DATA SCIENTIST

This lesson plan was created by Emily Lim as part of the Acadia Teacher Fellowship program. ATF created lesson plans are created by educators for educators. Any books or links suggested in this curriculum are not an endorsement by the National Park Service.

Grade Span	9-12
Time Span	5 week project, about 5 hours per week.
Standards	**All Standards are from the Oklahoma Academic Standards** **https://sde.ok.gov/oklahoma-academic-standards** **Science** B.LS2.1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacities of ecosystems at different scales. B.LS2.8 Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce. B.LS4.5 Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. EN.LS2.1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacities of ecosystems at different scales. EN.ESS3.4 Evaluate design solutions for a major global or local environmental problem that reduces or stabilizes the impacts of human activities on natural systems.* **Mathematics** Data & Probability (D) A1.D.1 Display, describe, and compare data. For linear relationships, make predictions and assess the reliability of those predictions. A1.D.1.1 Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of central tendency, location, and spread. Know how to use calculators, spreadsheets, or other appropriate technology to display data and calculate summary statistics. **Computer Science** L1.DA.CVT.01 Use tools and techniques to locate, collect, and create visualizations of small- and large data sets (e.g., paper surveys and online data sets).

	L2.DA.CVT.01 Use data analysis tools and techniques to identify patterns from complex real-world data. L2.DA.CVT.02 Generate data sets that use a variety of data collection tools and analysis techniques to support a claim and/or communicate information. Inference & Models
Focus Question	• Have migration patterns changed and if so, can we determine why?
Overview	To become a data scientist and use data to create an evidence based argument whether humans are impacting migratory patterns of birds.
Objectives	• Use computational and/or mathematical representations to present data • Use data analysis tools and techniques to identify patterns from complex real-world data. • Use mathematical and/or computational representations to support explanations of factors that affect carrying capacities of ecosystems at different scales

Materials Needed	• Chromebooks *(if technology is not available for every student use a single teacher device or split students into groups based on the number of available devices)*
	• Migratory Data from the following sources
	  ○ https://ebird.org/explore
	• Bird identification
	  ○ https://merlin.allaboutbirds.org/
	• Excel or Google sheets *(have the google sheets or Excel table already set up)*
	• Color printer
	• https://app.datawrapper.de/map/iblSx/data
	• Article to read *(make an audio version available or have text to speech)*
	• Laminator
	• Rings for binding
	• Hole punch
	• Scissors

Vocabulary	Migration: is the regular movement of a species in order to locate resources needed for survival. *(movement of animals from one place to another, usually based on the time of year)* Barrier: an obstacle that prevents or impedes movement
Teacher Prep	• Download ebird to device(s) • Download merlin to device(s) • Familiarize yourself with both apps

	• Familiarize yourself with how to identify the species that migrate through your region ○ Ebird - science - ebird status and trends -abundance animations - explore abundance animations - filter by region and sub region • Identify a trail to take students on a walk to observe birds • Walk trail to identify any barriers and notice what you might see
Background	There are many types of migration, human migration, animal migration, even plant migration. Bird migration is the regular seasonal movement of birds, often north and south. Migration is driven by resources such as food and nesting sites. Migration has a large mortality rate due to many factors. More information here: https://www.allaboutbirds.org/news/the-basics-how-why-and-where-of-bird-migration/ The goal of this lesson is to have students analyze data to determine if migratory patterns are changing and if they can identify why. Many factors are affecting migratory patterns. Insect population is key to a healthy bird population. Habitat removal by land development.
Procedure	**Engage:** What birds live in our backyard and how many can we identify? Week 1: Take students on a walk/hike near your school. Ask them to record bird sounds and/or take photos of birds on the walk. *(provide bird cards and have students pull the cards for the birds they think they see)* Document using table in appendix A In classroom Name any birds they think they can identify Have students pair up and compare what they noticed *(may need to facilitate to ensure students are evenly distributed in groups)* **Explore:** What tools do we have that can allow us to identify more birds? Introduce Merlin App Load location pack for your region Filter by top 20 common birds for your region Play songs and show photos Ask students to create a flip chart of common birds in their region Each student is assigned one bird

Color print photos from https://www.allaboutbirds.org/guide/
Example in Appendix D
Each student prints out 25 copies
Bird photo on one side, name, etc. on the other side
Laminate 25 separate cards
Punch hole and put on ring
You will now have 25 rings of 25 different birds *(may consider omitting the printing, laminating, and hole punching)*

Week 2:

Take students on the same walk/hike near your school. Ask them to use their flip chart and the data table to document birds.

