Unit 5: Natural Selection and Evolution

CONTENT AREA: Biology	GRADES: 9-12	UNIT: 5 of 5

Pacing:

Performance Expectations: NJSLS-S-HS-LS4-1, NJSLS-S-HS-LS4-2, NJSLS-S-HS-LS4-3, NJSLS-S-HS-LS4-4, NJSLS-S-HS-LS4-5

Evidence Statement(s): NJSLS-S-HS-LS4-1, NJSLS-S-HS-LS4-2, NJSLS-S-HS-LS4-3, NJSLS-S-HS-LS4-4, NJSLS-S-HS-LS4-5

Essential Question: What changes in living things have occurred over time and what scientific evidence is cited to support biological evolution?
How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms? How does biodiversity affect humans?

21st Century Skills: 9.2.8.B.3, 9.2.8.B.4

Career Ready Practices: CRP4, CRP6, CRP7

Technology:

Technical Terms (Suggested)	Core Instructional Materials	Assessment Statement
*All terms should be taught in context rather than in isolation. These terms should be addressed after conceptual understanding.	NJSLS-S-HS-LS4-1 NJSLS-S-HS-LS4-2 NJSLS-S-HS-LS4-3 NJSLS-S-HS-LS4-4 NJSLS-S-HS-LS4-5	

Modifications			
<u>English Language Learners</u>	<u>Special Education</u>	<u>At Risk</u>	<u>Gifted & Talented</u>
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair-share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

5E Model

Performance Expectation: NJSLS-S-HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence	
Engage: Anticipatory Set	Fossilized rocks (earth science kits) https://www.youtube.com/watch?v=lIEoO5KdPvg
Exploration: Student Inquiry	Mold,casts to illustrate fossil formation The Zoo of You (Nova Interactive) http://www.indiana.edu/~ensiweb/lessons/gff.pdf.html
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. http://evolution.berkeley.edu/evolibrary/article/evo_05 (phylogeny) http://www.hhmi.org/biointeractive/creating-phylogenetic-trees-dna-sequences Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): **LS4.A: Evidence of Common Ancestry and Diversity** (pp. 162-163, NRC, 2012) ● Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by amino acid sequences and from anatomical and embryological evidence. (NJSLS-S-HS-LS4-1) ● http://www.pbslearningmedia.org/resource/tdc02.sci.life.evo.lp_fossilevid/the-fossil-evidence-for-evolution/comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in am
Elaboration: Extension Activity	http://sciencecases.lib.buffalo.edu/cs/collection/results.asp?subject_headings=Evolutionary%20Biology gradualism/punctuated equilibrium lessons BLAST AP BIOLOGY LAB - Comparing DNA sequences to determine common ancestry
Evaluation: Assessment	

5E Model

Performance Expectation: NJSLS-S-HS-LS4-2
Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

Engage: Anticipatory Set	Reproductive potential www.youtube.com/watch?v=yuUi2E3t3UY
Exploration: Student Inquiry	http://online.infobase.com/HRC/LearningCenter/Details/8?articleId=377842 Science Online through CPHS Infobase.com
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. http://fwww.pointloma.edu/sites/default/files/filemanager/Biology/Grad_Biology/Biotic_potential_activity_-_graphing_populations.pdf (biotic potential) https://www.ngsslifescience.com/biology_lesson_plans_natural_selection.html (good for all topics) Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas) **LS4.C: Adaptation** (pp. 164-166, NRC, 2012) ● Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (NJSLS-S-HS-LS4-2) ● Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4) ● Adaptation also means that the distribution of traits in a population can change when conditions change. (NJSLS-S-HS-LS4-3) ● Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (NJSLS-S-HS-LS4-5)

	● Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (NJSLS-S-HS-LS4-5) http://biologycorner.com/worksheets/pepperedmoth.html: Simulation
Elaboration: Extension Activity	www.radixendeavor.org/resources/for-the-birds https://www.ngsslifescience.com/biology_lesson_plans_natural_selection.html (monk parakeets)
Evaluation: Assessment	

