. These annual averages were subjected to regression analysis yielding a regression line: Number Banded = 233.84 - 21.40x where x = the five-year period starting with 1 for 1971-1975 through 10 for 2016-2020,  $r^2 = 0.575$  and  $P = 0.018$ . These data are represented graphically in **Figure 1. Bottom.**

Additionally, the Capture Index for 2016-2020 was 117, and the National Temperature Index anomaly was +1.04° F for Apr-Sep and +1.18° F for Jan-Dec for that five-yr period alone compared to +2.08° F for the entire 50 yr.

## DISCUSSION

The additional climate data presented here for 2016-2020 continue the prior 1971-2015 breeding season warming trend, but at an increased rate. Adding the 2016-2020 data to those of 1971-2015 creates a +2.61° F rise in the Mean Annual Temperature over 10 five-yr intervals (average 0.261° F./interval) compared to a previous +1.44° F rise over nine five-yr intervals (average 0.13° F / interval) hence an increase in the rate of warming.

The new data presented here on declining numbers of HY finches banded over the entire 1971-2020 period suggest that fewer young led to lesser recruitment of adults to the subsequent adult breeding population hence, the overall population decline.

Bolgiano (2004) used Christmas Bird Count data and Breeding Bird Survey data to assess changes in certain boreal bird populations including those of the Purple Finch. He suggests that spruce budworm infestations of the 1970s in the southern Appalachians may have had a direct effect on higher finch numbers on Christmas Bird Counts over the 1950-2001 period.

He illustrates Purple Finch counts per 10 party-hours of observer effort in the 4-10 range during 1950-1970, then increasing to 9-20 during 1971-1983, followed by gradual decline to 2-3 during 1990-2001.

He cites five studies (Sanders 1970, Erskine 1977, Mitchell 1952, Crawford and Jennings 1989, and Dowden et al. 1953) linking Purple Finches to spruce budworms as a food source. Contrarily, he cites Morris et al. (1958) who found finch populations not to increase as budworms increased.

Bolgiano's (2004) Breeding Bird Survey review involved 1968-2003 data from eastern Quebec, Canada which compared annual mean numbers of birds per survey route: 2-7 per route, 1968-1977, followed by an increase to 7-12 per route 1978-1988, only to decline precipitously to 2-4 through 2003.

Wooton (2020, see his Fig. 4), Demography and Populations, reviews Breeding Bird Survey data, 1966-1994, on a wider geographical scale over all of North America. He divided the data into three sectors and assessed them as follows. "East" (northeast United States and southern Canada) experienced a 50-% decline while Canadian populations were stable 1968-1989, then declined 67% 1989-1994. A sharp erratic decline occurred in the "North" while "Western" North American populations were stable where breeding densities were much higher than in other portions of the breeding range.

Unlike the regions studied in these cited articles involving spruce forests, spruce trees are a very minor component of the forest habitat at Jenny Lake. As pointed out previously (Yunick 2018), the studies cited in Wooton (2020) relating Purple Finch declines to competition from House Finches (*H. mexicanus*) and House Sparrows (*Passer domesticus*) in lower elevation urban environments does not apply to the wooded montane habitat at Jenny Lake. Only one House Finch was ever banded there, an AHY/M, on 24 Jun 1990 in over 50 yr of banding. Never has a House Sparrow been recorded there.

An examination of precipitation data showed no correlation to the population decline, but the decline in production of offspring was strongly related to the rising Temperature Index Anomaly as depicted in Fig. 1, A precipitous decline in young banded as Oct. - Dec. 2023

of 1991 and beyond coincided with the Temperature Index Anomaly crossing from negative (cooler than average) to continued positive (warmer than average) 1986-1990, no longer suiting this species' cool forest breeding requirement.

## ACKNOWLEDGMENT

My thanks to Laurie Freeman for assistance with the statistical analyses, and to Christina Speciale at the Albany, New York office of the National Weather Service for providing Glens Falls, New York climate data. Comments and suggestions by John Bates improving the ms were received with thanks and appreciation.