Have students create a data table on birds they can identify
Examples Appendix B
Ask students if they think time of day matters

Explanation:

Introduce Migration
Class discussion:
What is migration?
What things migrate?
Can plants migrate?
Exit ticket: If they could migrate, where would they go and when? Why?

Introduce ebird
Students download ebird to their devices
Set up a username and password
Download bird pack for their region
Filter by region to see migration animation for your state, city, etc.

Learn how to use ebird:
Have students learn how to find ebird animations for their region. Assign a different bird to each student. *(consider assigning the less complicated species accordingly to assist with meeting mastery level expectations)*
Students answer:
Species
Highest abundance in their area (month, week)
Lowest abundance in their area (month, week)
Breeding season

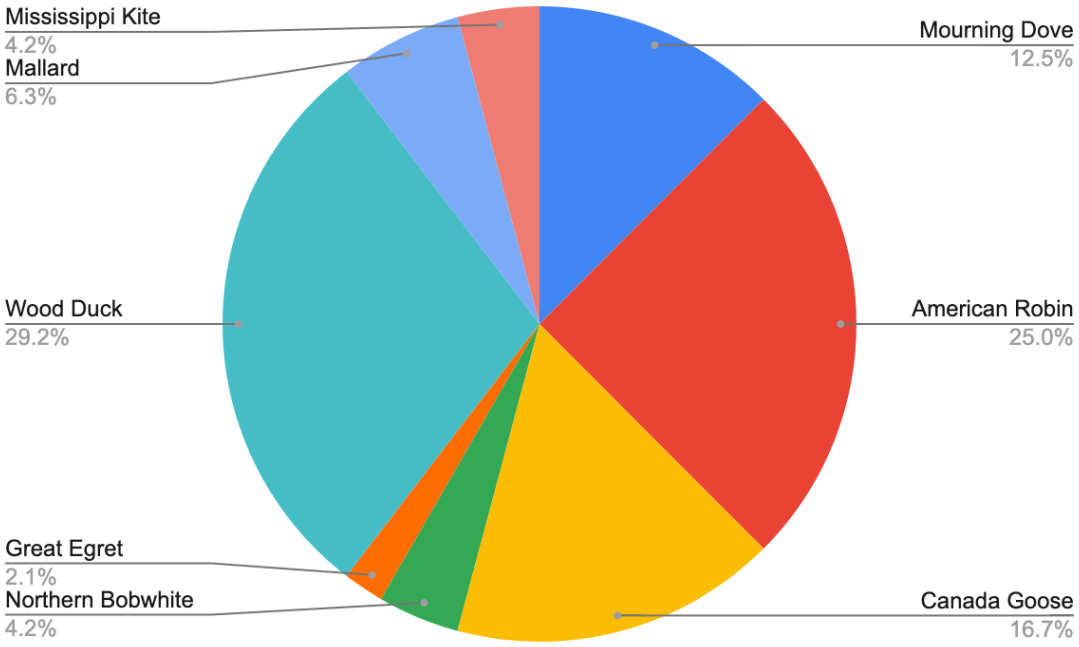
	Week 3: Students choose a species to research the following: *(provide a fillable chart or outline, consider assigning the less complicated species accordingly to assist with meeting mastery level expectations)* Migratory pattern for 2020 Migratory pattern from at least 4 earlier time periods *(fewer time periods or assign specific time periods based on data availability)* What do you notice about the migratory pattern? Is the migratory pattern changing? What might be contributing or causing the migratory shift? *(provide a selection of options or suggestions)* What can be done to mitigate the effect? *(provide an example or two)* **Extension:** Week 4: Students identify a way they can have a positive impact on migration patterns in their area, i.e. keeping meadows unmowed, saving natural waters, and not using pesticide to kill insects. *(give a modified list of impacts to choose from or assign based on expected level of mastery)*
	Evaluate: Week 5: Students create a Public Service Announcement infographic that explains the following: Bird species and habitat Migration pattern changes over time Factors affecting migratory pattern changes Steps that can be taken to mitigate these effects Data sources are cited No opinions are given, only data analysis Students find an audience for their presentation Elementary or middle school class

