Pond Investigators

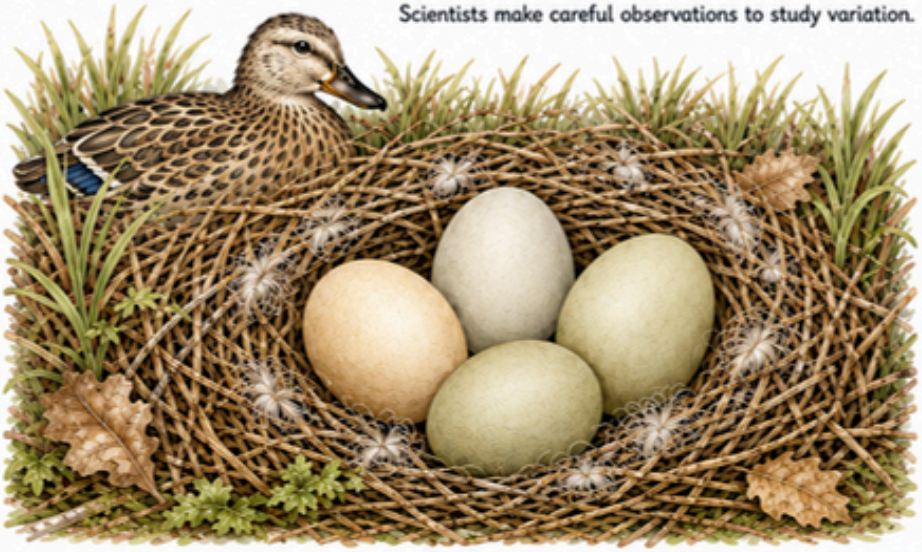
Young Scientists at Work



MALLARD EGGS 1

Focus: Variation

Mallard eggs are usually unmarked.
They may be creamy, grayish, or greenish buff.
Eggs can differ slightly in size, shade, shape, and surface.
Scientists make careful observations to study variation.



OBSERVATION CHALLENGE

- Which egg appears longest?
- Which appears widest?
- What small color differences do you notice?
- Which observations are measurements, and which are descriptions?



VOCABULARY

variation — small differences among individuals of the same kind

observe — to look carefully and notice details

pattern — something that repeats or can be compared

evidence — information that supports an idea



SCIENTIST'S CLAIM

Which claim is best supported by the evidence?

- ☐ Every mallard egg looks exactly the same.
- ☐ Mallard eggs can differ slightly in size, shade, and shape.
- ☐ Mallard eggs are usually covered with dark spots.

Use details from the nest to support your choice.

SCIENCE THINKING

Why do scientists compare small differences among eggs?

Which observations are measurements, and which are descriptions?

CAREGIVER DISCUSSION

Which egg would be easiest to recognize? What evidence supports your answer?



NGSS CONNECTION — BUILDS TOWARD 3-LS4-2
Variation among individuals may provide evidence for understanding living things.

COMMON CORE — RI.2.1 AND RI.2.7
Ask and answer questions about key details; explain how images support understanding.

★ **BIG IDEA:** Scientists observe subtle variation and use evidence to understand living things. ★



EGG DETECTIVE

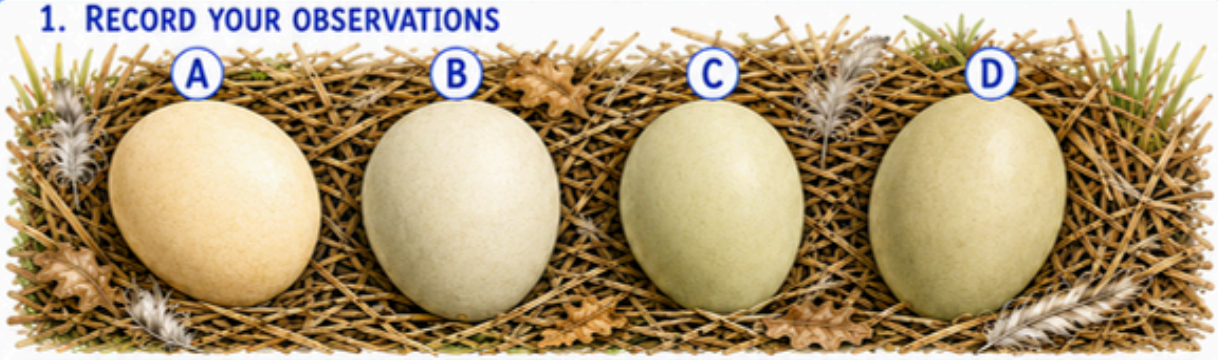
2

Become an Egg Detective!

Study the four mallard eggs. Record observations about size, shape, and shade. Then use your evidence to make a claim.

Big Idea: Scientists compare observations to identify subtle variation.

1. Record Your Observations



EGG	SIZE	SHAPE	SHADE
A			
B			
C			
D			

2. Compare the Evidence

The two most similar eggs are _____ and _____.

Detail 1: _____

_____

Detail 2: _____

_____

3. Observation or Inference?

Write O for observation or I for inference.

Egg B appears wider than Egg A. _____

Egg C came from the oldest duck. _____

Egg D is a paler shade than Egg B. _____

The mother chose Egg A as her favorite. _____

4. Make a Claim

My claim is _____.

My strongest evidence is _____.

This evidence supports my claim because _____.

_____.

Investigator Extension

What measurement could make your comparison more reliable?

_____.

variation — small differences among individuals of the same kind

observation — information gathered by carefully looking or measuring

inference — an idea based on observations and what you already know

evidence — information that supports a claim

NGSS Connection — Builds Toward 3-LS4-2
Use evidence to explain variation among individuals.

Common Core — W.2.2 and W.2.8
Write an explanation and gather information to answer a question.

Scientists compare subtle differences and support claims with evidence.



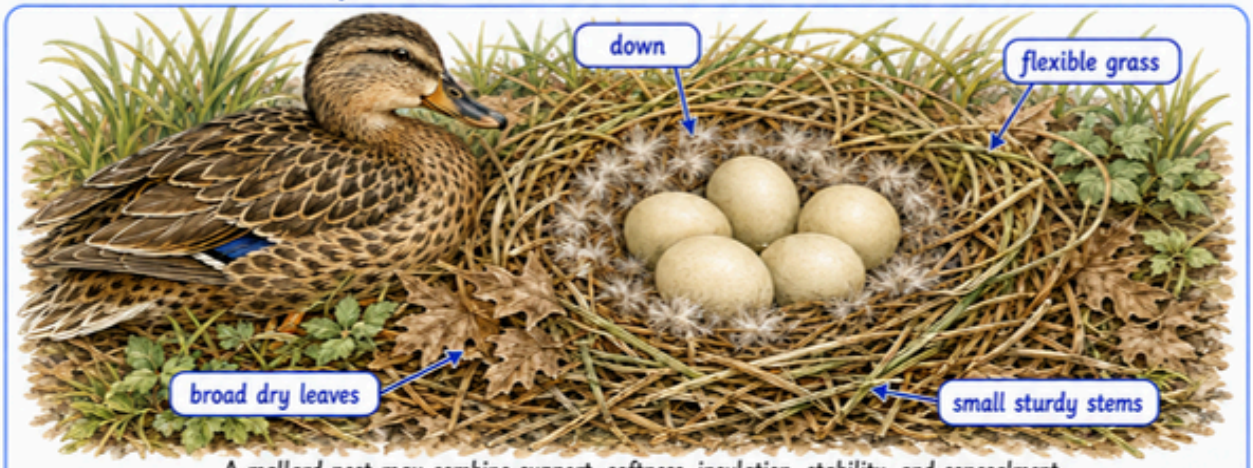
MALLARD NESTS

3

Focus: Materials and Purpose

Mallards usually build nests on the ground near protective cover.
Different materials can help a nest in different ways.
One material may provide more than one benefit.
Scientists study material properties to understand how nests work.