5E Model

Performance Expectation: NJSLS-S-HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	
Engage: Anticipatory Set	Discussing Gause's Competitive Exclusion Principle provides a means of introducing advantageous heritable traits in the context of current environmental issues.
Exploration: Student Inquiry	https://geneed.nlm.nih.gov/specialty.php?spageID=2 gene-ed might be good for other topics http://www.hhmi.org/biointeractive/using-genetic-crosses-analyze-stickleback-trait
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): **LS4.C: Adaptation** (pp. 164-166, NRC, 2012) ● Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (NJSLS-S-HS-LS4-2) ● Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4) ● Adaptation also means that the distribution of traits in a population can change when conditions change. (NJSLS-S-HS-LS4-3)

	- Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (NJSLS-S-HS-LS4-5) - Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (NJSLS-S-HS-LS4-5)
Elaboration: Extension Activity	http://www.mhhe.com/biosci/genbio/virtual_labs_2K8/labs/BL_19/ http://programs.clarendoncollege.edu/programs/NatSci/Biology/Zoology/zoo%20online%20outlines/Ecology.pdf (prairie dog population activity)
Evaluation: Assessment	

5E Model

Performance Expectation: NJSLS-S-HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations.	
Engage: Anticipatory Set	Darwin's Finches: Students will attempt to match beaks with diet. Following the initial attempt, diet will be revealed to the students. The final follow up will be a class discussion where students correctly identify purpose of beak structures. The initial beak measuring activity is appropriate as an anticipatory set activity. The making of a beak from class room materials is appropriate as an elaboration activity. https://www.nsta.org/publications/press/extras/files/virus/Virus-Activity5.pdf
Exploration: Student Inquiry	http://www.sciencechannel.com/tv-shows/greatest-discoveries/videos/100-greatest-discoveries-shorts-natural-selection/ http://nationalgeographic.org/encyclopedia/adaptation/
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): **LS4.C: Adaptation** (pp. 164-166, NRC, 2012)

	● Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (NJSLS-S-HS-LS4-2) ● Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4) ● Adaptation also means that the distribution of traits in a population can change when conditions change. (NJSLS-S-HS-LS4-3) ● Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (NJSLS-S-HS-LS4-5) ● Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (NJSLS-S-HS-LS4-5)
Elaboration: Extension Activity	The final activity from our Anticipatory Set activity (making beaks using rubber bands, etc. can be used as the elaboration activity. https://www.nsta.org/publications/press/extras/files/virus/Virus-Activity5.pdf
Evaluation: Assessment	

5E Model

Performance Expectation: NJSLS-S-HS-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.

Engage: Anticipatory Set	Note: review unit 3 as well humans/climate https://www.youtube.com/watch?v=8yvEDqrc3XE
Exploration: Student Inquiry	http://evolution.berkeley.edu/evolibrary/article/evo_42 Peppered moth, geographic isolation,
Explanation: Concepts & Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): **LS4.C: Adaptation** (pp. 164-166, NRC, 2012) ● Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (NJSLS-S-HS-LS4-2) ● Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4) ● Adaptation also means that the distribution of traits in a population can change when conditions change. (NJSLS-S-HS-LS4-3) ● Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (NJSLS-S-HS-LS4-5) ● Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (NJSLS-S-HS-LS4-5) http://www.indiana.edu/~ensiweb/lessons/quick.speciation.html Illustration of speciation **(NO** Hardy-Weinberg)
Elaboration: Extension Activity	Speciation in real time close reading and questions ; An Origin of species on PBS website Human/Climate Effects: The following article progresses from the increased CO_2 content in water which converts to carbonic acid leading to coral bleaching which induces species variation and alternate species increasing in number within an ecosystem.

	https://kuscholarworks.ku.edu/bitstream/handle/1808/5346/Buddemeier%20and%20Fautin.1993.pdf?sequence=1&isAllowed=y
Evaluation: Assessment	

How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?
How does biodiversity affect humans?
High school students investigate patterns to find the relationship between the environment and natural selection. Students demonstrate understanding of the factors causing natural selection and the process of evolution of species over time. They demonstrate understanding of how multiple lines of evidence contribute to the strength of scientific theories of natural selection and evolution. Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution. Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe extensive scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution. Students can use models, apply statistics, analyze data, and produce scientific communications about evolution. Understanding of the crosscutting concepts of patterns, scale, structure and function, and cause and effect supports the development of a deeper understanding of this topic. (p. 2, Life Science Topics Storyline).