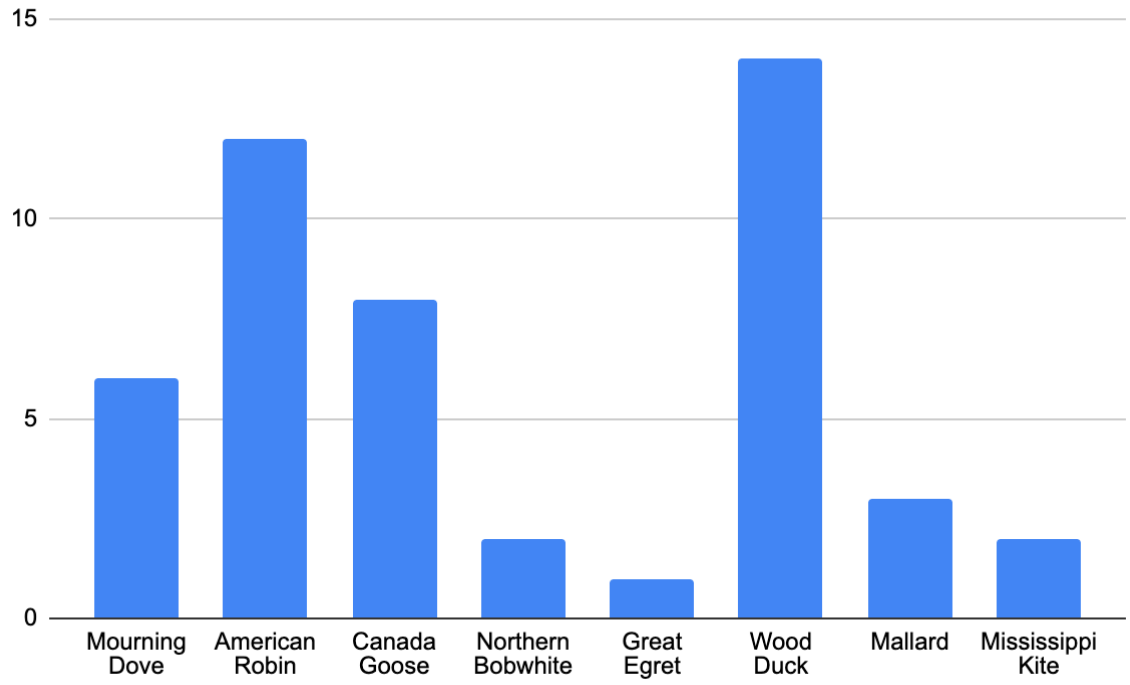
	Elected official Land developer Nature preserve Fish and Wildlife Rubric to evaluate project: See Appendix C Bird ID quiz: https://ebird.org/quiz/ This quiz is customizable by region. Each student can practice their identification via sight and song. *(assign from the steps above according to the expected level of mastery for each individual student. Provide a rubric with a clear timeline of completion)*

Appendix A

Data Scientist Name	Date	Location	Time start	Time end	Stationary count	Traveling count	What was the weather like?
		Used to identify		Witnessed the bird			
Species	# of birds of same type	Sound	Sight	Stationary	In motion	Notes	

Appendix B


Mississippi Kite
4.2%
Mallard
6.3%
Mourning Dove
12.5%
Wood Duck
29.2%
American Robin
25.0%
Great Egret
2.1%
Northern Bobwhite
4.2%
Canada Goose
16.7%


15
10
5
0
Mourning Dove
American Robin
Canada Goose
Northern Bobwhite
Great Egret
Wood Duck
Mallard
Mississippi Kite