## LITERATURE CITED

- Bolgiano, N.C. 2004. Changes in Boreal bird irruptions in Eastern North America relative to the 1970s Spruce budworm infestation. *American Birds* 58:26-33.
- Crawford, H.S. and D.T. Jennings. 1989. Predation by birds on spruce budworm *Choristoneura fumiferana*: functional, numerical, and total responses. *Ecology* 70:152-163.
- Dowden, P.B., H.A. Jaynes and V.M. Carolin. 1953. The role of birds in a spruce budworm outbreak in Maine. *Journal of Economic Entomology* 46:307-312.
- Erskine, A.J. 1977. Birds in Boreal Canada: communities, densities, and adaptations. Canadian Wildlife Service Report Series No. 41, Ottawa.
- Mitchell, R.T. 1952. Consumption of spruce budworms in a Maine spruce-fir forest. *Journal of Forestry* 50:397-389.
- Morris, R.F., W.F. Cheshire, C.A. Miller and D.G. Mott. 1958. Numerical response of avian and mammalian predators during a gradation of the spruce budworm. *Ecology* 39:487-494.
- NOAA. 2022. National Temperature Index. <http://www.ncdc.gov/temp-and-precip/national-temperature-index>.
- Sanders, C.J. 1970. Population of breeding birds in the spruce-fir forests of northwestern Ontario. *Canadian Field-Naturalist* 84:131-135.
- Wooton, J.T. 2020. Purple Finch (*Haemorhous purpureus*), version 1.0. In *Birds of the World* (A.F. Poole and F.B. Gill, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. <https://doi.org/10.2173/bow.purfin.01>.
- Yunick, R.P. 2018. Observations of the decline over 47 years, 1970-2016, in an Adirondack Breeding population of Purple Finches attributable to climate change. *North American Bird Bander* 43:41-57.

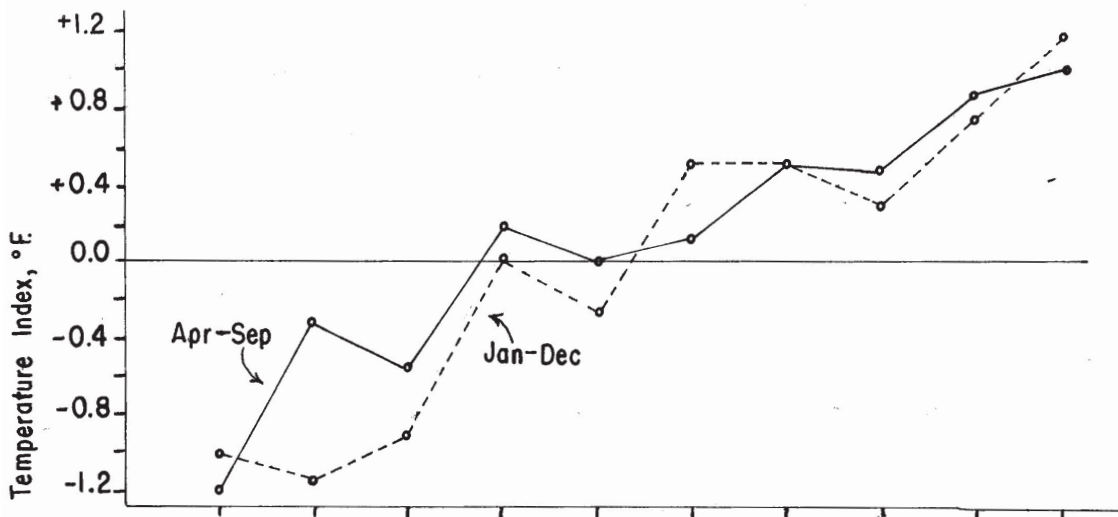


Figure 1. Top. A plot of the National Temperature Index anomaly from Yunick (2018) extended to include the additional five-year period 2016-2020. Data derived from National Oceanic and Atmospheric Administration (2022).

