



Quick Guide to Using EcoChains: Arctic Crisis™ In Your Middle School Classroom

EcoChains: Arctic Crisis is a fun and educational card game designed to highlight the impacts of climate change on the Arctic marine ecosystem. In this 2-4 player game of strategy and survival, players build an Arctic marine food web, learn about the importance of sea ice, and see the potential impact of future changes on the ecosystem. The game also incorporates climate change solutions and ecosystem-based management options.

Using Games in Teaching and Learning: Educational games offer an active and engaging method of introducing complex concepts and reinforcing instruction. Games are increasingly used in educational settings to help inspire curiosity, creativity, collaboration, optimism, and problem-solving skills among a wide variety of audiences. Serious games address real-world challenges, compress time and space, encourage systems thinking, and promote active engagement, making them particularly well suited to teaching complex topics such as climate change. Emerging research also suggests that using gameplay to introduce new concepts results in longer lasting knowledge retention when compared to more traditional instruction methods.

With game-based learning, it is critical to allow time for students to reflect and debrief after gameplay in the classroom. Debriefing helps ensure that game-based learning experiences are meaningful by allowing students to explore and express what knowledge they have gained, how it connects to prior learning, and how it can be applied in the classroom and beyond.

Extension: One way to expand on game-based learning is to encourage students to design their own variant of the game by modifying existing game play and/or content. Students should report back during debrief on the specific learning objectives they included and how their game design improved learning.



Learning Goals: Students will understand the nature of the Arctic marine food web and the impact of a warming climate.

Note: Sea ice is a critical underpinning to the Arctic marine food web. Depending on your class, you may wish to introduce the role of sea ice in the Arctic prior to the students playing the game, or to encourage critical thinking in your students, you might wish to play the game without introduction, allowing them to arrive at this during the gameplay debrief.

Objectives: The students will be able to:

- 1) Classify organisms by their roles in the food chain (primary producer versus consumer)
- 2) Organize a list of organisms into a food chain
- 3) Predict how an event at one level of the food chain will impact the entire chain
- 4) Recognize the dependence of key Arctic marine species on sea ice
- 5) Describe the impacts (positive and negative) of human activities on the Arctic marine ecosystem

Classroom Tips:

Space: This game builds out into a large web so allocating enough space is critical. Students will not be able to play it at their desks unless multiple desks are pushed together; if available playing at a lab table is a great idea.

Time: The game can be played in a 40-minute class period. We recommend you allocate 5 minutes for directions and game set up, 25 minutes for gameplay, and 10 minutes for debriefing with the students after gameplay.

Players: A typical game is played with 2-4 players, however, a single game can accommodate up to 8 players if students are teamed up into pairs.



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Connecting to Curriculum:

Middle School science includes a wide-ranging rotation of topics with EcoChains fitting comfortably into areas covered in *ecology, biodiversity, food webs, energy flow and climate*.

Connecting with NGSS:

Disciplinary Core Ideas

MS-LS2.A: Interdependent Relationships in Ecosystems

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.

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

MS-LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

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

MS-LS2.C: Ecosystem Dynamics, Functioning, and Resilience

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

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-ESS3.C: Human Impacts

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems

MS-ESS3.D: Global Climate Change

MS-ESS3-5 Ask questions to clarify evidence of the factors that have given rise in global temperatures over the past century

Practices

The post-gameplay debriefing works well with the NGSS Practices:

- Constructing Explanations and Designing Solutions
- Obtaining, Evaluating and Communicating Information
- Engaging in Argumentation from Evidence – to debate the role of humans and energy use, energy efficiency, whether sea ice is critical for the continuation of the Arctic food web, alternative energy, geo-engineering, role of migration in survival

Cross Cutting Concepts

- Cause & Effect
- Systems and System Models
- Stability and Change
- Influence of Engineering, Technology and Science on Society and the Real World