Big Idea: Different materials can provide overlapping benefits.



A mallard nest may combine support, softness, insulation, stability, and concealment.

MATERIAL EVIDENCE

DOWN	FLEXIBLE GRASS	DRY LEAVES	SMALL STEMS
Observable properties: soft, fluffy, lightweight	*Observable properties:* long, bendable, woven	*Observable properties:* broad, light, overlapping	*Observable properties:* firm, narrow, sturdy
Possible benefits: insulation, softness, concealment	*Possible benefits:* shape, support, stability	*Possible benefits:* lining, concealment, insulation	*Possible benefits:* support, shape, stability

THINK LIKE A SCIENTIST

Which two materials might work together to make a soft but stable nest?

What visible properties support your answer? _____

Why might one material provide more than one benefit? _____

_____



Scientists use words such as can, may, and possible when evidence supports more than one explanation.



material — what something is made from



property — a feature that can be observed



function — the job or purpose something may serve



insulation — material that helps slow heat loss



NGSS CONNECTION — K-2-ETS1-1
Ask questions, make observations, and gather information about materials and a problem.



COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among ideas; explain how images support understanding.

Scientists connect material properties to possible functions.



NEST BUILDER CHALLENGE

4

Become a Nest Engineer!

Design a model nest that can hold four model eggs, stay together when gently moved, and provide a soft inner surface.

Big Idea: Scientists design, test, and improve solutions.

CHOOSE YOUR MATERIALS

DOWN — soft, fluffy, lightweight



FLEXIBLE GRASS — long, bendable, woven



DRY LEAVES — broad, light, overlapping



SMALL STEMS — firm, narrow, sturdy



You may choose more than one material.

1. SKETCH AND LABEL YOUR NEST

Label at least three materials.

2. EXPLAIN YOUR DESIGN

Material 1:
I chose it because its _____ property may help _____.

Material 2:
I chose it because its _____ property may help _____.

3. TEST YOUR MODEL

- ☐ Held four model eggs
- ☐ Stayed together when gently moved
- ☐ Had a soft inner surface

Evidence from my test: _____

4. IMPROVE YOUR DESIGN

One change I would make after testing is _____ because _____.

INVESTIGATOR EXTENSION

How could you make the test fair if two nest designs were compared?

_____

_____

design — a plan for solving a problem

property — a feature that can be observed

test — to try something and gather evidence

improve — to make a solution work better



NGSS CONNECTION — K-2-ETS1-2 AND K-2-ETS1-3
Develop a model and compare evidence from tests.

COMMON CORE — W.2.2
Write an informative explanation using facts and details.

★ Engineers use evidence from tests to improve designs. ★



HATCHING

Focus: Life-Cycle Evidence

5

Big Idea: Hatching follows a general sequence, but timing can vary.

A mallard duckling must break out of its shell.
Scientists observe visible clues to describe the hatching sequence.
Individual ducklings may move through the stages at different speeds.

1 INTACT EGG



The shell looks whole. The duckling is developing inside.

2 FIRST PIP



A tiny opening or crack appears. The duckling has begun breaking the shell.

3 DUCKLING EMERGING



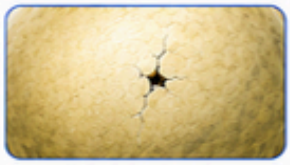
The opening grows as the duckling pushes and turns inside the shell.

4 NEWLY HATCHED



The duckling is out. Its down may look wet and flattened before it dries.

LIFE-CYCLE EVIDENCE



Tiny opening — the first visible pip



Larger opening — more shell has broken



Bill and egg tooth — help begin breaking the shell



Empty broken shell — evidence that hatching is complete

An egg tooth is a small temporary point near the tip of a hatchling's bill.
It helps the duckling begin opening the shell.

EVIDENCE HUNT

- What visible clue appears first?
- How does the shell opening change?
- Which clues show that the duckling is making progress?
- What stays the same across the stages?
- Why might two eggs reach the same stage at different times?

SCIENCE THINKING

Which two clues provide the strongest evidence that hatching is a sequence?

_____

_____

How do those clues support your answer?

_____

_____



life cycle — the stages of growth and change in a living thing

sequence — events arranged in the order they happen

stage — one part of a process

evidence — information that helps answer a question

NGSS CONNECTION — BUILDS TOWARD 3-LS1-1
Use patterns and models to describe stages in a life cycle.

COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among steps; explain how images support understanding.

★ Scientists use visible changes to describe a sequence. ★



WHAT HAPPENED FIRST?

6

Become a Sequence Scientist!

The four pictures are out of order.
Study the visible clues. Number the events from 1 to 4.

Big Idea: Scientists use patterns and evidence to reconstruct a sequence.

A. DUCKLING EMERGING



ORDER: _____

B. INTACT EGG



ORDER: _____

C. NEWLY HATCHED



ORDER: _____

D. FIRST PIP



ORDER: _____

EVIDENCE FOR THE FIRST EVENT

I think Card _____ happened first.

Visible clue: _____

_____

EVIDENCE FOR THE FINAL EVENT

I think Card _____ happened last.

Visible clue: _____

_____

REVISE THE CLAIM

Incorrect claim: All ducklings hatch at exactly the same speed.
Rewrite the claim so it matches the evidence.

_____

_____

Why is the revised claim more accurate?

_____

_____

CHECK THE PATTERN

What changes from one stage to the next?

_____

What remains recognizable throughout the sequence?

_____

Which single clue was most useful for ordering the events?

_____

sequence — events arranged in the order they happen

pip — the first small opening made during hatching

claim — a statement that can be supported with evidence

revise — to change an idea after considering evidence

NGSS CONNECTION — BUILDS TOWARD 3-LS1-1
Use patterns and models to describe stages in a life cycle.

COMMON CORE — RI.2.3 AND W.2.2
Describe connections among steps; write an informative explanation.



Scientists revise explanations when evidence shows a better idea.