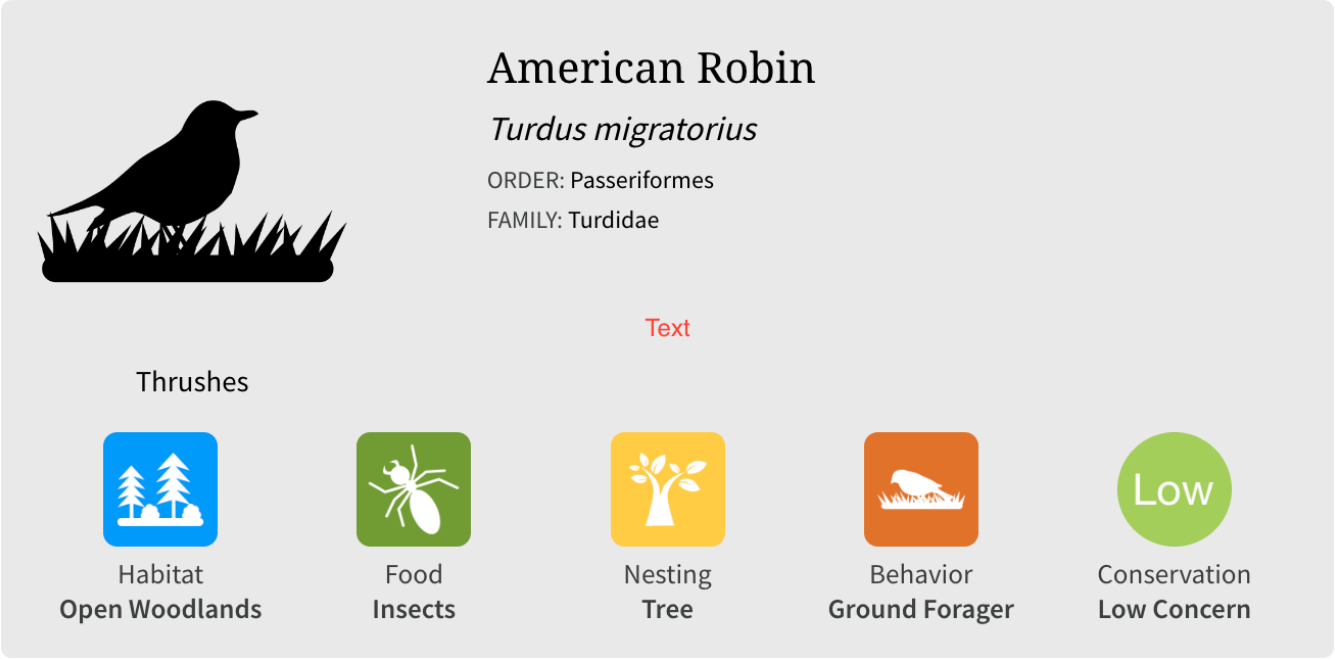
Appendix C

One option for creating this rubric is to have the class create it together. When students develop rubrics in a collaborative environment, they will have more ownership in the evaluation tool.
Below is an example, if you don't want to create a rubric as a class.

	No Evidence	Emerging	Proficient	Advancing	Mastery
Graphic representation of migration patterns	No graphs or charts	A graph or chart is present but does not clearly identify changes in migration patterns	graph showing change over time	Full color graph showing pattern changes over time.	Full color graph is labeled with migratory pattern changes, years, and data sources are cited
Factors affecting migratory patterns	No factors that affect migratory patterns are listed	Some factors are listed	Most factors are listed in presentation	Most factors are listed in presentation with data that supports these factors	All factors are listed in presentation with evidence cited
Photos of bird	No photos present	Photos are present but small or limited	Photos are included in presentation. Photos show both male and female species	Full color photos that are large and add to the presentation	Full color photos show male and female bird, add to the presentation and are taken by student
Photos of habitat	No photos present	Photos are present but small or limited	Photos are present and represent all habitats of bird	Full color photos that add to the information presented	Photos of habitat are full color and show how habitat is changing over time
Visual map of migration pattern labeled with seasons	No map present	Map is present but data is hard to understand	Map has arrows showing migration directions, flow and/or seasons	Map has arrows showing migration directions, flow and seasons and is easy to understand	Map is full color and has arrows showing migration directions, flow and seasons and is easy to understand

Appendix D

When making laminated ID cards, one side could look like this. The other side could be a full color photo. This was taken from https://www.allaboutbirds.org/guide/



https://macaulaylibrary.org/asset/222821411