

NATURE'S CALENDAR



THEMES:

- Climate Change
- Phenology
- Indigenous science
- Cultural connections
- Graphing data

GRADE LEVEL(S):

- 7th Grade (w/6th & 8th grade crossover)

DURATION:

- 45 Minute Presentation
- 30-45 Minute Activity

SKILLS

- Identifying patterns
- Making Connections
- Interpreting Data
- Graphing & Analyzing
- Creating, Synthesizing
- Citing Evidence
- Comparing & Observing

BEST TIME FOR ACTIVITY:

- Anytime



SUMMARY

Phenology and Climate Change

“Nature’s Calendar” presents the concepts of observing phenology and seasonal patterns, through Cherokee and other cultural stories, a presentation, and a graphing activity using data collected in Great Smoky Mountains National Park. Students will learn about changing weather patterns and compare data relating to the seasonal arrival of animals and timing of plants. Students will create and analyze graphs to determine if species are changing their habitats to accommodate earlier and warmer springs in the mountains.

OBJECTIVES AND CONNECTIONS

Students will...

- Be able to give a definition of phenology by using an example relevant to their personal experience.
- Understand the difference between weather and climate.
- Be able to create and interpret a scatter plot graph.
- Be able to determine if a trend line in a graph is positive, negative or flat.
- Be able to relate why it is important to biologists to study phenology.
- Understand the relationship between climate, plants, and animal survival; how physical environment affects human activities.
- Understand the flow of energy through ecosystems and how populations respond to biotic and abiotic factors.
- Analyze climate data and draw conclusions on how cycling of matter affects survival.
- Explain effects and environmental implications of using energy resources.

MATERIALS

Preparation

*Materials designated with a * will be provided in the activity box.*

- Computer and projector for “PowerPoint” Presentation
- *Powerpoint presentation: Phenology Nature's Calendar PPT
- Blank grid sheet to use as graph paper [Julian or Gregorian versions]
- Pencils if using paper graphs or dry erase markers if using transparency graphs
- *Data sheets to give out to students for Spring Peeper and Black-throated Green warbler
 - Pheno_Table_BTG Warbler.pdf
 - Pheno_Table_Spring Peeper.pdf





NORTH CAROLINA SCIENCE CORRELATIONS

- ✓ LS.6.1 Understand the structures, processes and behaviors of plants that enable them to survive and reproduce.
- ✓ LS.6.2 Understand the flow of energy through ecosystems and the responses of populations to the biotic and abiotic factors in their environment.
- ✓ ESS.7.1.4 Use models to predict weather conditions based on observations (including clouds, air masses, fronts), measurements (wind speed and direction, air temperature, humidity and air pressure), weather maps, satellites and radar.
- ✓ ESS.7.1.5 Use models to explain the influence of convection, global winds and the jet stream on weather and climatic conditions.
- ✓ ESS.7.2.1 Engage in argument from evidence to explain that the good health of humans and environment requires: monitoring the atmosphere, maintaining air quality and stewardship.
- ✓ ESS.8.4.3 Analyze and interpret data to illustrate the relationship between human activities and global temperatures since industrialization.
- ✓ ESS.8.4.4 Obtain, evaluate and communicate information to compare the long term implications of the use of renewable and nonrenewable energy resources and the importance of stewardship and conservation

NORTH CAROLINA SOCIAL STUDIES CORRELATIONS

- ✓ 7.G.1.3 Explain how natural disasters, preservation efforts and human modification of the environment affect modern societies and regions.
- ✓ 7.G.2.2 Use maps, charts, graphs, geographic data and available technology tools to interpret and draw conclusions about social, economic, and environmental issues in modern societies and regions.

NORTH CAROLINA MATH CORRELATIONS

- ✓ 6.SP.4 Display numerical data in plots on a number line.
- ✓ 7.RP.2 Recognize and represent proportional relationships between quantities.
- ✓ 7.SP.7 Develop a probability model and use it to find probabilities of simple events

TENNESSEE SCIENCE CORRELATIONS

- ✓ 6.LS2.6: Ecosystems: Interactions, Energy, and Dynamics - Research the ways in which an ecosystem has changed over time in response to changes in physical conditions, population balances, human interactions, and natural catastrophes.

TENNESSEE SOCIAL STUDIES CORRELATIONS

- ✓ 7.54 Explain the impact of geographic features on North American Indian cultures.
- ✓ 7.55 Describe the existence of diverse networks of North American Indian cultures including: varied languages, customs, and economic and political structures.

TENNESSEE LANGUAGE ARTS CORRELATIONS

- ✓ 7.SL.CC.1 Prepare for collaborative discussions; engage effectively with varied partners.
- ✓ 7.SL.PKI.4 Present claims and findings, emphasizing salient points in a focused, coherent manner.





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About this project:

The Seeking Paths in Nature (SPiN) project was developed through a partnership between Great Smoky Mountains National Park (GRSM) and the Cherokee Preservation Foundation. SPiN encompasses the focused efforts to enlighten the public, students, and GRSM employees on the history and cultural connections inherent between the Cherokee and the land, currently deemed as Great Smoky Mountains National Park, as well as surrounding communities.

Background Information:

The land of Great Smoky Mountains National Park lies on the traditional homeland of the sovereign nations of Cherokee, or Aniyuwiya*, (*pronounced “a-nee-ya-wee-ya”) meaning the Principal People. We recognize the Cherokee and their ancestors as the original and continuing stewards of this land, going back to time immemorial. The Cherokee have a deep, complex, and reliant relationship with the land. Their intimate knowledge and relationship with the land along with the seasonal availability of plants and animals has resulted in stories, medicinal remedies, foodways, arts, technologies, science, and many other practices that prioritize ecologically sustainable stewardship and partnership with the land. Many Cherokee continue these significant traditions.

Vast changes to the land came in the late 1700s when European immigrants, largely of Scotch-Irish heritage, moved to the Southern Appalachians. The massive influx of people and greediness led to disputes and conflicts between the Europeans and Cherokee, eventually resulting in the tribe being forced to sign over their lands first to Great Britain, and later to the United States. Though some found ways to remain on their traditional lands in the 1830s, most Cherokee were forced to move west. Nearly 16,000 Cherokee were forced to walk to newly appointed Cherokee lands located in present-day Oklahoma. This tragic journey is known as the “Trail of Tears” due to the deaths of approximately 4,000 Cherokee people. Since the arrival of settlers, there have been many impacts of colonization including wars, conflicts, disease, broken treaties, land resource exploitation, forced assimilation, and genocide. Despite it all, the Eastern Band of Cherokee Indians have persevered.

Today, the Cherokee live on just a small fraction of their traditional homelands known as the Qualla Boundary. They are revitalizing their culture through efforts such as language preservation, the arts, education, community building, natural resource management, and commercial enterprises. Currently, the EBCI Qualla Boundary adjoins a southern portion of Great Smoky Mountains National Park, and the Cherokee proudly proclaim: “Si O Tse Do Ha”*, (*pronounced “she oh tsay doe ha”) or “We’re Still Here!”



Acknowledgements:

Special thanks for contributions from the Cherokee Preservation Foundation, Friends of the Smokies (FOTS), Great Smoky Mountains Association (GSMA), Cherokee Central Schools, Eastern Band of Cherokee Indians (EBCI) Natural Resources, Museum of the Cherokee Indian (*in particular Dakota Brown and Dawn Arneach*), EBCI Speaker's Council [*Laura Pinnix, Roger Smoker, Bo Lossiah, Marie Junaluska, Mary Wachacha (in memoriam), and Dr. Hartwell Francis*]. For your insight, we thank Russ Townsend, EBCI Tribal Historic Preservation Office Program (THPO), and the many teachers who assisted in content creation and piloting [*Jessica Metz, Malia Crowe Shulski, Kaitlin Roberts, Matt Tooni, Lizzie Carver, Amanda Clapp, Nikki McCoy, Randi Neff, Max Lanning, Melissa Crisp, Judy Dulin, Michelle Whaley, and Brian Hardison*], community members *Louise & Butch Goings, Peggy Hill-Kerbow*, the National Park Service (NPS), AmeriCorps Project Conserve members, and Great Smoky Mountains National Park Education staff and interns.

Thank you to our project coordinators whose leadership and creative energy were vital to the success of this project. Jessica Metz led the project in 2014 – 2016, Julie Townsend (in memoriam) led the project from 2016-2019. For their seasonal terms as project assistants, we thank Jessica Stump, Natrieifia Miller and Kahawis.

We dedicate this curriculum guide in the memory of Julie Townsend; her good humor, knowledge and relationships in the community are missed daily. Julie lived her life by the Cherokee concept of Gadugi - “we learn together” and it is with this intent that we offer these activities to you.