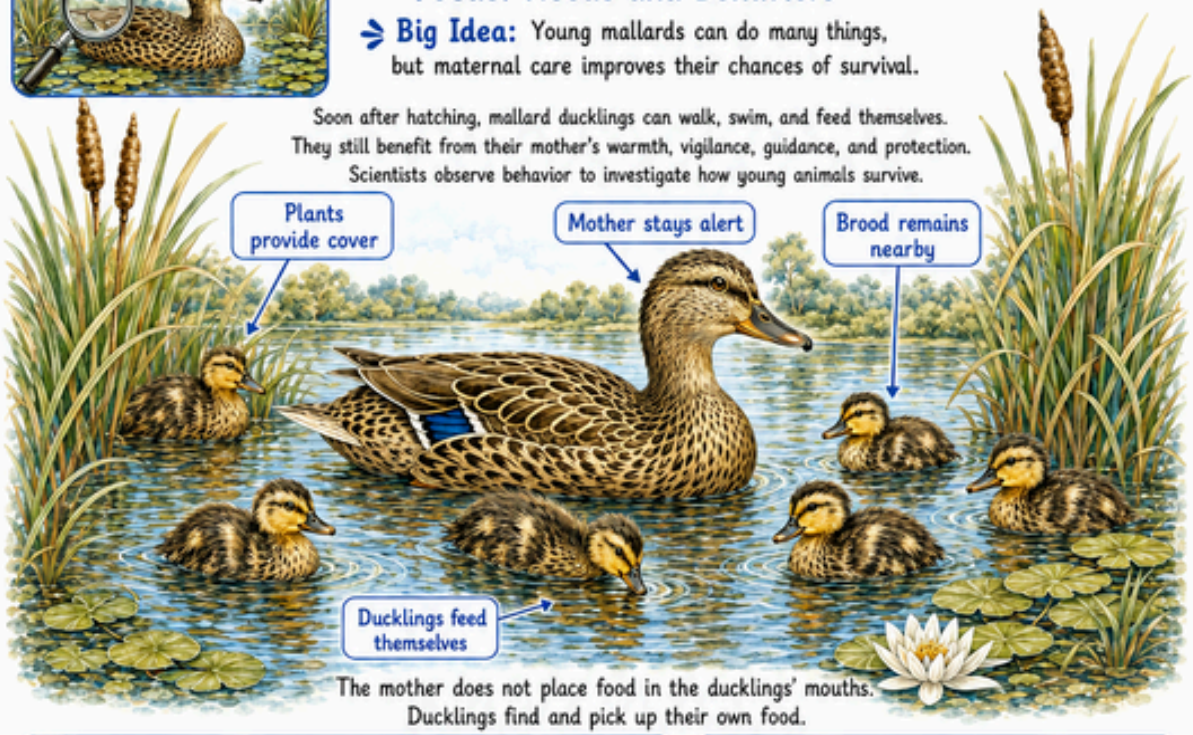
DUCKLINGS

7

Focus: Needs and Behaviors

Big Idea: Young mallards can do many things, but maternal care improves their chances of survival.

Soon after hatching, mallard ducklings can walk, swim, and feed themselves. They still benefit from their mother's warmth, vigilance, guidance, and protection. Scientists observe behavior to investigate how young animals survive.



The mother does not place food in the ducklings' mouths. Ducklings find and pick up their own food.

BEHAVIOR EVIDENCE

ALERT MOTHER



She watches the surroundings while ducklings feed.

MOVING TOGETHER



The brood follows the mother toward water or cover.

RESTING CLOSE



Ducklings may rest beside or beneath the mother for warmth.

USING COVER



The family stays near vegetation that can help conceal them.

OBSERVATION OR INFERENCE?

Write O for an observation or I for an inference.

Three ducklings are close to the mother. _____

The mother knows danger is nearby. _____

One duckling is picking food from the water. _____

The plants make every duckling completely safe. _____

THINK LIKE A SCIENTIST

What visible evidence shows that ducklings can act independently?

What visible evidence shows that maternal care may still help?

How are those ideas both true?

Observation tells what is directly visible.
Inference is an idea based on observations and prior knowledge.

VOCABULARY

behavior — *something an animal does*

vigilance — *carefully watching for possible danger*

guidance — *help finding a direction or place*

precocial — *able to move and feed soon after hatching*

NGSS CONNECTION — REINFORCES 1-LS1-2
Parent and offspring behavior patterns can help offspring survive.

COMMON CORE — RI.2.1 AND RI.2.7
Ask and answer questions about details; explain how images support understanding.

★ **Scientists use observations to explain how ability and maternal care work together.** ★



SURVIVAL INVESTIGATION

8

Become a Resource Detective!

Study each picture. Decide how it relates to a duckling.
Mark one category for every card.

Big Idea: Living things need resources, but not everything around them is necessary for survival.



CLASSIFICATION KEY:

- **N** — NEEDED FOR SURVIVAL
- **H** — HELPFUL BUT NOT NECESSARY
- **X** — NOT NEEDED BY A DUCKLING

WATER



N ☐ H ☐ X ☐

NATURAL FOOD



N ☐ H ☐ X ☐

PROTECTIVE VEGETATION



N ☐ H ☐ X ☐

ROOM TO MOVE



N ☐ H ☐ X ☐

SHADE



N ☐ H ☐ X ☐

FLOATING TOY



N ☐ H ☐ X ☐

BICYCLE



N ☐ H ☐ X ☐

TELEVISION



N ☐ H ☐ X ☐

COUCH



N ☐ H ☐ X ☐

EXPLAIN ONE DECISION

I placed _____ in _____.

This picture shows _____.

That evidence supports my choice because _____.

_____

SITUATION CHECK

Could one card fit a different category in a different situation? Explain.

_____

_____

_____

THINK LIKE A SCIENTIST

Which cards show natural resources? _____

_____

Which cards came from people? _____

Why is 'helpful' different from 'needed for survival'?

_____

Which evidence was most important for your decisions?

_____

A category may depend on the situation. Scientists explain why their evidence fits their choice.

- **resource** — something a living thing uses to meet a need
- **survive** — to stay alive
- **necessary** — required for a particular need
- **evidence** — information that supports a decision

NGSS CONNECTION — REINFORCES 1-LS1-2
Parent and offspring behaviors can help young animals survive.

COMMON CORE — W.2.1 AND SL.2.1
Support a choice with reasons; discuss ideas with others.

★ *Scientists classify resources and explain decisions with evidence.* ★



FEATHERS

9

Built for More Than Flight!

Big Idea: A duck's feathers work together to help it survive.



1. WATER RESISTANCE

Overlapping outer feathers and preening help water bead and roll away, keeping much of the insulating down beneath drier.



2. WARMTH

Soft down traps pockets of air close to the body. The trapped air slows heat loss.



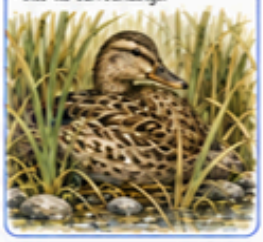
3. FLIGHT AND MOVEMENT

Strong wing and tail feathers form broad surfaces that help ducks lift, steer, balance, and slow.



4. PROTECTION AND COLOR

Body feathers protect skin. Feather colors and patterns can also help a duck blend into its surroundings.



SCIENCE NOTE:
One feather can support more than one function. Feather shape, position, and arrangement all matter.



THINK LIKE A SCIENTIST

Which feather evidence best explains how a duck stays warm?

What evidence shows that feathers work as a system?

How could damaged outer feathers affect the down beneath them?

down — soft feathers that trap insulating air

contour feather — an outer feather that shapes and covers the body

preen — to clean and arrange feathers with the bill

function — the job a structure helps perform

NGSS CONNECTION — REINFORCES 1-LS1-1
Use structure evidence to explain how body parts help animals survive.

COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among ideas; use images to explain information.

★ *Scientists connect structures with the functions they help perform.* ★



FEATHER CASE FILE

10

Become a Feather Detective!

Study each case. Use the visible evidence to decide which feather function or functions are involved.

Big Idea: Scientists use evidence to connect structures with the functions they help perform.



CASE 1 — BEADING WATER



After swimming, droplets bead on the outer feathers while the soft down beneath remains much drier.

Function(s): _____

Evidence: _____

_____

CASE 2 — COLD MORNING



On a cold morning, the duck fluffs its feathers and traps more air close to its body.

Function(s): _____

Evidence: _____

_____

CASE 3 — QUICK TURN



During flight, the duck spreads its wing and tail feathers to lift, steer, balance, and slow.

Function(s): _____

Evidence: _____

_____

CASE 4 — HIDDEN AT THE POND EDGE



The duck's brown patterned feathers are difficult to notice among reeds and shadows.

Function(s): _____

Evidence: _____

_____

COMPARE THE CASES

Which two cases show that feathers can work together in different ways?

_____

How does the feather evidence support your answer?

