Environmental Literacy Model

Title	Birds and Human Impacts in Chesapeake Bay ecosystems
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School, District	Pickering Creek Audubon Center and Wicomico County
Audience (grade, course)	6th grade science

Curriculum Anchor	Notes

Curriculum Anchor

Defining the Learning Objectives and Curriculum Connection
Curriculum indicators, performance expectations, and/or learning objectives.

MWEE takes place throughout the Ecology Unit during 4th Quarter. Teachers can decide if they want student groups to study specific birds, a single bird and if they want to revisit the same bird(s) throughout the lessons. Teachers will have discretion on the investigations throughout the MWEE but can use this outline as a guide.

NGSS Performance Measures

MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (LS2.A)

MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (LS2.A)

MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (LS2.B)

MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (LS2.C)

MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* (LS2.C, LS4.D, ETS1.B)

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*

Maryland Environmental Literacy Standards Indicators

Standard 3, Topic C, Indicator 1: Analyze and explain the movement of matter and energy through Earth's systems and the influence of this movement on the distribution of life. (MS-LS2-4)

Standard 4, Topic A, Indicator 1: Explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level. (MS-LS2-3)

Notes

Some suggestions for teachers:

1.   Compare native and non-native species.

2.   Compare migratory and residential species.

3.   Offer students a list of pre-selected list of birds from which to investigate.

4.   Examine impacts of water quality and fish on bird populations

Standard 4, Topic B, Indicator 1: Analyze the growth or decline of populations and identify a variety of responsible factors. (MS-LS2-1) Standard 4, Topic C, Indicator 1: Explain how the interrelationships and interdependencies of organisms and populations contribute to the dynamics of communities and ecosystems. (MS-LS2-2) Standard 5, Topic A, Indicator 1: Analyze the effects of human activities on Earth's natural processes. (MS-ESS3-3) Standard 7, Topic A, Indicator 1: Investigate factors that influence environmental quality. (MS-LS2-5)	
### Describing the Local Context The issue that will serve as the context for learning. Human activity within Wicomico County affects wildlife within Chesapeake Bay ecosystems.	Because birds are easily accessible to students - they can be seen in every school yard and backyard - students will narrow focus specifically to birds as examples of wildlife impacted by human activities.
### Identifying the Driving Question A broad, open-ended, life-relevant question that is based on the standards/learning objectives. Guides inquiry for the investigation(s) and prompts the development of actionable claims. How do human activities impact wildlife populations in Chesapeake Bay ecosystems?	Because birds are easily accessible to students - they can be seen in every school yard and backyard - students will narrow focus specifically to birds as examples of wildlife impacted by human activities.

Issue Investigations	
Issue Investigation #1	**Notes**

Asking Questions, Defining Issues and Problems Students define the issue, problem, or phenomenon to be investigated and develop questions that are relevant for investigation. 1. How do scientists use scientific processes to study wildlife, such as birds? - Pickering Creek-led, introductory lesson 2. How does matter/energy cycle among living and nonliving parts of the ecosystem? - Teacher-led lesson Student Brainstorms- What are ways we/scientists could answer our issue question?	NGSS MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. MELS Standard 4. Topic A, Indicator 1: Explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level.
Planning and Conducting Investigations Students develop plans for collecting, analyzing, and communicating information and/or data to help them answer their questions and understand the problem. Students identify and justify appropriate sources of information and/or data, and determine methodologies for the collection of information and/or data. Assess students' prior knowledge. (Survey) Introduce Owl Pellets Dissection ● Clearly define the connection to the Chesapeake Bay in each issue investigation. During owl pellet dissection, make sure to connect a local species like a barred vs. a burrowing owl. ● Introduce other stakeholders' perspectives, like when discussing cats outside, include why people do this. (This will allow students to develop a more well-rounded argument with multiple sides.)	Day 1- Intro to matter/energy cycles, Led by Pickering Creek Day 2- Owl Pellet Dissection, Teacher Led