We acknowledge that the spelling of Cherokee words included in these documents may differ slightly, as there are variations of Cherokee dialects within EBCI.



NATURAL RESOURCES
EASTERN BAND OF CHEROKEE INDIANS



NATURE'S CALENDAR: VOCABULARY AND DEFINITIONS



Grade Level: 7

Subject Area: Science

Activity time: 45 minutes

Setting: Classroom

Skills: Analyzing, Listening,
Listing, Organizing

Materials:

Computer(s) with internet
connection / projector.

Worksheets

Vocabulary:

- **Abiotic Factors:** non-living factors, such as temperature, water, sunlight, elevation, soil quality.
- **Biological Inventory:** a list of the different types of species.
- **Biological Monitoring:** a process of revisiting a particular location to see how it has changed over time.
- **Biological Synchronicity:** species that depend on one another to sustain their life cycle such as a bird that only eats a particular type of caterpillar arriving back from migration while its food is active.
- **Biotic Factors:** living components in an ecosystem.
- **Climate:** The average weather (usually taken over a 30-year time period) for a particular region and time period.
- **Graph:** a visual representation of relationships, demonstrated by plotted points, with an independent (X) and dependent (Y) pair of axes.
- **Native Plant:** a plant that was not introduced into its habitat, region or ecosystem by humans
- **Phenology:** from the Greek *Phenos* meaning change. The study of annual or cyclical change or the study of change in nature's calendar.
- **Producer:** green plants that synthesize food through the process photosynthesis.
- **R-value:** reliability of trends of a linear relationship between two variables. It is always between +1 and -1. The closer to +1, the better the fit.
- **Scatter Plot:** a type of plot or mathematical diagram visualizing values for usually two variables for a set of data. It can be used to suggest correlations between variables with a certain confidence.
- **Symbiotic:** mutually beneficial relationship between different organisms.
- **Trend line:** a line drawn over graph highs and lows to show positive (upward) or negative (downward) direction or pattern.
- **Weather:** The specific condition of the atmosphere at a particular place and time.



IN-CLASS ACTIVITY 1

DISCUSSION: PHENOLOGY INTRODUCTION



Background:

Seasons and Phenology in Cherokee Life

(start Powerpoint presentation to lead this discussion)

The Cherokee, both today and historically, have ties to the land of this region. Many people gather traditional plants in the early spring to use as tonic or look to the natural world for signs of weather patterns. The study of seasonal changes may seem new, but people have observed phenomena for millennia and noticed trends and incorporated them in their cultures:

- You can tell when the temperature is below freezing by noticing if the leaves of rhododendron are curled up.
- A Blackberry Winter is when we have a cold snap while the blackberries are in bloom, usually in late April or early May.
- You can predict how much snow we will get in a winter by looking at the cross section of a persimmon seed grown locally – if you see a spoon, there will be a lot of snow. A fork, will be mild with little snow and a knife, a cold winter with cutting winds.



Observation has inspired local schedules in harvesting and planting. Which of these bits of advice will still be true in the future as our climate changes?

- When the daffodils begin to bloom, it is time to plant peas
- When the blossoms of the apple tree begin to fall, plant your corn seeds
- When dandelions are blooming, plant beets and carrots
- Plant potatoes when the shadbush flowers
- When elm leaves are the size of a penny, plant kidney beans

One question that arises in this time of changing weather patterns, is whether past assumptions will still hold true. For example, if it warms up in February and plants emerge early, and then we get a freeze in March, could that damage early spring plants used as a tonic?

Phenology is the study of recurring plant and animal life cycle events, or phenophases, such as leafing and flowering, maturation of agricultural plants, emergence of insects, and migration of birds. Phenology is simply the study of nature's calendar. Phenology observes the relationship between 1) discrete phenological events, 2) events and the season, 3) events and local weather conditions, and 4) events and climatic changes. Changes in phenological events like flowering is among the most sensitive biological responses to climate change. Across the world, many spring events are occurring earlier—and fall events are happening later—than they did in the past. However, not all species are changing at the same rate.

Scientists in the Smokies and around the world are looking at phenology as a way to understand how climate change may be impacting their area. We still need more information to answer lots of questions, ranging from simple questions like “What regulates the pace at which a particular species develops?” to more complex questions like “How does phenology affect where organisms live? With sufficient phenological observations, we can document patterns of phenology for critical plant and animal species across the United States, and then use this information to build models to help humans understand and adapt to changing landscapes and climates.



Procedure: Discussions

1. Start the phenology lesson with the *SPiN Phenology Natures Calendar* Powerpoint presentation. The script will provide prompts to help students understand the concepts of phenology, the differences between weather and climate, and the process of scatter plot graphing.
2. Slides can be hidden to tailor the program longer or shorter.
3. A sample graphing activity using trillium flowers is given, then the students can graph data from studies of black throated green warblers and spring peeper frogs and their appearances in the spring.
4. When directed in the presentation, begin the graphing activity in the next section. We provide both Julian and Gregorian calendar version for the graphs. Pick one to use with your students or have them do both and compare. Some scientists prefer the Julian calendar because it can be confusing to convert dates using the Gregorian calendar when graphing.

Extension Activities / Videos:

- Video: (8min) Phenology and Citizen Science in Great Smoky Mountains National Park: <https://www.youtube.com/watch?v=wsSoqcVAhpo>
- Video: Phenology data collection project in the Smokies: https://youtu.be/JN9P_NuoXR8
- Video: NEON Measuring Plant Phenology from Ground to Space: https://www.youtube.com/watch?v=_4uHLXL1yZA
- Video: Project BudBurst: The Stories Plants Tell: the Science of Phenology: https://www.youtube.com/watch?v=OHY-c_RDMkM



IN CLASS ACTIVITY 2: GRAPHING WORKSHEETS



Grade Level: 7

Subject Area: Science

Activity time: 45-50
minutes

Setting: Indoors

Skills:

- Identifying patterns
- Making Connections
- Interpreting Data
- Graphing & Analyzing
- Creating, Synthesizing
- Citing Evidence
- Comparing & Observing

Materials:

- Worksheets
- Powerpoint presentation



Phenology Activity Background:

Scientists come to the Great Smoky Mountains to study the impacts of climate change on a number of species and ecosystems. Phenology is just one of those studies, and it involves plants and animals.

In this segment of the lesson we will focus on White Trillium wildflowers as an example, and then students can try their hand at graphing and analyzing phenological data by observing the first appearances of Spring Peeper frogs or Black Throated Green Warblers in the spring. They will be incorporating mathematics into science by observing trends and understanding how real data is collected and analyzed.

Procedure:

Graphing Activity

1. Print out pages for graphing Spring Peepers and Warblers. It is recommended that they be printed single sided so that students can work in pairs, with one reading dates and other placing marks on the graph.
2. When directed during the Powerpoint, hand out the blank graph paper, pencils or dry erase markers and 1 of the 2 data sheets to students or student pairs. (Spring Peepers or Black-throated Green Warblers)
3. Instruct the students to create graphs using the data table. They will label their graphs with x and y axes, and input dots on the graph that corresponds closely to the years and dates of the species appearances in the spring.
4. In doing so, they will be creating a scatter plot and analyzing the results. Monitor the students to be sure they understand the placement of dots relative to the graph.
5. After students create their graphs, return to the Powerpoint to check their work and discuss the results.
6. Questions to ask: quiz on dates of first arrivals and where they fall on the graph; ask about years with no data and how it affects results; trend lines: are they positive or negative; r-values and reliability of data.
7. Stress the conclusions that can be made: reliable trend lines depend on meaningful and rigorous data over many years. Repetition, replication and consistent logging of data are very important to making accurate scientific conclusions.