_____

_____

Can one case involve more than one function? Explain.

_____

_____

SITUATION CHALLENGE — HEAVY RAIN

A duck's outer feathers become damaged during several days of heavy rain.

Predict one possible effect on the down beneath. _____

_____

Which feather function would be most directly affected? _____

_____

What evidence supports your prediction? _____

_____

_____

Feather functions overlap. Shape, position, condition, and arrangement all affect how feathers work.

structure — a body part or feature	**function** — the job a structure helps perform	**evidence** — information that supports a claim	**predict** — to state what may happen using evidence

NGSS CONNECTION — REINFORCES 1-LS1-1
Use structure evidence to explain how body parts help animals survive.

COMMON CORE — W.2.1 AND W.2.8
State a claim; recall and gather information to support it.

★ *Feather detectives explain how visible evidence supports a scientific claim.* ★



FEET AND WEBBING

Structure Clues for Moving

11

Big Idea: The shape of a foot can provide evidence about how an animal moves.

Scientists compare body structures to learn how they help living things move and survive. Look for webbing, claws, toe shape, and the surface beneath each foot.

COMPARE FOUR FEET

DUCK FOOT



Broad webbing spreads through the water like a paddle.

Flexible joints also allow the foot to fold and step on land.

Mallards use ponds, wetlands, shorelines, and nearby land.

GOOSE FOOT



Broad webbing pushes against water.

Strong legs also support walking and grazing on land.

Geese use lakes, ponds, fields, and shorelines.

CHICKEN FOOT



Spread toes and claws grip the ground.

Chickens scratch soil and leaf litter while searching for food.

Chickens move mostly on land.

HUMAN FOOT



A broad sole and flexible toes support balance and walking.

Human feet are not shaped like paddles.

Humans move mostly on land.

STRUCTURE CLUES

WEBBING



skin connecting toes; increases the surface that pushes water

SCALES AND CLAWS



firm surfaces and pointed tips can help grip or scratch

BROAD SOLE



a wide contact surface can support balance

TOE SHAPE



toe number, length, and arrangement relate to different movements

A structure can support more than one job. Scientists use several clues before making a claim.

OBSERVATION OR INFERENCE?

Observation: what is directly visible.

Inference: an idea based on observations and prior knowledge.

One observation I can make about webbing is

_____

THINK LIKE A SCIENTIST

Which two feet show the clearest evidence for swimming? _____

What visible evidence supports your answer? _____

_____

Which foot shows the clearest evidence for scratching the ground? _____

How are the duck and goose feet alike? How are they different? _____

_____

_____

VOCABULARY

- **adaptation** — a body part or behavior that helps a living thing survive
- **structure** — the way a body part is built
- **webbing** — skin connecting toes
- **compare** — to look for similarities and differences

NGSS CONNECTION — REINFORCES 1-LS1-1

Use structure evidence to explain how body parts help animals survive.

COMMON CORE — RI.2.3 AND RI.2.7

Describe connections among ideas; use images to explain information.

★ Scientists compare structures to explain how they help living things move. ★



FOOT COMPARISON LAB

Become a Comparison Scientist!

12

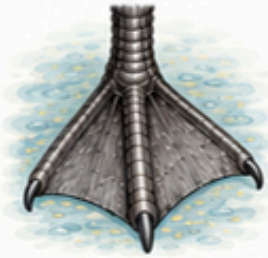
Big Idea: Body structures provide evidence about how animals move.

Study each foot. Record what you observe. Then use evidence to make a claim.

A. DUCK FOOT



B. GOOSE FOOT



C. CHICKEN FOOT



D. HUMAN FOOT



	WEBBING	TOE POSITION	SURFACE AREA	LIKELY MOVEMENT
Duck				
Goose				
Chicken				
Human				

MAKE A CLAIM

Which foot or feet show the strongest evidence for swimming?

My claim: _____

Evidence 1: _____

Evidence 2: _____

EVIDENCE HUNT

What shows webbing?

_____

Which feet have separate toes and claws?

_____

Which feet have the widest surface area?

_____

What visible clue best supports your claim?

_____

COMPARE AND EXPLAIN

How are duck and goose feet alike? _____

_____

How are they different? _____

_____

How could similar feet support both swimming and walking? _____

_____

VOCABULARY

- **adaptation** — a body part or behavior that helps a living thing survive
- **structure** — the way a body part is built
- **webbing** — skin connecting toes
- **compare** — to look for similarities and differences
- **evidence** — observations that support a claim

NGSS CONNECTION — K-2-ETS1-2; REINFORCES 1-LS1-1
Compare models and use structure clues to consider how body parts may support movement.

COMMON CORE — W.2.2
Write an informative explanation using facts and evidence.

★ Scientists compare structures and use evidence to explain how they may help living things move. ★



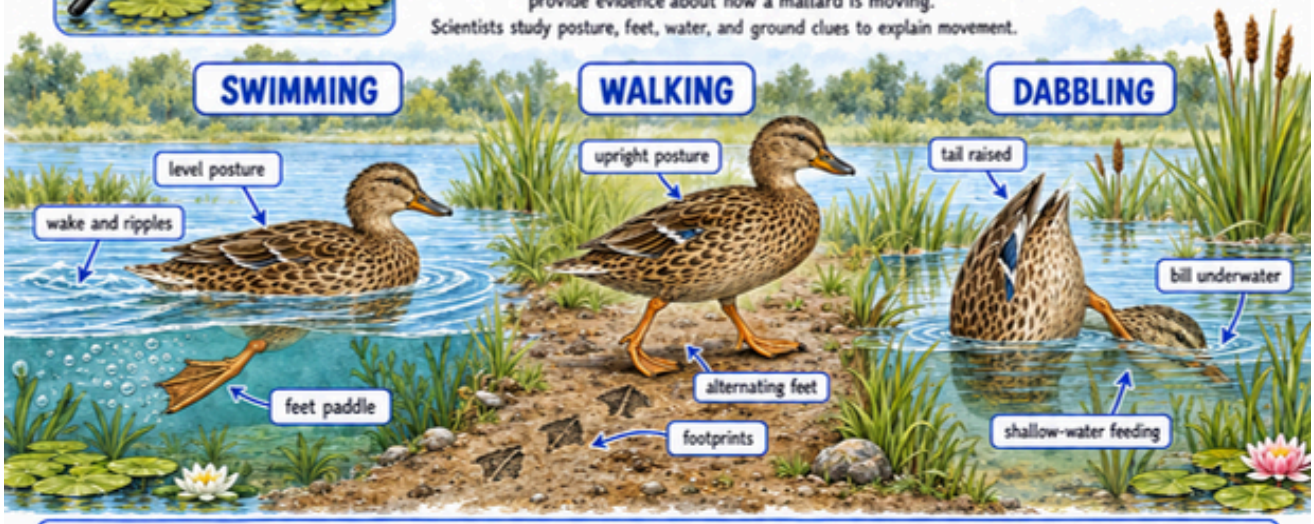
SWIMMING, WALKING, AND DABBLING

13

Focus: Movement Clues

Big Idea: Body position, foot position, and environmental clues provide evidence about how a mallard is moving.

Scientists study posture, feet, water, and ground clues to explain movement.



Movement leaves clues. A wake can show swimming. Footprints can show walking. A raised tail and submerged bill can show dabbling.

A mallard may use several body structures during one action.

COMPARE THE MOVEMENTS

	SWIMMING	WALKING	DABBLING
POSTURE			
FOOT POSITION			
ENVIRONMENTAL CLUE			

OBSERVATION OR INFERENCE?