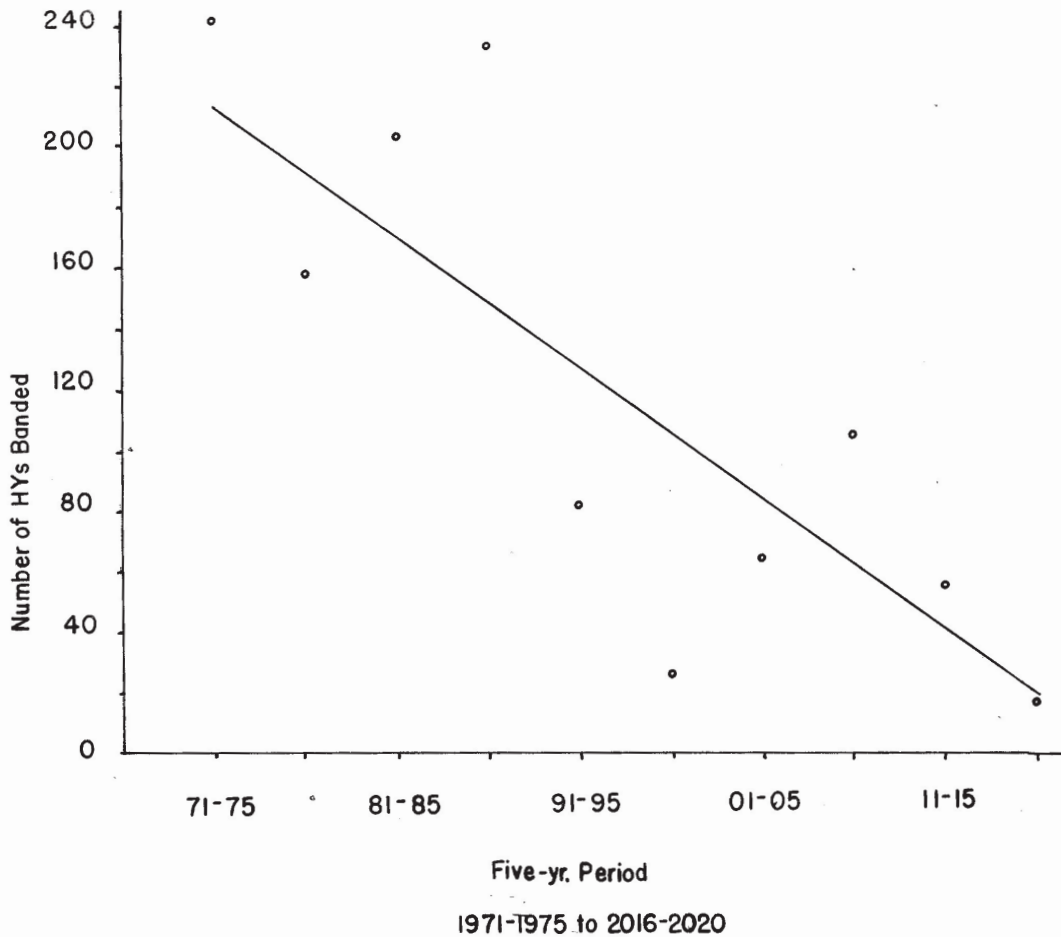


Figure 1. Bottom. A plot of numbers of Hatching-Year Purple Finches banded at Jenny Lake over 10 five-year periods 1971-1975 through 2016-2020. Data from Table 5.

**Table 1. Addendum to Yunick (2018: Table 1 ) representing Purple Finch annual banding and return captures 2016-2020. See text for explanation of age/sex abbreviations.**

| <b>Year</b>               | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> | <b>Total</b> | <b>1970-2015</b> | <b>New Total</b> |
|---------------------------|-------------|-------------|-------------|-------------|-------------|--------------|------------------|------------------|
|                           |             |             |             |             |             |              | <b>Total</b>     |                  |
| <b>Banded</b>             |             |             |             |             |             |              |                  |                  |
| <b>Age/Sex</b>            |             |             |             |             |             |              |                  |                  |
| ASY/M                     | 17          | 23          | 7           | 11          | 3           | 61           | 1455             | 1516             |
| SY/M                      | 30          | 19          | 18          | 12          | 35          | 114          | 1668             | 1782             |
| AHY/M                     | 5           | 0           | 1           | 0           | 2           | 8            | 134              | 142              |
| Total M                   | 52          | 42          | 26          | 23          | 40          | 183          | 3257             | 3440             |
| AHY/F                     | 33          | 14          | 15          | 9           | 21          | 92           | 3030             | 3122             |
| AHY/U                     | 13          | 3           | 0           | 0           | 4           | 20           | 782              | 802              |
| U/U                       | 0           | 0           | 0           | 0           | 0           | 0            | 19               | 19               |
| Total                     | 46          | 17          | 15          | 9           | 25          | 112          | 3831             | 3943             |
| HY/U                      | 27          | 27          | 6           | 6           | 20          | 86           | 6044             | 6130             |
| Year Total                | 125         | 86          | 47          | 38          | 85          | 381          |                  |                  |
| Cum. Total                | 13,256      | 13,342      | 13,389      | 13,427      | 13,512      | 13,512       | 13,131           | 13,512           |
| <b>Returns</b>            |             |             |             |             |             |              |                  |                  |
| <b>Age/Sex</b>            |             |             |             |             |             |              |                  |                  |
| ASY/M                     | 22          | 16          | 15          | 9           | 14          | 76           | 1608             | 1684             |
| SY/M                      | 2           | 1           | 2           | 0           | 0           | 5            | 247              | 252              |
| AHY/M                     | 0           | 0           | 0           | 0           | 1           | 1            | 43               | 44               |
| Total M                   | 24          | 17          | 17          | 9           | 15          | 82           | 1898             | 1980             |
| AHY/ F                    | 15          | 11          | 15          | 6           | 8           | 55           | 1242             | 1297             |
| AHY/U                     | 1           | 0           | 0           | 0           | 0           | 1            | 109              | 110              |
| Total                     | 40          | 28          | 32          | 15          | 23          | 138          | 3199             | 3337             |
| Total Banded and Returned | 165         | 114         | 79          | 53          | 108         | 519          | 16,330           | 16,849           |