NATURE'S CALENDAR: EXTENSIONS AND REFERENCES



Extension activities:

- Collect Phenology data in your schoolyard. Pick a tree and follow it throughout the year and post the data on Nature's Notebook: https://www.usanpn.org/natures_notebook
- Pick a day to watch birds and post the data onto eBird: <https://ebird.org/home>
- Pick a day and take a picture of trees, flowering plants, insects and post the photos on iNaturalist: <https://www.inaturalist.org/>.
- Visit one of the many gardens in the area or contact a local farmer to visit the classroom.
- Visit the Museum of the Cherokee and the Oconaluftee Indian Village in Cherokee, NC. The Heritage of Cherokee Agriculture (pamphlet)
- Garden Genetics: Teaching with Edible Plants (other activities)
- Itse Selu by Daniel Pennington(book) - discuss Green Corn Festival, Cherokee language
- Discuss current EBCI projects: seed banks, garden wagon, etc. Visit: <https://ebci.ces.ncsu.edu/>
- Visit other sites: <https://www.blueridgeheritage.com/heritage/agriculture/cherokee-agriculture/>

References:

- National Phenology Network: <https://www.usanpn.org> (check out Nature's Notebook)
- Great Smoky Mountains National Park - Adopt-a-Plot Phenology Program <https://www.nps.gov/grsm/learn/news/park-recruits-adopt-a-plot-volunteers-2021.htm>
- Tribes and Climate Change Research: https://nanopdf.com/download/tribes-and-climate-change-research-usda-forest-service-5b041d89c798c_pdf
- Culturally Important Plants and Climate: <https://www.srs.fs.usda.gov/compass/2015/12/16/teaching-cherokee-indian-youth-about-culturally-important-plants/>
- Living Stories of the Cherokee: University of North Carolina Press (1998).
- Cherokee Heritage Trails Guidebook. Riggs, B. & Duncan, B.
- Museum of the Cherokee Indian: Exhibits, stories, and programs
- Mooney, James -The Bride from the South: From Myths of the Cherokee (1897-98)
- National Park Service - Citizen Science Programs - <https://www.citizenscience.gov/catalog/nps/#>
- NOAA: Climate and Weather Video link: <https://www.ncei.noaa.gov/climateandweathervideos>
- NASA: What's the Difference Between Weather and Climate? | NASA Climate Kids: <https://climatekids.nasa.gov/weather-climate/>
- Great Smoky Mountains Institute at Tremont Phenology: <https://gsmit.org/community-science/phenology/>





TEACHER COPY of Graphing Activity INSTRUCTIONS

Creating a Graph and Trend Line (Print single-sided p.2-3 Spring Peepers and/or p. 9-10 Black-throated Green Warblers as extension activity. Graphing answers using calendar dates are on p. 4-5 and 11-12; using Julian dates: p. 6-7 and 13-14. Answers to questions are in **BOLD** below.)

Groups 1. & 2. Data Tables

Spring Peeper First Heard			Black-throated Green Warbler First Heard		
Year <i>x axis</i>	Calendar date <i>y axis</i>	Julian date <i>y axis</i>	Year <i>x axis</i>	Calendar date <i>y axis</i>	Julian date <i>y axis</i>
1985	30-Apr	120	1985	8-Apr	98
1986	16-Mar	75	1986	1-Apr	91
1987			1987		
1988			1988		
1989	21-Feb	51	1989	21-Apr	111
1990			1990		
1991	8-Feb	39	1991		
1992			1992	6-Apr	97
1993			1993	12-Apr	102
1994	23-Feb	54	1994		
1995	28-Feb	59	1995	27-Mar	86
1996			1996		
1997			1997		
1998	19-Mar	78	1998	31-Mar	90
1999	2-Feb	33	1999	4-Apr	94
2000	1-Mar	61	2000	24-Mar	84
2001	18-Feb	49	2001	3-Apr	93
2002	14-Mar	73	2002	29-Mar	88
2003	1-Mar	60	2003	23-Mar	82
2004	25-Feb	56	2004	26-Mar	86
2005			2005	29-Mar	88
2006			2006	29-Mar	88
2007			2007	22-Mar	81
2008	19-Mar	79	2008	28-Mar	88
2009	9-Mar	68	2009		
2010	19-Jan	19	2010		
2011	12-Mar	71	2011	24-Mar	83
2012	2-Feb	33	2012	19-Mar	79
2013	2-Apr	92	2013	30-Mar	89
2014	12-Mar	71	2014	2-Mar	61
2015			2015	8-Mar	67
2016	1-Feb	32	2016	23-Mar	83
2017			2017	27-Mar	86
2018	10-Feb	41	2018	27-Mar	86
			2019	26-Mar	85

STEP 1

- 1) You will be entering data from the table on the left to a graph.
- 2) Label the x/y axes: the years along the bottom will be on the x-axis and the calendar dates OR epoch dates along the side will be on the y-axis.
- 3) Input a dot onto the graph that corresponds as closely as possible to the date and year.

STEP 2

- 1) When finished, answer the following questions:
 - **Q1.** What should you do for years that have no data? If you were to put a zero for the no data years, what would that do to the trend line? (*it should be left blank, as a "0" number would skew the data*)
 - **Q2. (Group 1 Peepers)** Approximately at what date were the Spring Peepers first heard in 1986, 2008, and 2016? (**Mar. 16, Mar. 19 & Feb. 1; Julian day 75, 78, 32**)
 - **Q2. (Group 2 Warblers)** Approximately at what date were the Black-throated Green Warblers first heard in 1985, 1995, and 2014? (**Apr. 8, Mar. 27, & Mar. 2; Julian day 98, 86, 61**)
 - **Q3.** What was the trend of your graph? (*looking at the Powerpoint, we can see it is a negative trend, the line is moving downward, with the dates of appearance coming earlier over time*)





Graphing INSTRUCTIONS – GROUP 1 Spring Peepers

Creating a Graph and Trend Line Activity

Group 1. Spring Peeper Data Table

Spring Peeper First Heard		
Year <i>x axis</i>	Calendar date <i>y axis</i>	Julian date <i>y axis</i>
1985	30-Apr	120
1986	16-Mar	75
1987		
1988		
1989	21-Feb	51
1990		
1991	8-Feb	39
1992		
1993		
1994	23-Feb	54
1995	28-Feb	59
1996		
1997		
1998	19-Mar	78
1999	2-Feb	33
2000	1-Mar	61
2001	18-Feb	49
2002	14-Mar	73
2003	1-Mar	60
2004	25-Feb	56
2005		
2006		
2007		
2008	19-Mar	79
2009	9-Mar	68
2010	19-Jan	19
2011	12-Mar	71
2012	2-Feb	33
2013	2-Apr	92
2014	12-Mar	71
2015		
2016	1-Feb	32
2017		
2018	10-Feb	41



STEP 1

- 1) You will be entering data from the table on the left to a graph.
- 2) Label the x/y axes: the years along the bottom will be on the x-axis and the months along the side will be on the y-axis.
- 3) Input a dot onto the graph that corresponds as closely as possible to the date and year.