Observation: what is directly visible. **Inference:** an idea based on observations and prior knowledge.

One observation I can make is _____

_____

One inference I can make is _____

_____

EVIDENCE HUNT

Which action leaves a wake? _____

Which action leaves footprints? _____

Which action shows a raised tail? _____

Which clue is strongest for each movement? _____

_____

VOCABULARY

posture — the position of the body | **movement** — a change in position or place | **dabble** — to feed by tipping forward in shallow water | **environmental clue** — evidence found in the surroundings | **evidence** — observations that support an explanation

NGSS CONNECTION — REINFORCES 1-LS1-1
Use structure and behavior clues to explain how animals move.

COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among ideas; use images to explain information.

★ Scientists use posture, foot position, and environmental clues to explain movement. ★



MOVEMENT EVIDENCE LAB

Become a Movement Detective!

14

Big Idea: Scientists compare multiple clues before deciding what movement probably occurred.

Six field notes were collected near a pond. Study each observation. Decide which movement—or movements—it could support.

1. A wake trails behind a duck.



☐ Swimming ☐ Walking ☐ Dabbling

2. Webbed footprints cross a muddy shoreline.



☐ Swimming ☐ Walking ☐ Dabbling

3. A duck's tail is raised above the water.



☐ Swimming ☐ Walking ☐ Dabbling

4. A wet bill holds tiny plant pieces.



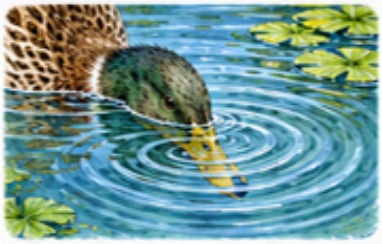
☐ Swimming ☐ Walking ☐ Dabbling

5. Alternating feet press against the ground.



☐ Swimming ☐ Walking ☐ Dabbling

6. Circular ripples form near a submerged head.



☐ Swimming ☐ Walking ☐ Dabbling

MOVEMENT CATEGORY KEY

Swimming — moving across water

Walking — stepping on land or the pond bottom

Dabbling — tipping forward to feed in shallow water

More than one clue may support a category.

CHECK FOR AMBIGUITY

A clue is ambiguous when it could support more than one explanation.

Clue number _____ could support more than one movement.

It could support _____ or _____.

My reason: _____

_____

RANK THE STRONGEST CLUES

Strongest clue for SWIMMING: No. _____ Why? _____

Strongest clue for WALKING: No. _____ Why? _____

Strongest clue for DABBLING: No. _____ Why? _____

MAKE AND SUPPORT A CLAIM

My claim: The movement was _____.

Evidence 1: Clue No. _____ shows _____.

Evidence 2: Clue No. _____ shows _____.

Together, these clues support my claim because _____.

_____.



THINK LIKE A SCIENTIST

One clue may not be enough. Strong explanations compare several observations.

Vocabulary

observation — information gathered directly with the senses
evidence — information that supports a claim
pattern — something that repeats or can be compared
ambiguous — able to support more than one interpretation
claim — a statement supported with evidence

NGSS CONNECTION — REINFORCES 1-LS1-1
Use structure and behavior evidence to compare animal movements.

COMMON CORE — W.2.1 AND W.2.8
State a claim; recall and gather information to support it.

Movement detectives compare clues, consider ambiguity, and support claims with evidence.

Pond Investigators
Young Scientists at Work

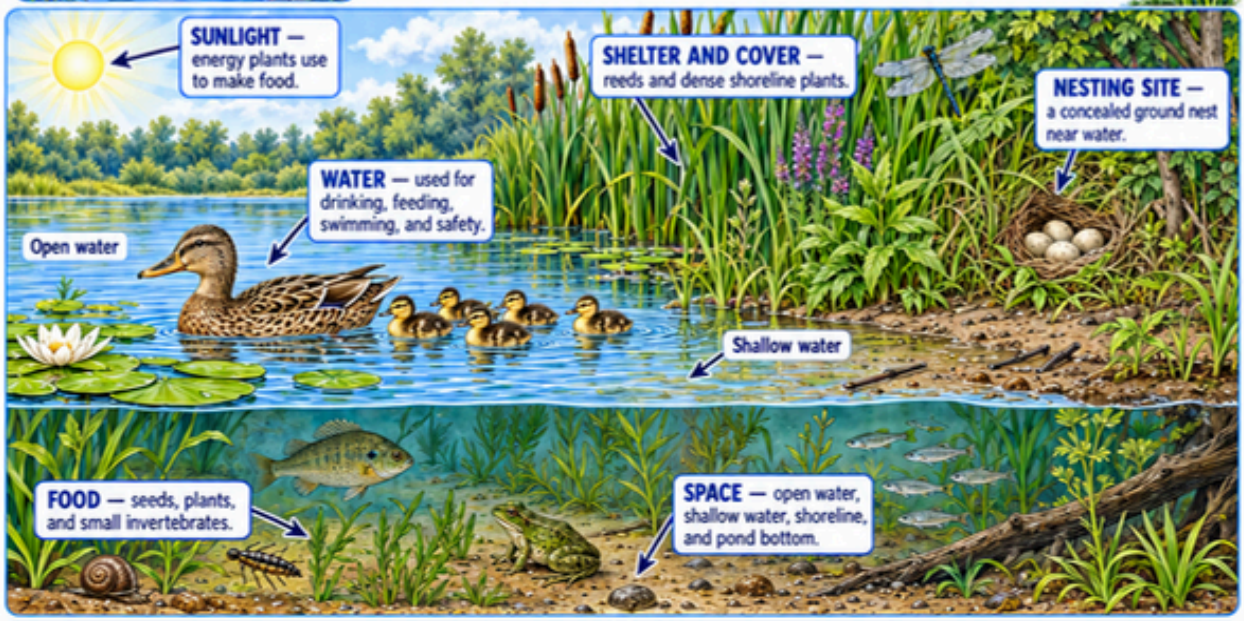
POND HABITAT: CONNECTED RESOURCES

15

Focus: Living and Nonliving Connections

Big Idea: Living and nonliving parts of a pond interact in many ways.

Scientists observe how organisms use food, water, shelter, space, and nesting sites.



EVIDENCE HUNT

Find one living part of the pond. _____

Find one nonliving part of the pond. _____

Which resource is the mother mallard using? _____

Which resource may help protect ducklings? _____

Where is the concealed nest? _____

What evidence shows shallow water? _____

FIND THE CONNECTIONS

One living–nonliving connection: _____

My evidence: _____

_____

One living–living connection: _____

My evidence: _____

_____

PREDICT A CHANGE

If shoreline plants decreased, what might happen?

_____

What evidence supports your prediction?

_____

SCIENTIST'S CLAIM

Which claim is best supported by the pond evidence?

- ☐ Living and nonliving parts of a pond can be connected.
- ☐ Only animals are important in a pond habitat.
- ☐ Every pond organism uses every resource in the same way.

Use evidence from the scene to support your choice.

_____

_____

_____

_____

RESOURCE CLUE STRIP

A resource is something a living thing may use to meet a need.



Food | Water | Cover | Space | Nesting Site

Vocabulary

habitat — the place where an organism lives and finds what it needs
resource — something a living thing uses to meet a need
interaction — a connection between living or nonliving parts
living — alive or once alive
nonliving — never alive

NGSS CONNECTION — 2-LS4-1
Observe and compare living things and resources in habitats.

COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among ideas; use images to explain information.

Scientists gather evidence to explain how living and nonliving parts of a habitat interact.



HABITAT CONNECTION INVESTIGATION

16

Become an Ecosystem Detective!