Analyzing and Interpreting Data Students present and share information and/or data to reveal patterns that indicate relationships. Students apply disciplinary concepts as they analyze and interpret information and/or data to make sense of the issue, problem, or phenomenon. Catalog and analyze material within owl pellet to develop a Chesapeake Bay food web.	
Constructing, Communicating, and Refining Explanations Students identify, synthesize, and apply evidence from their investigations (for example, measurements, observations, and patterns) to draw conclusions about the driving question. Apply to student's specific study species. Student conducts research to compare their bird with the owl. Students create a model of a food web for their bird. Student discussion, revisit driving question: <u>How does matter/energy cycle among living and nonliving parts of the ecosystem?</u>	
Issue Investigation#2 (Outdoor Field Experience at Pickering Creek Audubon Center)	**Notes**
Asking Questions, Defining Issues and Problems Students define the issue, problem, or phenomenon to be investigated and develop questions that are relevant for investigation. Program will support what students have already learned or preview what students will be learning. <u>How does large-scale wildlife habitat support bird species in the Chesapeake Bay watershed? How does large-scale habitat compare to other types of land use (developed, agriculture) within the watershed?</u>	<u>NGSS</u> MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (LS2.A) MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (LS2.A) MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or

biological components of an ecosystem affect populations. (LS2.C)

MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* (LS2.C, LS4.D, ETS1.B)

MELS
Standard 4, Topic B, Indicator 1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Standard 4, Topic C, Indicator 1: Explain how the interrelationships and interdependencies of organisms and populations contribute to the dynamics of communities and ecosystems.

Standard 3, Topic C, Indicator 1: Analyze and explain the movement of matter and energy through Earth's systems and the influence of this movement on the distribution of life.

Standard 7, Topic A, Indicator 1: Investigate factors that influence environmental quality.

Planning and Conducting Investigations

Students develop plans for collecting, analyzing, and communicating information and/or data to help them answer their questions and understand the problem. Students identify and justify appropriate sources of information and/or data, and determine methodologies for the collection of information and/or data.

Students will act as habitat biologists and assess species richness and diversity in several different habitats within the Center's acres including ponds, wetlands, meadows and forests.
- Students take an actively involved role in the planning process by choosing specific tools for the habitat richness and diversity assessment. Tools can include binoculars, dip nets, seine nets, bug boxes and butterfly nets.
- Students will then devise a procedure or a plan to sample and record species richness and diversity in 4 different habitats at the Center. (Students can use binoculars to identify and record birds that will be entered into the citizen science eBird program. Students can use dip nets and seine nets to survey invertebrates and other wildlife in the pond and wetland pools. Students can use bug boxes and butterfly nets to search for and study insects in warm-season grass meadows to evaluate food availability for certain birds.)

Students will continue their class discussions about the ways humans impact local species, habitats, and the watershed at large.

Analyzing and Interpreting Data

Students present and share information and/or data to reveal patterns that indicate relationships. Students apply disciplinary concepts as they analyze and interpret information and/or data to make sense of the issue, problem, or phenomenon.

Throughout the field experience at Pickering Creek Audubon Center, students will share their data and observations with their field groups and partners. A recorder for each group will tally the species richness and diversity within each visited habitat. Students will use their data and data from Pickering Creek's eBird account to draw conclusions about the importance of biodiversity to the health of an ecosystem, and whether the habitats at Pickering Creek provide the food, water, shelter and space that their specific bird(s) need.

Constructing, Communicating, and Refining Explanations Students identify, synthesize, and apply evidence from their investigations (for example, measurements, observations, and patterns) to draw conclusions about the driving question. Students will return to their classroom to compare their species richness and diversity data from Pickering Creek and will evaluate their schoolyard and local neighborhood for bird species richness and diversity. Students will re-evaluate the habitat needs of their birds and will determine where within the watershed they are likely to find it. They will compare and contrast how food sources may differ among different types of land use. Can their bird meet its habitat needs at both Pickering Creek and on their school grounds? They will be introduced to the question: How can they as students play a role in bird conservation? What birds might only be found at Pickering Creek Audubon Center? What birds could be found in both places?	Click or tap here to enter text.

Issue Investigation #3

	Notes

Asking Questions, Defining Issues and Problems
Students define the issue, problem, or phenomenon to be investigated and develop questions that are relevant for investigation.
 	
<u>Issue Question: How does the availability of certain resources impact the health of local bird populations?</u> - Pickering Creek-led lesson investigating bird habitat and human impacts within the schoolyard. Teachers will continue with data analysis and interpretation in the classroom.
 	