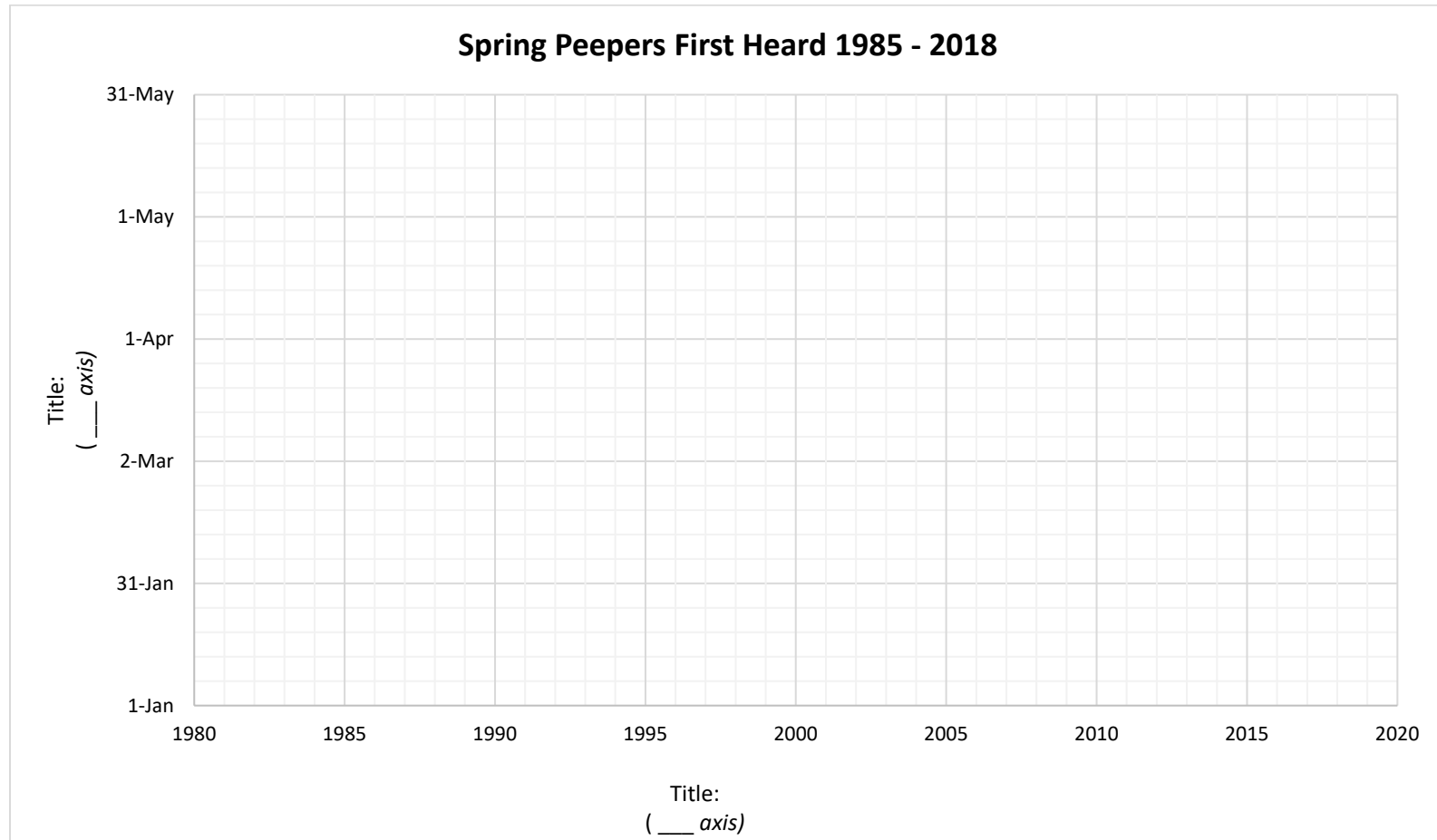
STEP 2

- 1) When finished, answer the following questions:
 - Q1. What should you do for years when there is no data? If you were to put a zero for the no data years, what would that do to the trend line?
 - Q2. Approximately at what date were the Spring Peepers first heard in 1986, 2008, and 2016?
 - Q3. What was the trend of your graph? Was it positive, negative, or no trend?



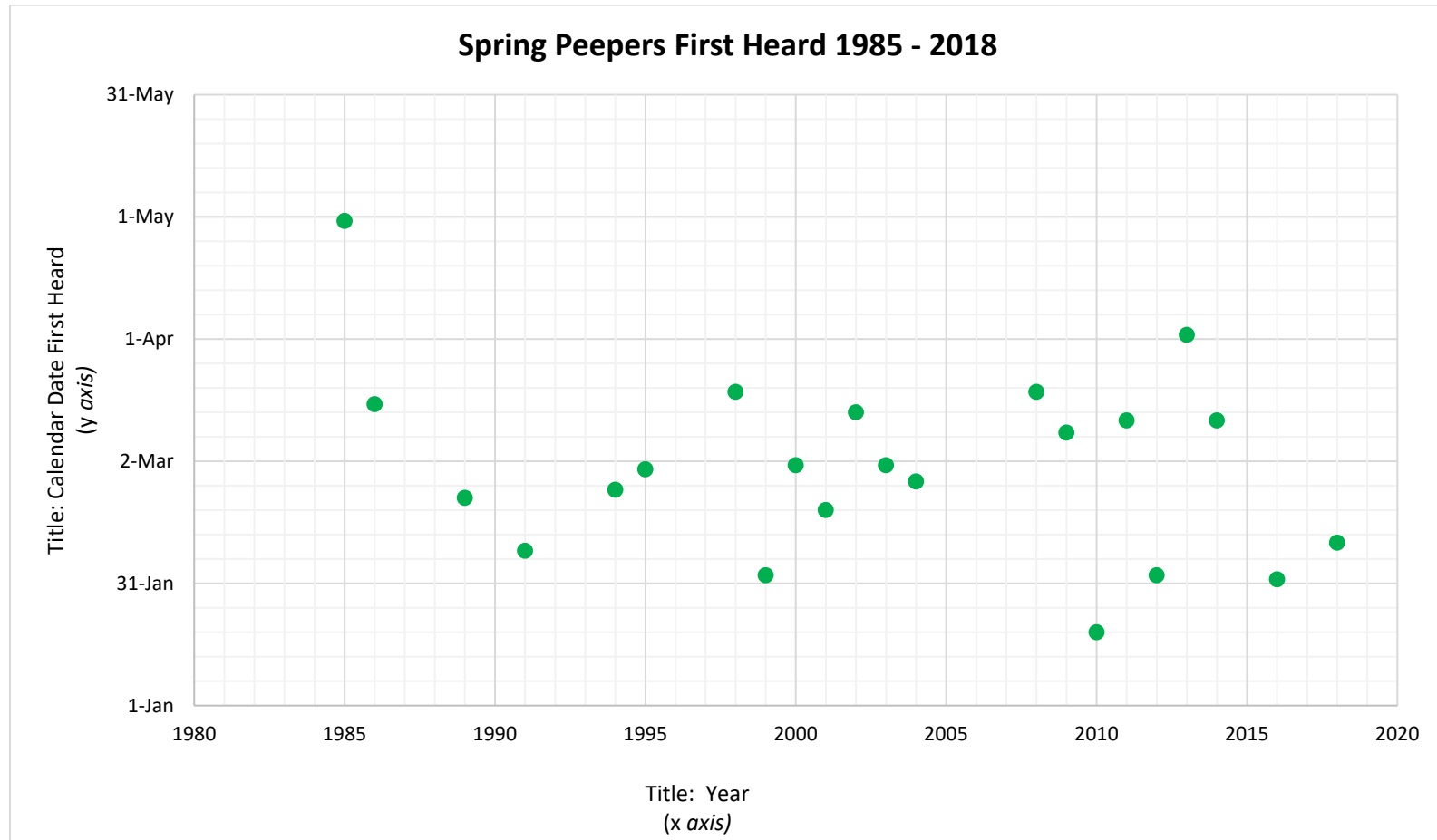


Group 1 ACTIVITY: Spring Peeper First Heard Calling 1985-2018 [Using Calendar Dates]





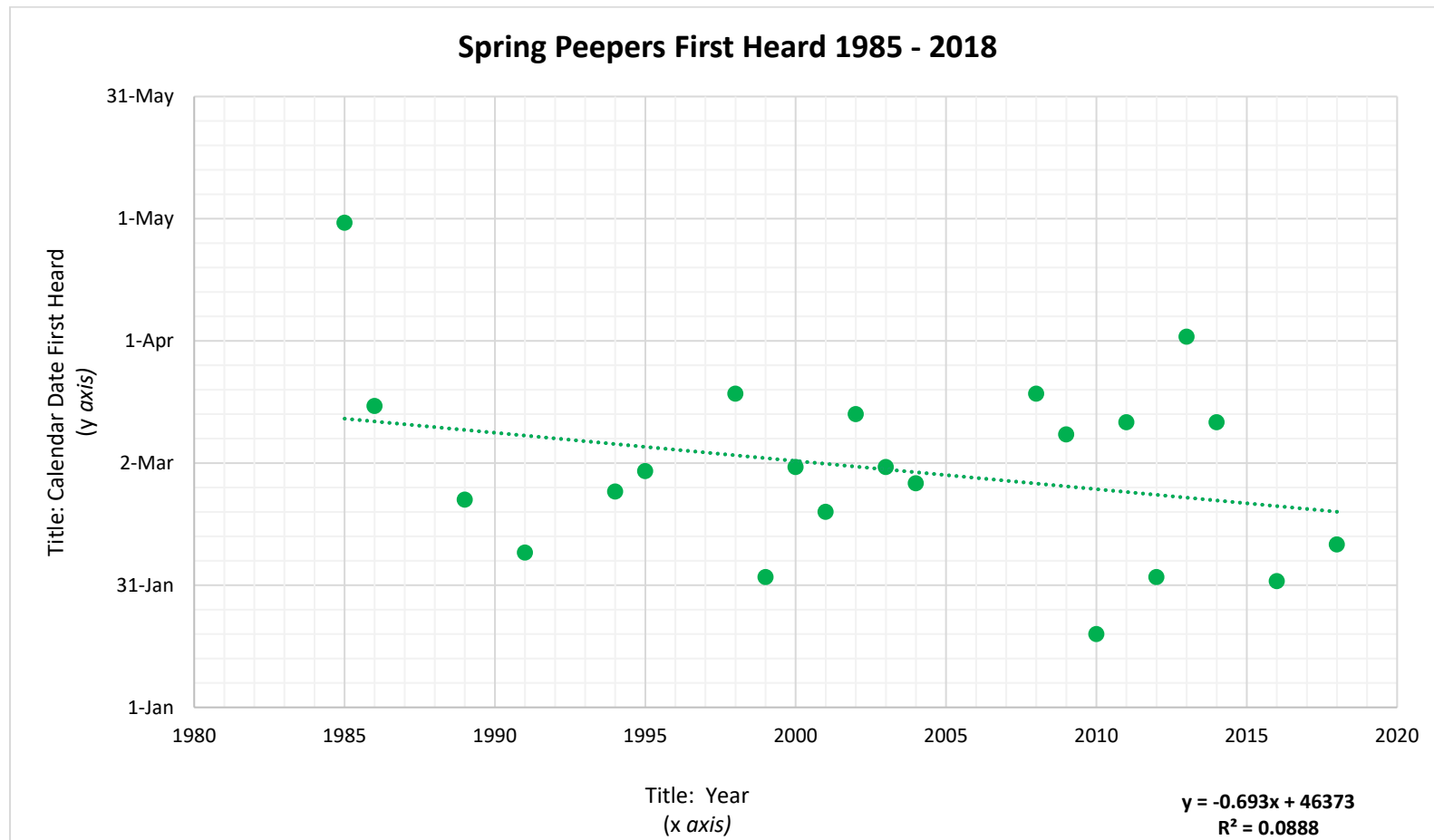
Graphing Answers – GROUP 1 [Using Calendar Dates]