Study the pond evidence. Build a model that shows selected relationships.

★ **Big Idea:** Evidence can reveal specific connections in a habitat.



EVIDENCE HUNT

Which parts are living?

Which parts are nonliving?

What may use shoreline plants for shelter?

What may use plants or insects for food?

Which connection might affect more than one organism?

PREDICT A CHANGE

Suppose many shoreline plants decrease.

One possible DIRECT effect is _____

One possible INDIRECT effect is _____

What pond evidence supports your prediction?

BUILD A CONNECTION MODEL

Draw at least four arrows. Write what two arrows mean.


SUNLIGHT


POND WATER


SHORELINE PLANTS


INSECTS


FISH


FROG


DUCK

Arrow 1 connects _____ to _____.

It shows: ☐ FOOD ☐ SHELTER ☐ ANOTHER RESOURCE

What the arrow means: _____

Arrow 2 connects _____ to _____.

It shows: ☐ FOOD ☐ SHELTER ☐ ANOTHER RESOURCE

What the arrow means: _____

REVISE THE MODEL

After considering another connection, add or revise one arrow.

My revised arrow connects _____ to _____.

This improves my model because _____

SCIENTIST'S CLAIM

Which claim is best supported by the evidence?

☐ Only the largest animals are important.

☐ Many pond organisms depend on shared resources and on one another.

☐ A model must show every relationship to be useful.

Use evidence from the scene and your model to support your choice.

A model shows selected relationships. It does not show every part of the ecosystem.

Vocabulary

ecosystem — living and nonliving things interacting in one place

depend — to need or rely on something

connection — a relationship between two or more things

direct effect — a change that happens first

indirect effect — a later change caused through another connection

model — a representation used to explain selected ideas

NGSS CONNECTION — 2-LS4-1
Observe and compare living things and resources in habitats.

COMMON CORE — W.2.2 AND SL.2.1
Write an explanation; discuss ideas and evidence with others.

★ **Scientists build, explain, and revise models of habitat connections.** ★



MALARD COMMUNICATION

Focus: Signal and Situation

17

★ **Big Idea:** Scientists examine a signal and its context before proposing a possible function.

A **signal** is something another animal can detect. Scientists study sounds, posture, movement, spacing, and surroundings as evidence.

1. SEPARATED DUCKLINGS



Signal observed: repeated peeping
Context: ducklings are separated from family members
Possible function: may help family members locate one another

2. ALERT MOTHER



Signal observed: call and alert posture
Context: ducklings orient toward the mother
Possible function: may warn of possible danger

3. REGROUPING NEAR COVER



Signal observed: movement, spacing, and soft calls
Context: family members gather near cover
Possible function: may help the family stay together

4. CALM CONTACT CALLS



Signal observed: quiet repeated calls
Context: the family is feeding or swimming together
Possible function: may help maintain contact

SIGNAL EVIDENCE



Scientists combine several clues before making an inference.

OBSERVATION OR INFERENCE?

Observation — what can be directly seen or heard

Inference — an explanation based on observations, context, and prior knowledge

One signal I observe is _____.
The context is _____.
One possible function is _____.
My evidence is _____.

EVIDENCE HUNT

- Which scene shows separated ducklings? _____
- Which scene shows an alert posture? _____
- Where do ducklings orient toward the mother? _____
- Which scene shows family members moving near cover? _____
- How does context change the possible function? _____

SCIENTIST'S CLAIM

Which claim is best supported?

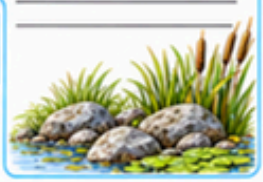
- ☐ Every mallard signal always has one meaning.
- ☐ A signal's possible function depends on the signal and its context.
- ☐ Mallards communicate only with sound.

Use evidence from two scenes to support your choice.

_____
_____
_____
_____

CAREGIVER DISCUSSION

- Why should scientists examine more than one clue?
- How could the same sound have different possible functions in different situations?



Vocabulary

- **signal** — a sound, movement, posture, or other cue another animal can detect
- **behavior** — something an animal does
- **context** — the situation surrounding a signal or behavior
- **function** — the job a structure or behavior may perform
- **evidence** — observations or information that support an explanation

NGSS CONNECTION — REINFORCES 1-LS1-2
Use evidence to explain how parent and offspring behaviors may help young animals survive.

COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among ideas; use images to explain information.

★ Scientists study signals and contexts to propose possible functions of animal communication. ★



COMMUNICATION EVIDENCE CHALLENGE

Become a Communication Scientist!

18

Study each scene. Match a possible function, then support your idea with two pieces of evidence.

Big Idea: The strongest explanation considers both the observed signal and the surrounding situation.

SCENE A



Possible function: _____

Evidence 1: _____

Evidence 2: _____

Another possible explanation: _____

SCENE B



Possible function: _____

Evidence 1: _____

Evidence 2: _____

Another possible explanation: _____

SCENE C



Possible function: _____

Evidence 1: _____

Evidence 2: _____

Another possible explanation: _____

SCENE D



Possible function: _____

Evidence 1: _____

Evidence 2: _____

Another possible explanation: _____

POSSIBLE FUNCTION CARDS

Use each card where the evidence fits best.
More than one interpretation may be reasonable.

- MAINTAIN CONTACT
- STAY TOGETHER
- LOCATE ONE ANOTHER
- WARN OF POSSIBLE DANGER

COMPARE THE EVIDENCE

	Sound	Posture or Movement	Spacing	Surroundings
A				
B				
C				
D				

SCIENTIST'S CLAIM

Which scene has the strongest evidence for its proposed function?

Scene _____

My proposed function: _____

Evidence 1: _____

Evidence 2: _____

Why this evidence is strong: _____

CONSIDER ANOTHER EXPLANATION

Choose one scene. How could the same signal have another possible function in a different context?

Scene _____

Another possible function: _____

Different context: _____

CAREGIVER DISCUSSION

Why might the same sound have different possible functions?

Why should scientists compare more than one clue?

VOCABULARY

signal — a sound, movement, posture, or other cue another animal can detect
context — the situation surrounding a signal or behavior
function — the job a structure or behavior may perform
evidence — observations that support an explanation
explanation — an idea supported by evidence

NGSS CONNECTION — REINFORCES 1-LS1-2
Use evidence to explain how parent and offspring behaviors may help young animals survive.

COMMON CORE — W.2.1 AND SL.2.1
State an opinion and support it with reasons and evidence; discuss ideas with others.

Communication scientists compare signals and contexts before proposing possible functions.



MALE AND FEMALE MALLARDS

Compare Adult Plumage

19

Big Idea: Adult male and female mallards share the same basic body structures, but their feather colors and patterns often differ.

Scientists compare visible traits to identify patterns. Adult mallards have the same basic duck structures: bills, wings, webbed feet, and feathers. During much of the year, males and females can look different in color and pattern.

ADULT MALE — DRAKE

During breeding plumage, a drake often has a glossy green head, white neck ring, chestnut chest, and gray body.



ADULT FEMALE — HEN

A hen usually has mottled brown feathers with darker markings that can blend with vegetation and ground cover.



BOTH MALLARDS

Both have feathers, wings, bills, webbed feet, streamlined bodies, and a blue-violet wing patch called a speculum.

TRAIT EVIDENCE

HEAD COLOR	BILL COLOR	CHEST AND BODY	WING PATCH	WEBBED FEET
Male / Female	Male / Female	Male / Female	Male / Female	Male / Female

One trait alone may not be enough. **Scientists** compare several visible clues.