PowerPoint on birds and habitat needs, some adaptations. Student worksheet.
    1.   What do birds need? (Food, water, shelter, space=healthy habitat)
    2.   What resources are available?
    3.   How do human impacts resource availability?
    4.   What are the human activities that affect birds?
        a.   Human impacts: fragmentation, introduction of nonnative species, climate change, habitat degradation, water quality, cats
    5.   Predict: What bird would you see in different habitats?
    6.   What happens when humans do [different activities]?
    7.   How do humans affect interactions within ecosystems?
        a.   Examples: cats, burning fossil fuels, change land use
Research specific bird to know the resources they need. (This bird to be revisited throughout the quarter by the student.)
	<u>NGSS</u>
	MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (LS2.A)
	
	MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (LS2.A)
	
	<u>MELS</u>
	Standard 4, Topic B, Indicator 1: Analyze the growth or decline of populations and identify a variety of responsible factors.
	
	Standard 4, Topic C, Indicator 1: Explain how interrelationships and interdependencies of

	organisms and populations contribute to the dynamics of communities and ecosystems.
Planning and Conducting Investigations Students develop plans for collecting, analyzing, and communicating information and/or data to help them answer their questions and understand the problem. Students identify and justify appropriate sources of information and/or data, and determine methodologies for the collection of information and/or data. Students will be completing an environmental resource survey of the schoolyard using quadrats. Schoolyard Investigation worksheet: Look around schoolyard. Bird survey?, Habitat and humans. Include evidence of other wildlife (predator/prey); food resources. Are there resources available for your specific bird? Is there healthy habitat available for your bird in the schoolyard? What is present? What is missing? Record human influence over the habitats [2—rural and urban; natural and developed]. Students collect data to put together a collective map of the schoolyard.	Click or tap here to enter text.
Analyzing and Interpreting Data Students present and share information and/or data to reveal patterns that indicate relationships. Students apply disciplinary concepts as they analyze and interpret information and/or data to make sense of the issue, problem, or phenomenon. Utilize Google maps to create collaborative map to put student data together. Label land cover of school area and neighborhood and compare to eBird data. Make comparisons using data from eBird-comparing population data and locations.	Click or tap here to enter text.

Constructing, Communicating, and Refining Explanations Students identify, synthesize, and apply evidence from their investigations (for example, measurements, observations, and patterns) to draw conclusions about the driving question. Students answer: Is there healthy habitat available for your bird? What is present? What is missing? Students use their data of schoolyard/community investigations to communicate how humans impact the resource availability for their species. (presentations? Posters?) Class Discussion- What is the role of humans in what we have observed? (relates to Driving Question)	Click or tap here to enter text.

Issue Investigation # 4

ENVIRONMENTAL LITERACY MODEL ELM

Notes

Asking Questions, Defining Issues and Problems Students define the issue, problem, or phenomenon to be investigated and develop questions that are relevant for investigation. <u>How do humans change the physical or biological systems of Chesapeake Bay ecosystems? How is your bird affected?</u> - Teacher-led lesson, co-developed with PCAC Use of pesticides, DDT, story of eagles/ospreys; Articles/stories/Rachel Carson Mystery: Eagles and Ospreys populations are decreasing. Give pieces of the puzzle. Things that are in the water can negatively impact bird populations. Bioaccumulation and connections to fish populations, land use, and water quality.	<u>NGSS</u> MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (LS2.C) <u>MELS</u> Standard 3, Topic C, Indicator 1: Analyze and explain the movement of matter and energy through earth's systems and the influence of this movement on the distribution of life.

Planning and Conducting Investigations Students develop plans for collecting, analyzing, and communicating information and/or data to help them answer their questions and understand the problem. Students identify and justify appropriate sources of information and/or data, and determine methodologies for the collection of information and/or data. Potential field trip to Snow Hill partnerships – canoeing and taking water quality? Connect to cycle of nutrients. If possible, take water quality measurements in creeks/streams within walking distance of school.	Day 1- Schoolyard Inventory, Led by Pickering Creek Day 2- Inventory Data Analysis, Teacher Led
Analyzing and Interpreting Data Students present and share information and/or data to reveal patterns that indicate relationships. Students apply disciplinary concepts as they analyze and interpret information and/or data to make sense of the issue, problem, or phenomenon. Use water quality report card or FieldScope to compare to collected student data. What are impacts on ecosystem? What are impacts on birds? Graphing activity?	
Constructing, Communicating, and Refining Explanations Students identify, synthesize, and apply evidence from their investigations (for example, measurements, observations, and patterns) to draw conclusions about the driving question. Students will identify ways humans can positively impact ecosystem health. Students are able to communicate that what affects the land affects the water and will then affect bird populations in positive and negative ways.	