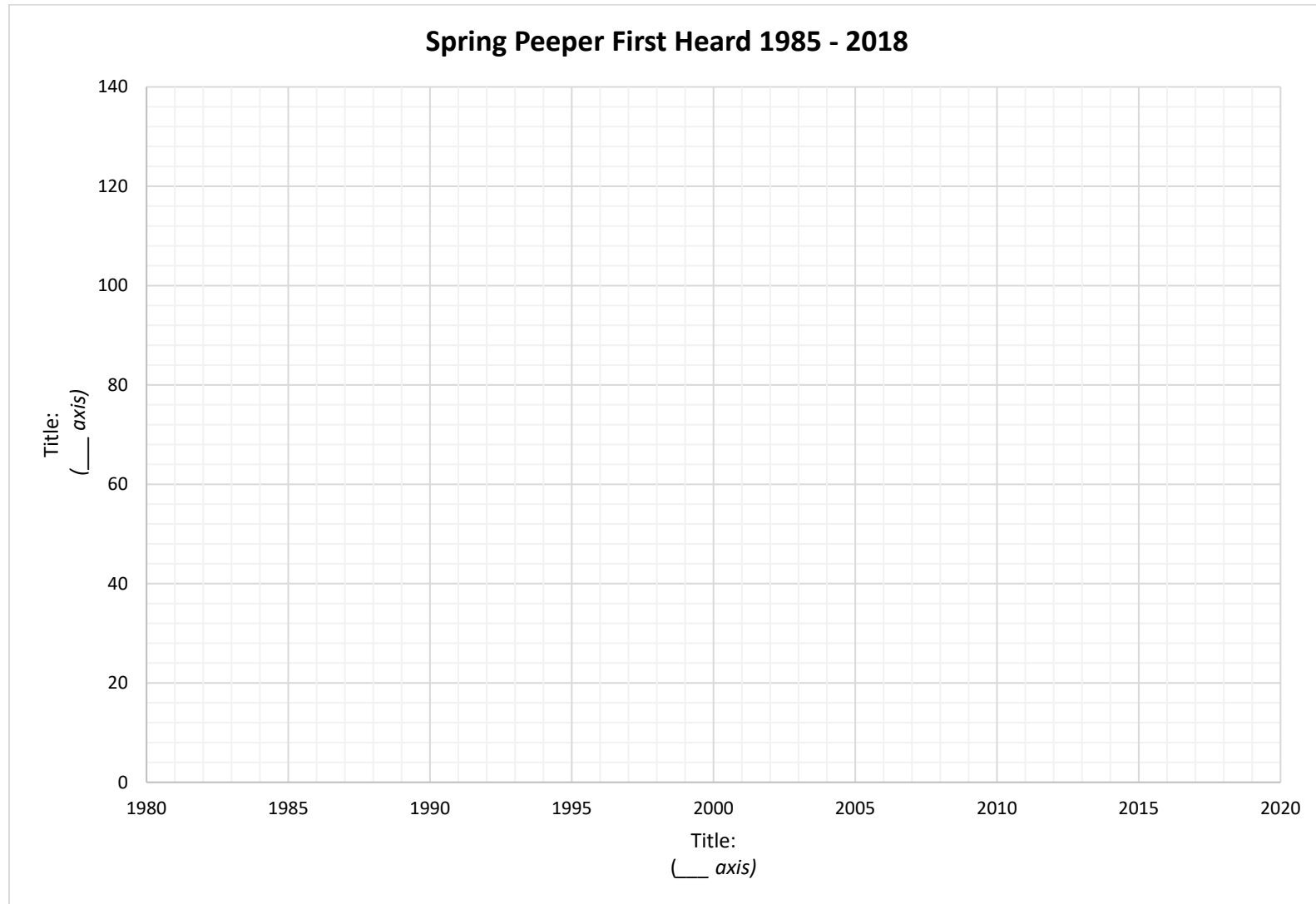
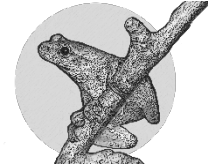
Graphing Answers with Trend Line – GROUP 1

[Using Calendar Dates]



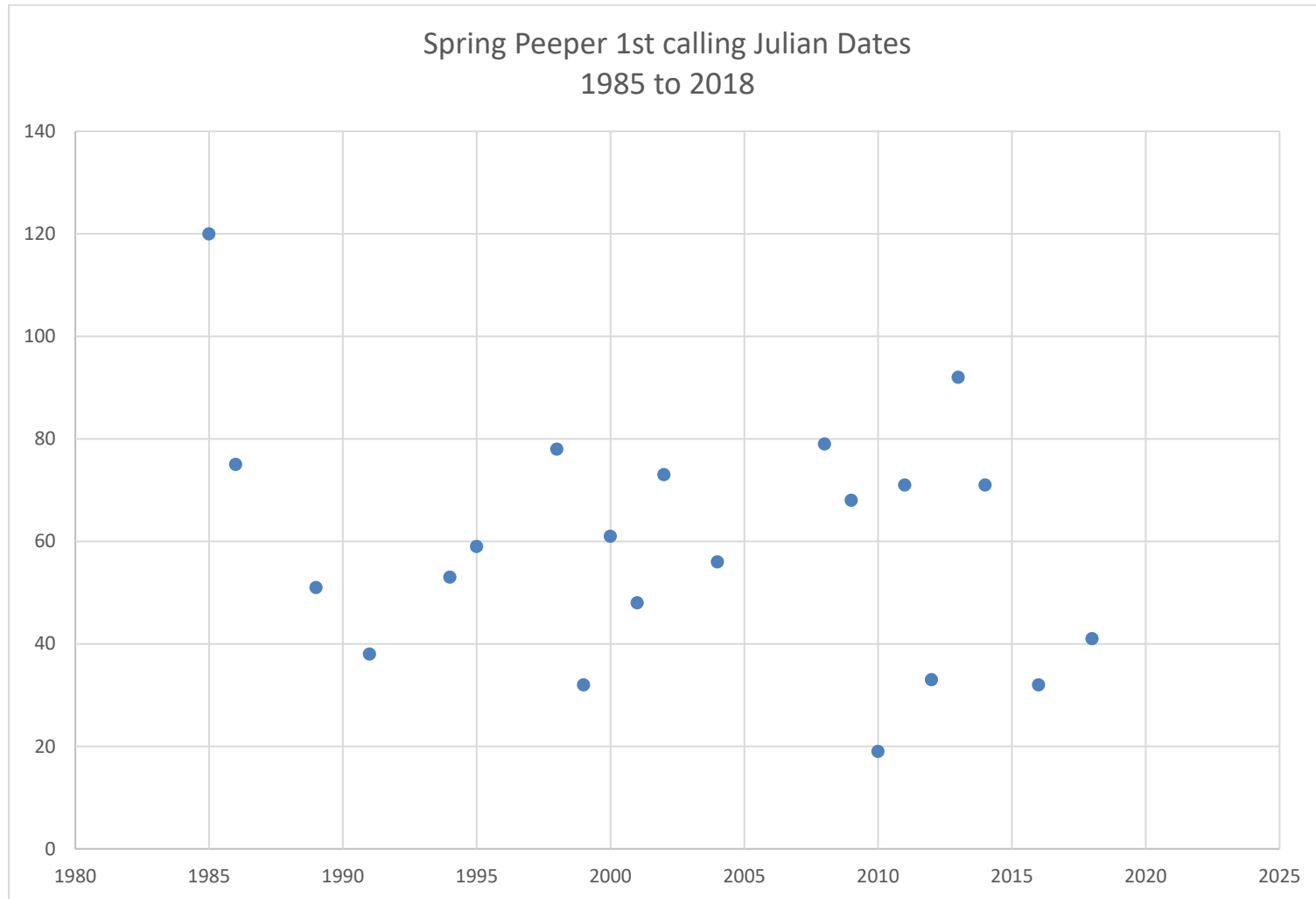


Group 1 ACTIVITY: Spring Peeper First Heard Calling 1985-2018 [Using Julian Dates]