IMPORTANT SEASONAL CLUE

After breeding, a male molts into duller eclipse plumage for part of the year. He may look more brown, but his bill and wing pattern can still provide clues.



Breeding-plumage drake (bright colors) — Eclipse-plumage drake (duller colors)

Feather color can also vary with age, season, light, and individual differences.

OBSERVATION OR INFERENCE

Observation — a detail you can directly see.

Inference — an explanation based on observations and prior knowledge.

One difference I observe is _____

_____

One similarity I observe is _____

_____

These clues may identify the duck as _____

_____

Vocabulary

- **trait** — an observable feature of a living thing
- **plumage** — a bird's feathers
- **drake** — an adult male duck
- **hen** — an adult female duck
- **speculum** — a colored patch on the wing

Evidence Hunt

- Which traits are shared?
- Which colors and patterns differ?
- Where is the speculum?
- Why should you use several clues?
- How might season affect identification?

Scientist's Claim

Which claim is best supported?

- ☐ Male and female mallards have completely different body structures.
- ☐ Male and female mallards share structures but often differ in plumage.
- ☐ Every brown mallard is female.

Use evidence from several traits.

Caregiver Discussion

- Which shared trait was easiest to find?
- Why can identifying a duck from color alone be difficult?



NGSS CONNECTION — BUILDS TOWARD 3-LS3-2 AND 3-LS4-2
Builds toward explaining how environments can affect traits and how trait differences may affect survival.

COMMON CORE — RI.2.3 AND RI.2.7
Describe connections among ideas; use images to explain information.

★ Scientists compare several traits—and consider season—before identifying a mallard. ★



MALLARD TRAIT EVIDENCE CHALLENGE

20

Become a Trait Detective!

Study each trait card. Decide whether the trait is usually evidence for an adult male, an adult female, or both mallards.

Big Idea: Scientists compare several traits and consider season before identifying a mallard.

A. SORT THE TRAIT EVIDENCE

MALE	FEMALE	BOTH
Card numbers: _____	Card numbers: _____	Card numbers: _____

B. EIGHT TRAIT CARDS (UNSORTED)

1. WEBBED FEET



2. GREEN BREEDING HEAD



3. WINGS



4. ORANGE-AND-DARK BILL



5. YELLOWISH BILL



6. BLUE-VIOLET WING PATCH



7. MOTTLED BROWN BODY



8. BROAD BILL



C. EXPLAIN WITH EVIDENCE

Choose one card you placed under **MALE** or **FEMALE**. Explain why it is useful evidence.

Card number: _____

My explanation: _____

Choose one card you placed under **BOTH**. Explain how the picture supports your choice.

Card number: _____

My explanation: _____

D. SEASONAL TRAIT CHECK



Breeding-plumage male (bright colors)



Eclipse-plumage male (duller colors)

A male's feather colors can change after breeding.

Which trait card may look different with season? _____

Why does seasonal plumage change not change whether the duck is male or female?

Seasonal plumage changes appearance, not biological sex.

Evidence Hunt

- Which cards show shared structures?
- Which cards show plumage?
- Which bill clues differ?
- Which trait can change with season?
- Why is one clue sometimes not enough?

Scientist's Claim

Which claim is best supported?

- ☐ One color always identifies every mallard correctly.
- ☐ Several traits and the season provide stronger evidence.
- ☐ Seasonal plumage changes a mallard's biological sex.

Use at least two trait cards as evidence.

Caregiver Discussion

- Which trait was easiest to sort? Why?
- Which shared trait surprised you?
- How does season make identification more challenging?

Vocabulary

- **trait** — an observable feature of a living thing
- **plumage** — a bird's feathers
- **evidence** — information that supports a claim
- **seasonal** — changing with the season

Standards

NGSS CONNECTION — BUILDS TOWARD 3-LS3-2 AND 3-LS4-2
Use evidence to compare inherited traits and variation.

COMMON CORE — W.2.1 AND W.2.8
Write a claim with reasons; recall and gather information.

★ **Scientists identify mallards by comparing several traits and considering seasonal change.** ★



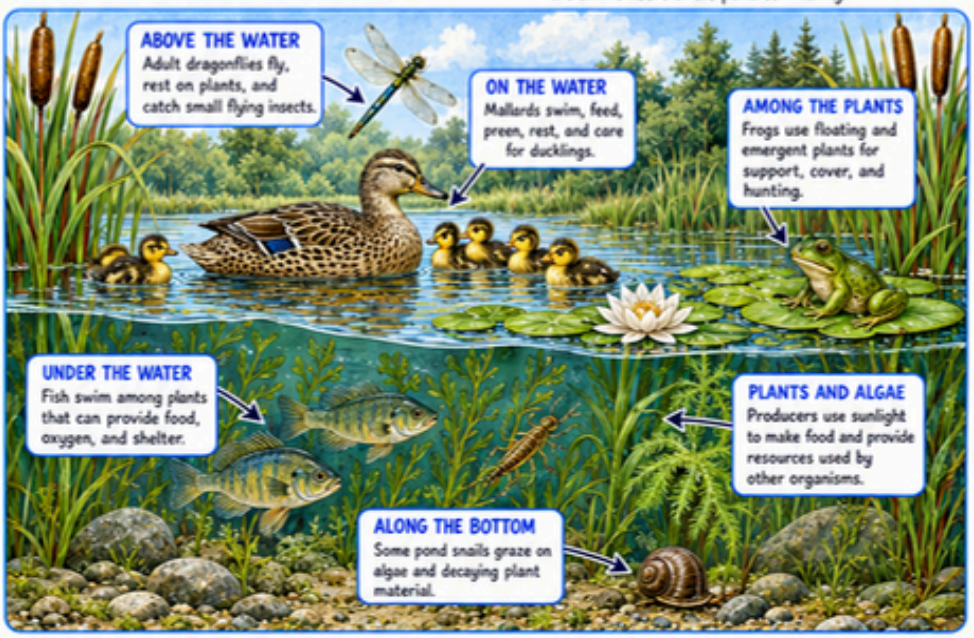
POND COMMUNITY

Species Interactions

21

Big Idea: A pond community includes all the populations of living things in the habitat. Organisms share space and resources and may interact in different ways.

Scientists observe where organisms live, what resources they use, and how they interact. Plants, algae, animals, and other living things are all members of the pond community.



Evidence Hunt

- Which organisms spend time at the surface?
- Which organisms use space above the water?
- Which organisms live underwater?
- Which community members are plants or algae?
- What interaction or shared resource do you notice?



Scientist's Claim

Which claim is best supported?

- ☐ Ducks are the only organisms that use the pond.
- ☐ Many populations share the habitat but use its spaces and resources differently.
- ☐ Every species uses the pond in exactly the same way.

Use evidence from the illustration.

Community Evidence

Close-up views show how different organisms use different parts of the pond.



Frog among plants uses plants for support, cover, and hunting.



Fish underwater uses water and plants for movement, food, oxygen, and shelter.



Dragonfly above uses airspace and plants while hunting small insects.



Snail near the bottom uses rocks and plants as surfaces for grazing and shelter.



Ducks at the surface use open water and shoreline for feeding, movement, and safety.

How does each organism use the pond differently?

Explain Your Thinking

How can many populations share one pond without using it in exactly the same way?

What evidence from the picture supports your explanation?

From Organism to Community

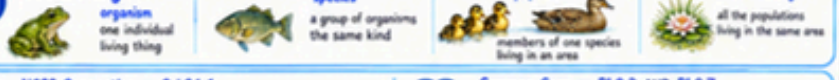


Caregiver Discussion

- Which organisms seem most connected to pond plants?
- What might change if most pond plants disappeared?