**Table 2. Addendum to Yunick (2018: Table 2 ) representing monthly Purple Finch bandings 2016-2020.**

| <b>Year</b> | <b>Month</b> |            |            |            |            |            |            |            |            |            |            |            | <b>Total</b> |
|-------------|--------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|
|             | <b>Jan</b>   | <b>Feb</b> | <b>Mar</b> | <b>Apr</b> | <b>May</b> | <b>Jun</b> | <b>Jul</b> | <b>Aug</b> | <b>Sep</b> | <b>Oct</b> | <b>Nov</b> | <b>Dec</b> |              |
| 2016        |              |            | 1          | 11         | 24         | 19         | 30         | 16         | 20         | 4          |            |            | 125          |
| 2017        |              |            |            | 6          | 8          | 22         | 47         | 3          |            |            |            |            | 86           |
| 2018        |              |            |            |            | 5          | 26         | 10         | 1          | 3          | 2          |            |            | 47           |
| 2019        |              |            |            | 1          | 7          | 20         | 8          | 2          |            |            |            |            | 38           |
| 2020        |              |            |            | 2          | 21         | 20         | 3          | 27         | 12         |            |            |            | 85           |
| Total       |              |            | 1          | 20         | 65         | 107        | 98         | 49         | 35         | 6          |            |            | 381          |

**Table 3. Summary of monthly banding sessions conducted during the Mar-Oct breeding season, 2016-2020. Banding sessions were conducted Nov-Feb as well, but no Purple Finches were captured.**

| Year  | Month |     |     |     |     |     |     |     | Total |
|-------|-------|-----|-----|-----|-----|-----|-----|-----|-------|
|       | Mar   | Apr | May | Jun | Jul | Aug | Sep | Oct |       |
| 2016  | 3     | 5   | 4   | 2   | 5   | 5   | 3   | 1   | 28    |
| 2017  | 2     | 4   | 4   | 4   | 5   | 4   | 3   | 1   | 27    |
| 2018  | 3     | 3   | 4   | 4   | 5   | 5   | 4   | 3   | 31    |
| 2019  | 4     | 3   | 3   | 4   | 4   | 5   | 4   | 3   | 30    |
| 2020  | 4     | 3   | 5   | 3   | 4   | 5   | 5   | 3   | 32    |
| Total | 16    | 18  | 20  | 17  | 23  | 24  | 19  | 11  | 148   |

**Table 4. A comparison of temperature data from the National Weather Service station at Warren County Airport, Glens Falls, New York comparing previous 1971-2015 data (Yunick 2018) with data over the extended period 1971-2020. The value of x represents 5-year intervals: 1971-1975 = 1, 1976-80 = 2, etc. to 2016-2020 = 10; and T = temperature in °F as reported by National Weather Service.**

| Parameter           | Time Period | Regression Equation                               | Predicted Temp. Range During Time Period | Predicted Change |
|---------------------|-------------|---|--|------------------|
| Mean Ann. Temp., °F | 1971-2015   | $T = 44.55 + 0.18x$<br>$r^2 = 0.497, P = 0.034$   | 44.73° F to 46.17° F                     | +1.44° F         |
|                     | 1971-2020   | $T = 44.148 + 0.29x$<br>$r^2 = 0.064, P = 0.008$  | 44.44° F to 47.05° F                     | +2.61° F         |
| Min. Ann. Temp., °F | 1971-2015   | $T = -26.32 + 0.91x$<br>$r^2 = 0.59, P = 0.015$   | -25.41° F to -18.13° F                   | +7.28° F         |
|                     | 1971-2020   | $T = -26.04 + 0.836x$<br>$r^2 = 0.604, P = 0.008$ | -25.20° F to -17.68° F                   | +7.52° F         |
| Max. Ann. Temp., °F | 1971-2015   | $T = 93.57 - 0.047x$<br>$r^2 = 0.01, P = 0.79$    | 93.52° F to 93.15° F                     | -0.37° F         |
|                     | 1971-2020   | $T = 93.67 - 0.07x$<br>$r^2 = 0.035, P = 0.602$   | 93.60° F to 92.97° F                     | -0.63° F         |

---

**Table 5. Numbers of HY Purple Finches banded per five-yr period also represented as an annual average.**

| <b>Five-yr period</b> | <b>No. Banded</b> | <b>Ann. Average</b> |
|-----------------------|-------------------|---------------------|
| 1971-1975             | 1212              | 242.4               |
| 1976-1980             | 792               | 158.4               |
| 1981-1985             | 1023              | 204.6               |
| 1986-1990             | 1170              | 234.0               |
| 1991-1995             | 407               | 81.4                |
| 1996-2000             | 136               | 27.2                |
| 2001-2005             | 321               | 64.2                |
| 2006-2010             | 529               | 105.8               |
| 2011-2015             | 280               | 56.0                |
| 2016-2020             | 86                | 17.2                |



**Purple Finch by Com Stock Studio**