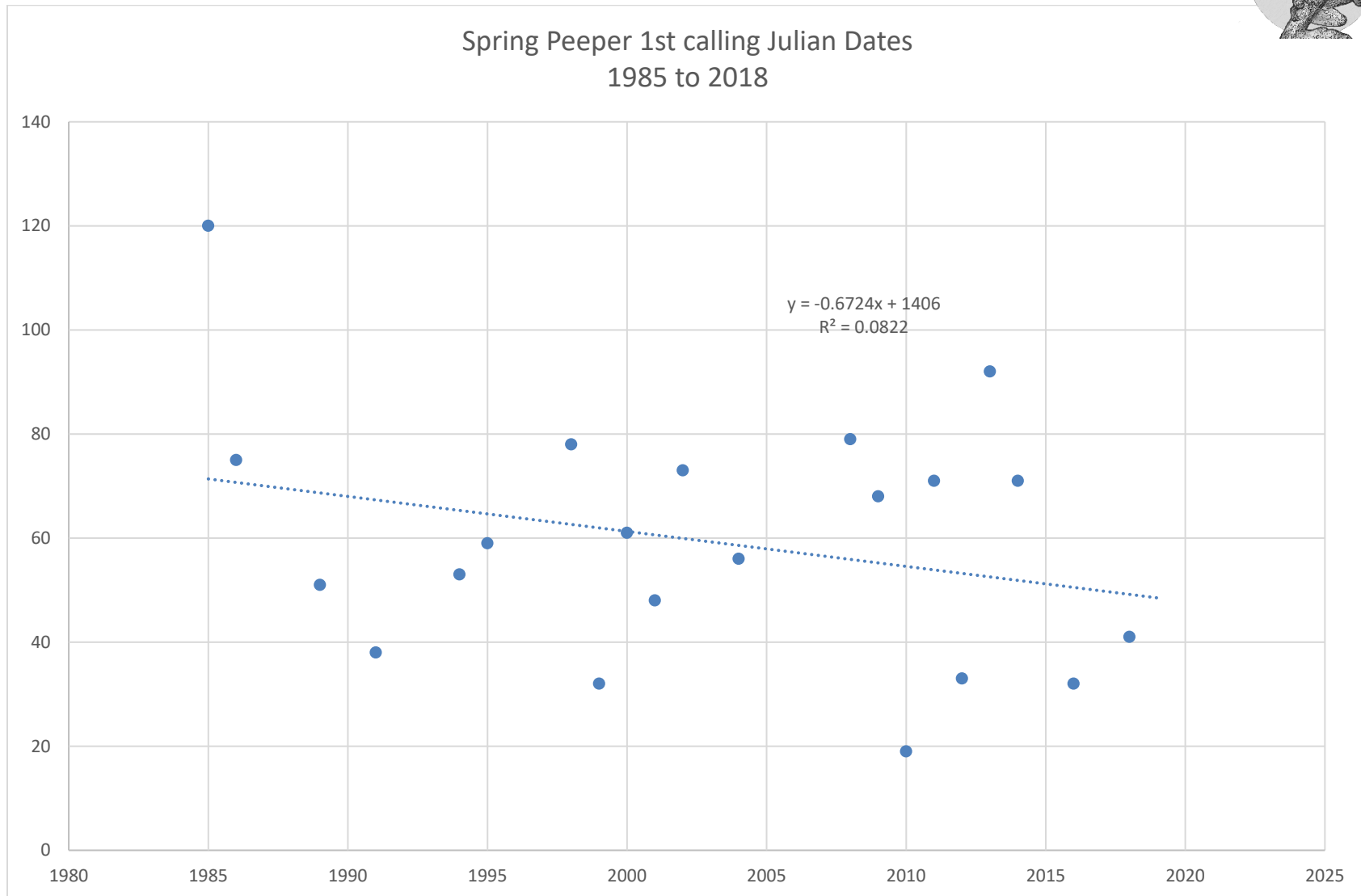


Graphing Answers – GROUP 1 [Using Julian Dates]





Graphing Answers with Trend Line – GROUP 1 [Using Julian Dates]





Graphing INSTRUCTIONS – GROUP 2 Warblers

Creating a Graph and Trend Line Activity



Group 2. Black-throated Green Warbler Data Table

Warbler First Heard		
Year <i>x axis</i>	Calendar date <i>y axis</i>	Julian date <i>y axis</i>
1985	8-Apr	98
1986	1-Apr	91
1987		
1988		
1989	21-Apr	111
1990		
1991		
1992	6-Apr	97
1993	12-Apr	102
1994		
1995	27-Mar	86
1996		
1997		
1998	31-Mar	90
1999	4-Apr	94
2000	24-Mar	84
2001	3-Apr	93
2002	29-Mar	88
2003	23-Mar	82
2004	26-Mar	86
2005	29-Mar	88
2006	29-Mar	88
2007	22-Mar	81
2008	28-Mar	88
2009		
2010		
2011	24-Mar	83
2012	19-Mar	79
2013	30-Mar	89
2014	2-Mar	61
2015	8-Mar	67
2016	23-Mar	83
2017	27-Mar	86
2018	27-Mar	86
2019	26-Mar	85

STEP 1

- 1) You will be entering data from the table on the left to a graph.
- 2) Label the axes: the years along the bottom will be on the x-axis and the months will be on the y-axis.
- 3) Input a dot onto the graph that corresponds as closely as possible to the date and year.

STEP 2

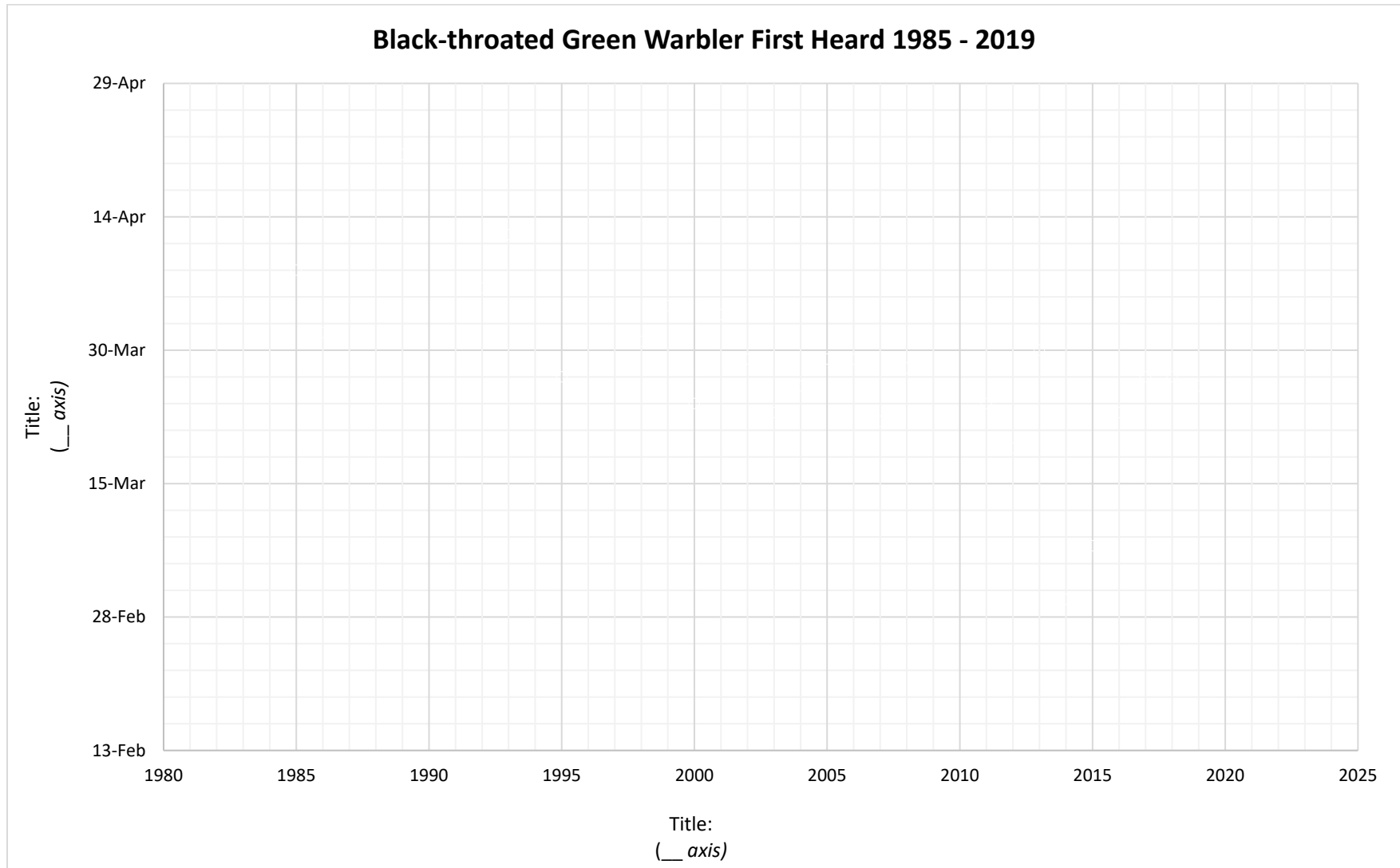
When finished, answer the following questions:

- Q1. What should you do for years when there is no data? If you were to put a zero for the no data years, what would that do to the trend line?
- Q2. Approximately at what date were the Black-throated Green Warblers first heard in 1985, 1995, and 2014?
- Q3. What was the trend of your graph? (Positive, negative or no trend?)



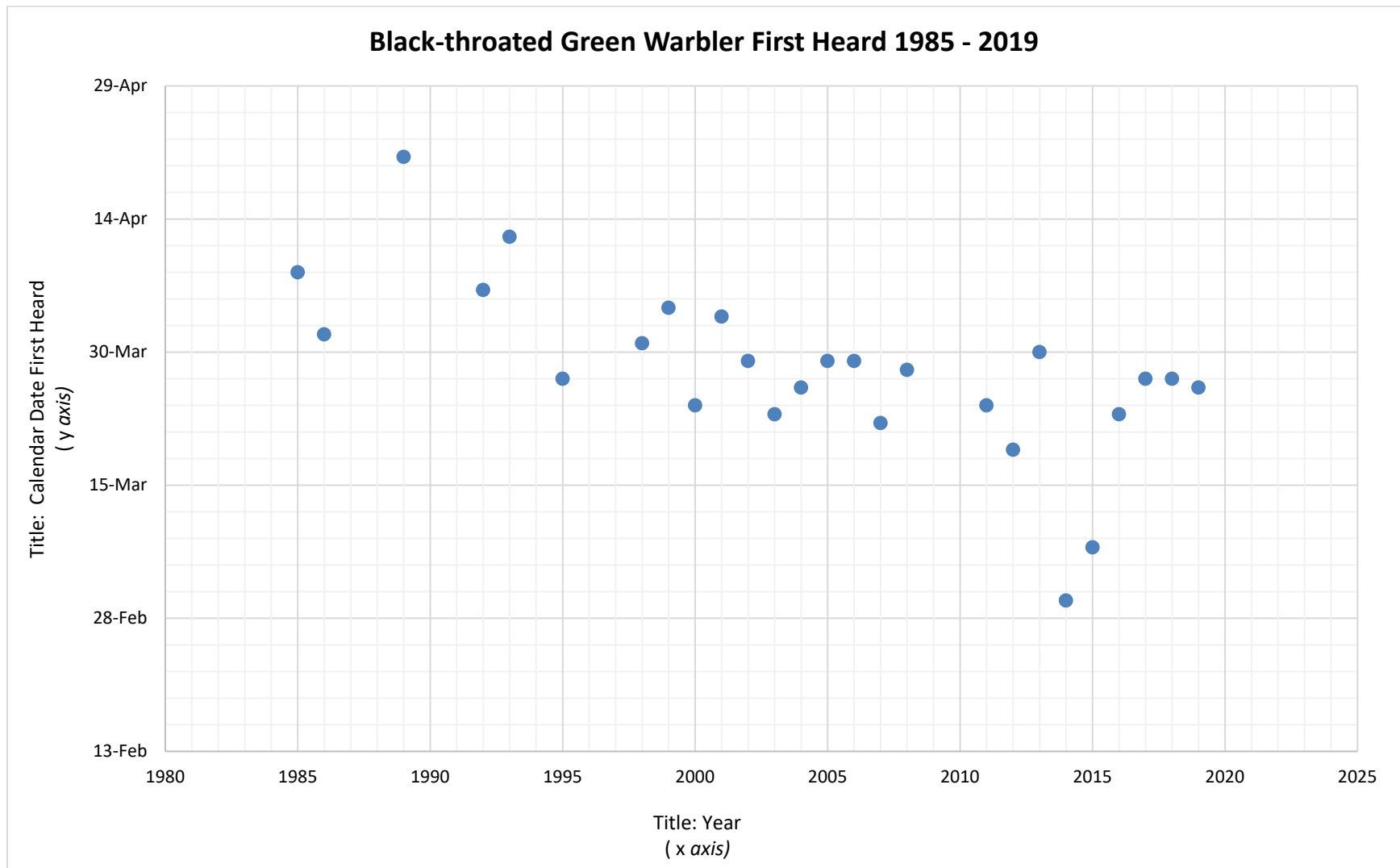


GROUP 2 – ACTIVITY: Black Throated Green Warbler First Heard [Using Calendar Dates]





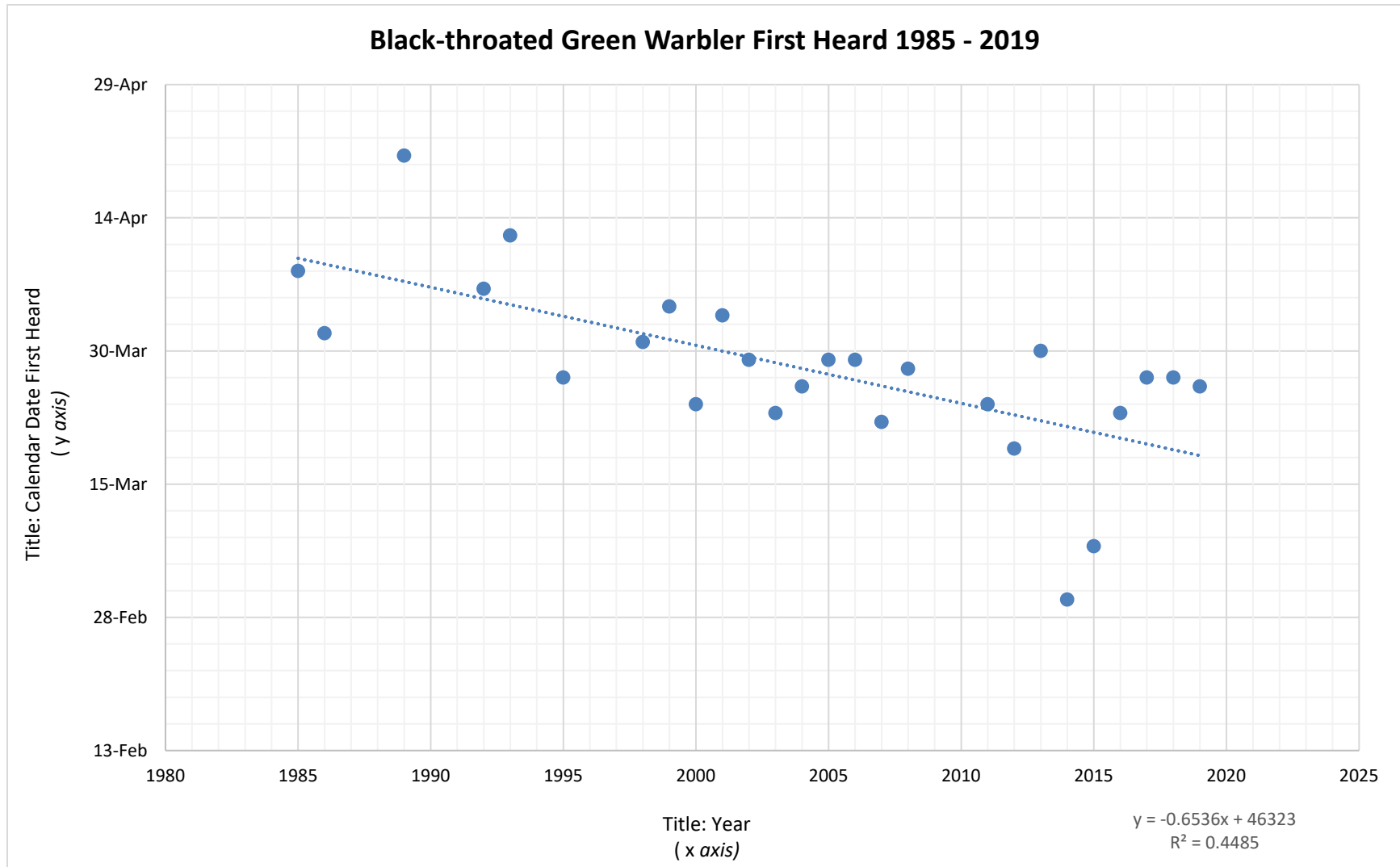
Graphing Answers – GROUP 2 [Using Calendar Dates]