Stewardship and Civic Action	Notes
Developing a Claim and Identifying Solutions Students develop a claim based on conclusions drawn in the Issue Investigation. The claim should reflect a problem, challenge, or opportunity that warrants informed action. Students identify and explore solutions to address the problem, challenge, or opportunity reflected in their claim. **Students will develop a claim by synthesizing data on resource availability, climate change and human impacts to the environment to identify change in bird population.** Probable student claim: Bird populations are decreasing due to loss of habitat, climate change, and human pollutants causing food scarcity during times of migration and loss of survivorship. Students will develop potential solutions to address their claim, such as: developing a bird friendly garden, including designing bird feeders that meet the nutritional need of multiple species; increasing community awareness of potential threats to bird species through plastic and water contamination; planting native plant species.	<u>NGSS Performance Expectations</u> MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* (LS2.C, LS4.D, ETS1.B) MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* <u>MELS</u> Standard 7, Topic A, Indicator 1: Investigate factors that influence environmental quality. Standard 5, Topic A, Indicator 1: Analyze the effects of human activities on Earth's natural processes.
Designing a Plan and Taking Informed Action Students design a plan for implementing solutions through informed action in their classrooms, schools, and/or communities. The plans should include criteria for determining the extent to which the action successfully addresses the problem, challenge, or opportunity reflected in the claim. Students implement their plans. After investigating and comparing potential bird garden sites on school garden, students will work together to develop proposals to improve bird habitat on school grounds. These projects will work to create a "Habitat Lab" that students can change and study in subsequent years. Some potential proposals could be: ● engineer bird feeders that can be placed and monitored on school grounds. ● planting native plants to improve habitat on school grounds. ● building and installing nest boxes which will be installed in a local park or on school grounds. ● bring awareness to their school campus and community by launching a chalk awareness campaign. Students will design chalk murals which will be drawn on the sidewalks of the school campus. As students walk to school and community members visit	Students can share present proposals in "Shark Tank" format. (Show a clip of Shark Tank in class) This is an opportunity to invite maintenance, administration, parents, potential partners. Students should be taking on the role of evaluating other students' projects. Proposals should all be supported with evidence from student investigations. Claim-Evidence-Reasoning rubric should be shared with

the school they will be made aware of how human action affect Bird populations and the Chesapeake Bay watershed.

Student proposals will undergo peer review as they present their ideas not only to the teacher but to administration and classmates. Proposals should all be supported with evidence from student investigations.

Student must submit with their proposal a claim, evidence, reasoning worksheet/statement that demonstrate how they are addressing the problem, challenge, or claim.

All proposals will need to include a "Share Your Knowledge" component, where students will decide how to share their project with the school or wider community. Examples might be inviting press to project installation days, developing a social media campaign, writing blog posts to be posted on the WCPS website, etc.

The "audience" of maintenance, administration, parents, potential partners, and Pickering Creek will provide feedback for students and help them choose the selected Habitat Lab project.

With support from the classroom teachers and Pickering Creek, students will implement their action projects.

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audience/stakeholders while presentations are ongoing.

(Pickering Creek Audubon Center will be involved in the evaluation of the student proposals and implementation of the Action Projects.)

Evaluating Action

Students reflect on the action and determine the extent to which it successfully addresses the problem, challenge, or opportunity reflected in the claim. Students share proposals for sustaining or extending the action.

Re-evaluation of student knowledge. (Post-assessment survey)

Students will reflect through written summary and class discussion. The written summary will address the following questions:

1. Who are the team members that you worked with to complete this project?
2. What is the *problem* that you worked to solve?
3. How is this *problem* important for your school and the surrounding community?
4. Who were the players (stakeholders) or people that you worked with? What did they do?
5. In 3 or 4 sentences, tell about the project that you completed. Be sure to include the steps you went through and any big changes you had to make to the original plan (if any).
6. Did your project "work"? How do you know that it did or did not work?
7. Describe anything that happened because of your project that you did not expect.

Summary Evaluation (Document: Hema Bhaskaran)

8. What are two or three of the most important things that you learned about habitat, wildlife and/or your school site during this project?
9. Think back to what you did and how you worked with others during the project. Answer the following questions:
    a. What did you enjoy about the project?
    b. What did you do well during the project?
    c. What was difficult or not enjoyable about the project?
    d. What could you do better during the next project?