Vocabulary



NGSS Connection — 2-LS4-1
Observe and compare the diversity of living things in habitats.

Common Core — RI.2.3 AND RI.2.7
Describe connections among scientific ideas; explain how images support understanding.

★ Scientists study communities by observing where organisms live and how they use shared resources. ★



COMMUNITY CHALLENGE

Become a Pond Community Expert!

Use observations and reasonable inferences to explain how organisms share one habitat.

22

Big Idea: Pond populations use different spaces and resources.



EVIDENCE HUNT

Find evidence in the pond scene.

- ☐ Organisms using water
- ☐ Organisms using plants
- ☐ Organisms using cover
- ☐ Different life stages
- ☐ Several populations sharing one habitat

What other evidence can you find?

_____

_____

_____

A. OBSERVATION OR INFERENCE?

Write O for an observation or I for an inference.

- ☐ The fish are underwater.
- ☐ The frog is resting on a plant.
- ☐ The snail may be searching for algae.
- ☐ The ducklings stay near the adult for protection.
- ☐ The dragonfly uses different pond zones during its life cycle.

Choose one inference. What picture evidence supports it?

_____

_____

_____

_____

B. COMMUNITY EVIDENCE TABLE

Check every resource each organism appears to use. Add a question mark when the picture is not enough to decide.

	Water	Plants	Food	Cover
Mallard	☐	☐	☐	☐
Frog	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Snail	☐	☐	☐	☐
Dragonfly	☐	☐	☐	☐

C. SCIENTIST'S CLAIM

Which claim is best supported by the evidence?

- ☐ Every organism uses the pond in exactly the same way.
- ☐ Different populations share the pond while using spaces and resources differently.
- ☐ Only mallards depend on pond resources.

Support your claim with evidence from the scene and table.

_____

_____

_____

_____

D. EXPLAIN YOUR THINKING

How can many populations live in the same pond?

_____

_____

_____

What evidence supports your answer?

_____

_____

_____

DRAGONFLY LIFE-CYCLE INFERENCE



What observation supports the inference that a dragonfly uses different pond zones during its life cycle?

_____

_____

_____

_____

_____

CAREGIVER DISCUSSION

- Which pond organism uses the greatest variety of spaces?
- What might change if most pond plants disappeared?
- Which statement is an observation? Which is an inference?

VOCABULARY

observation — information gathered directly with the senses

inference — an explanation based on observations and prior knowledge

population — members of one species living in an area

community — all the populations living in the same area

NGSS CONNECTION
2-LS4-1
Use observations to compare the diversity of living things in habitats.

COMMON CORE
W.2.2 AND W.2.8
Write informative text; recall and gather information to answer questions.

★ Scientists separate observations from inferences and use both to explain community patterns. ★

Pond Investigators

Young Scientists at Work

ALL ABOUT MALLARDS

Evidence Field Guide

23

Review the evidence before the final Pond Investigator Expert Challenge.

Big Idea: Scientists connect observations, patterns, claims, and evidence.

1 EGGS AND NESTS



Mallard eggs are usually unmarked creamy, grayish, or greenish buff. A concealed ground nest may include grasses, leaves, stems, and down.

Evidence clue: Compare subtle egg variation and nest materials.

2 HATCHING



A duckling first makes a pip or small crack, then gradually emerges. Individuals may hatch at different rates.

Evidence clue: Use cracks, shell openings, and wet down to identify stages.

3 DUCKLING BEHAVIOR



Mallard ducklings can walk, swim, and feed themselves soon after hatching. They still benefit from their mother's warmth, vigilance, guidance, and protection.

Evidence clue: Separate visible behavior from possible function.

4 FEATHERS AND FEET



Feathers can provide warmth, water resistance, camouflage, or flight. Webbed feet increase the surface that pushes against water.

Evidence clue: Connect a visible structure to more than one possible function.

5 MOVEMENT



Posture, foot position, and environmental clues help identify movement. Dabbling is tail-up feeding at or near the surface, not deep diving.

Evidence clue: Look for wakes, webbed footprints, ripples, and tail-up posture.

6 HABITAT RESOURCES



Mallards use open and shallow water, shorelines, plants, food, cover, nesting sites, and space. Living and nonliving pond parts interact in specific ways.

Evidence clue: Identify a resource and show how an organism uses it.

7 COMMUNICATION



Mallards communicate with sounds, posture, movement, and spacing. Scientists examine both the signal and situation before proposing a possible function.

Evidence clue: Use may, could, or possible function—not exact human translations.

8 TRAITS AND COMMUNITY



Male and female mallards share basic structures and usually a blue-violet wing patch. Male breeding plumage changes seasonally. A pond community includes all living populations in the habitat.

Evidence clue: Compare shared and varying traits, then identify one community connection.

OBSERVATION OR INFERENCE?

Observation — information gathered directly with the senses.
Inference — an explanation based on observations and prior knowledge.
Strong scientists label which is which.

FIELD NOTES

Record two details you want to remember for the Expert Challenge.

KEY WORDS	pip	function	situation	evidence
	the first small break in an eggshell	the job a structure or behavior may perform	what is happening around a signal or behavior	observations or information that support an explanation

NGSS CONNECTION — 2-LS4-1
Compare the diversity of living things in habitats.

PRIOR-GRADE CONNECTIONS
REINFORCES 1-LS1-1 AND 1-LS1-2

COMMON CORE — RI.2.7 AND W.2.8
Use images to build understanding and gather information.

A careful field guide helps investigators connect observations, patterns, claims, and evidence.



POND INVESTIGATOR EXPERT CHALLENGE

24

Use Evidence from the Whole Field Guide!

Study the pond scene. Complete each investigation target with an observation, inference, or evidence-based explanation.

Big Idea: Strong scientists use careful observations, patterns, claims, and relevant evidence.



1 EGG VARIATION
Describe one subtle difference among the mallard eggs.

2 NEST MATERIALS
Name two nest materials and suggest a possible function for each.

3 HATCHING CLUE
Identify one visible clue that shows a hatching stage.

4 DUCKLING RESOURCE
Identify one resource that may help a duckling survive.

5 FEATHER FUNCTION
Name one possible feather function and give picture evidence.

6 WEBBED-FOOT FUNCTION
Explain one structure-function relationship shown by webbed feet.

7 SWIMMING CLUE
Record one clue that shows a mallard is swimming.

8 WALKING CLUE
Record one clue that shows a mallard is walking.

9 DABBLING CLUE
Record one clue that shows surface dabbling.

10 COMMUNICATION
Suggest one possible function of a visible mallard signal. Use the situation.

11 MALE AND FEMALE TRAITS
Name one shared trait and one varying trait.

12 COMMUNITY CONNECTION
Describe one specific connection between two pond-community members.

CREATE YOUR OWN MISSION

Write five new investigation missions for another pond scientist.

1. _____
2. _____
3. _____
4. _____
5. _____

EXPERT REFLECTION

A strong scientific explanation uses a clear claim and relevant evidence. Choose one mission and explain your reasoning.

Vocabulary Reminder

observation — information gathered directly with the senses
inference — an explanation based on observations and prior knowledge
claim — a statement that can be supported with evidence
evidence — information that supports a claim or explanation

NGSS CONNECTION — 2-LS4-1
Observe and compare the diversity of living things in habitats.

COMMON CORE — W.2.1, W.2.2, W.2.8, AND SL.2.1
Write claims and explanations, gather information, and discuss ideas.

You are ready to investigate, explain, and think like a pond scientist!