#	STUDENT LEARNING OBJECTIVES	CORRESPONDING PEs and DCIs
1	Examine a group of related organisms using a phylogenic tree or cladogram in order to (1) identify shared characteristics, (2) make inferences about the evolutionary history of the group, and (3) identify character data that could extend or improve the phylogenetic tree.	LS4.A

2	**Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.** *[Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]*	**NJSLS-S-HS-LS4-1**
3	Make predictions about the effects of artificial selection on the genetic makeup of a population over time.	LS4.C
4	**Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.** *[Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.]* [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.*]*	**NJSLS-S-HS-LS4-3**
5	**Construct an explanation based on evidence for how natural selection leads to adaptation of populations.** *[Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.]*	**NJSLS-S-HS-LS4-4**
6	**Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.** *[Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming and how these behaviors influence reproduction.]*	**NJSLS-S-HS-LS2-8**
7	**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.** *[Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]*	**NJSLS-S-HS-LS4-5**
8	**Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.** *[Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.]* [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.*]*	**NJSLS-S-HS-LS4-2**

The Student Learning Objectives above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Analyzing and Interpreting Data (pp. 61-63, NRC, 2012) Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ● Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (NJSLS-S-HS-LS4-3)	**LS4.A: Evidence of Common Ancestry and Diversity** (pp. 162-163, NRC, 2012) ● Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (NJSLS-S-HS-LS4-1) **LS4.B: Natural Selection** (pp. 163-164, NRC, 2012)	**Patterns** (pp. 85-87, NRC, 2012) ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-3) **Cause and Effect** (pp. 87-89, NRC, 2012) ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4),(NJSLS-S-HS-LS4-5) - *Connections to Nature of Science*

Constructing Explanations and Designing Solutions (pp. 67-71, NRC, 2012)
Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-4)

Engaging in Argument from Evidence (pp. 71-74, NRC, 2012)
Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science.

- Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments.
(NJSLS-S-HS-LS4-5)

Obtaining, Evaluating, and Communicating Information (pp. 74-77, NRC, 2012)
Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.

- Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats

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- Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals.
(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3)

- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.
(NJSLS-S-HS-LS4-3)

LS4.C: Adaptation (pp. 164-166, NRC, 2012)
- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment.
(NJSLS-S-HS-LS4-2)

- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not.
(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4)

- Adaptation also means that the distribution of traits in a population can change when conditions change. (NJSLS-S-HS-LS4-3)

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future.
(NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-4)

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena
A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (NJSLS-S-HS-LS4-1)

(including orally, graphically, textually, and mathematically). (NJSLS-S-HS-LS4-1)	• Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (NJSLS-S-HS-LS4-5) • Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (NJSLS-S-HS-LS4-5)	

Connections to other DCIs in this grade-band:

HS.LS2.A (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4),(NJSLS-S-HS-LS4-5); **HS.LS2.D** (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4),(NJSLS-S-HS-LS4-5); **HS.LS3.A** (NJSLS-S-HS-LS4-1); **HS.LS3.B** (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-5); **HS.ESS1.C** (NJSLS-S-HS-LS4-1); **HS.ESS2.E** (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-5); **HS.ESS3.A** (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-5); **HS.ESS3.C**

Articulation of DCIs across grade-bands:

MS.LS2.A (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-5); **MS.LS2.C** (NJSLS-S-HS-LS4-5); **LS3.A** (NJSLS-S-HS-LS4-1); **LS3.B** (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3); **MS.LS4.A** (NJSLS-S-HS-LS4-1); **MS.LS4.B** (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4); **MS.LS4.C** (NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4),(NJSLS-S-HS-LS4-5); **MS.ESS1.C** (NJSLS-S-HS-LS4-1); **HS.ESS3.C** (NJSLS-S-HS-LS4-5)

Common Core State Standards Connections:

ELA/Literacy -

RST-11.12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4)
RST-11.12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (NJSLS-S-HS-LS4-5)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4)
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4),(NJSLS-S-HS-LS4-5)
SL.11-12.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2)

Mathematics -

MP.2	Reason abstractly and quantitatively. (NJSLS-S-HS-LS4-1),(NJSLS-S-HS-LS4-2),(NJSLS-S-HS-LS4-3),(NJSLS-S-HS-LS4-4),(NJSLS-S-HS-LS4-5)
MP.4	Model with mathematics. (NJSLS-S-HS-LS4-2)