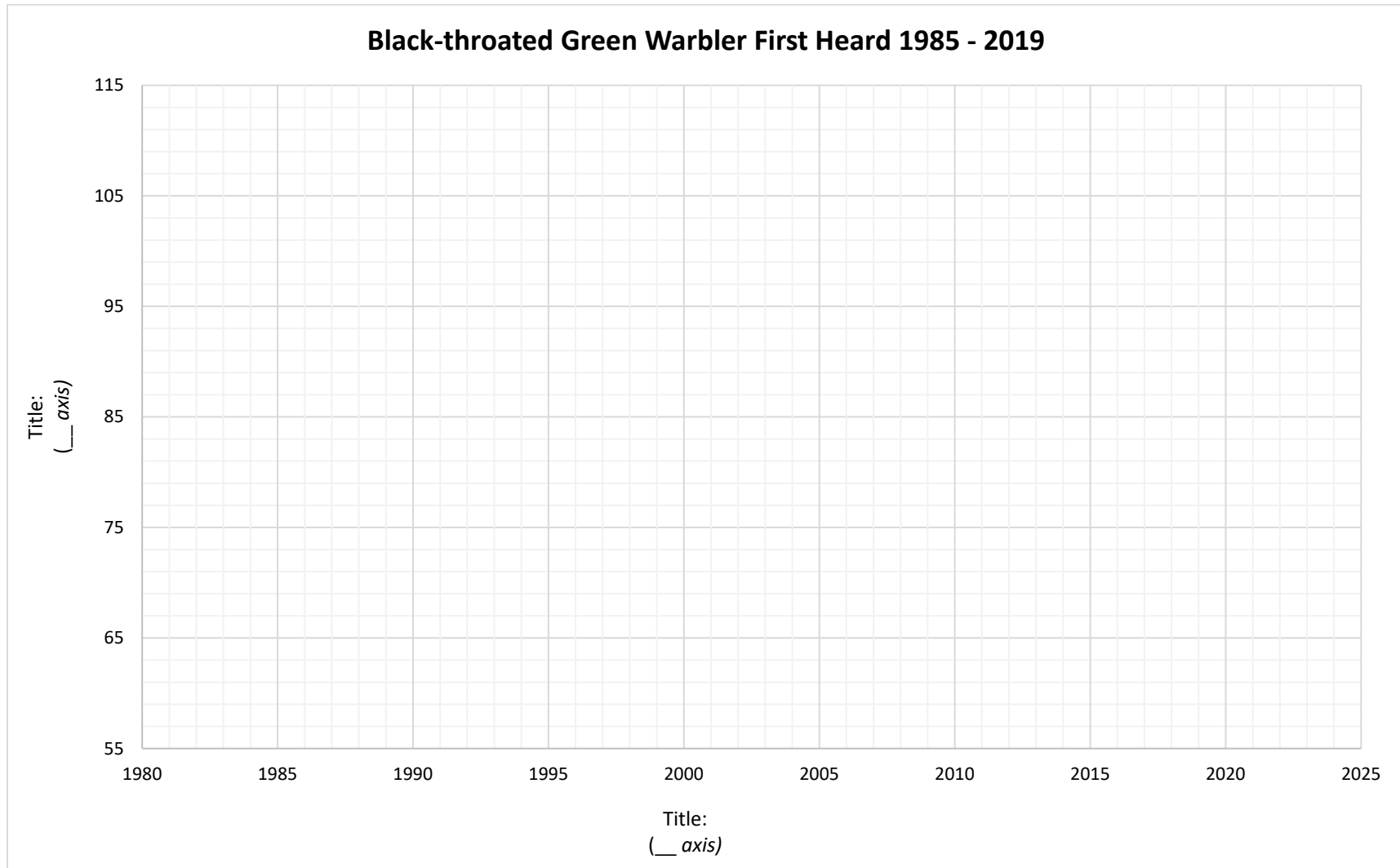
Graphing Answers with Trendline – GROUP 2

[Using Calendar Dates]



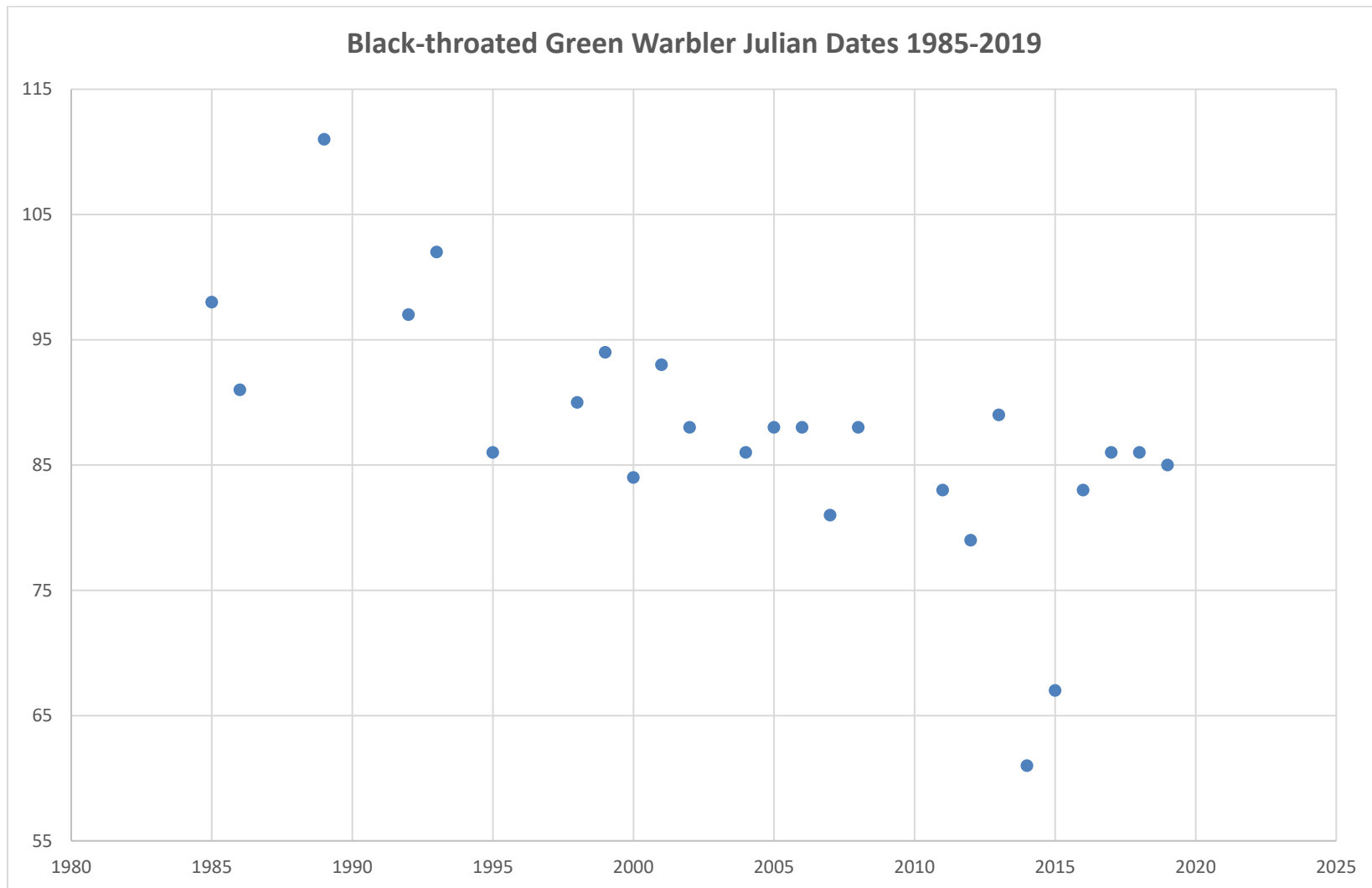


GROUP 2 – ACTIVITY: Black Throated Green Warbler First Heard [Using Julian Dates]





Graphing Answers – GROUP 2 [Using Julian Dates]





Graphing Answers with Trendline – GROUP 2

[Using Julian Dates]

