TEACHER NOTES · STEM SCIENCE COMPANION

Yechiel’s Fishery Farm

George and the Mosquito Patrol

Book 2 · Ages 7–10

Nature’s own pest control — and the quiet workers who keep a whole habitat healthy.

How to use these notes

Book 2 turns a real fishery problem into a science adventure: too many mosquitoes, and the natural, living ways to manage them without poisoning everything else. Along the way it teaches food webs, insect life cycles, the physics of a hunting jet, and the unseen labour that keeps water clean.

These notes map the biology, ecology, and physics chapter by chapter so you can pair the right demonstration with the right page — all without revealing a single plot turn.

> **A spoiler-free promise**
>
> Science only, never story. Every note here describes a concept your class can explore, not an event they’ll meet in the book. Read it aloud freely; the surprises stay safely between the covers.

The science at a glance

A one-line map of the real biology, ecology, and physics inside each chapter — handy for planning which lesson to pair with which read-aloud.

Ch.	Science focus
1	**A Small Bright Commute.** A quick refresher on adjusting to salinity, and where mosquito larvae gather.
2	**The Air-Show.** Specialised feeding above the water — the archerfish’s water jet.

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3	**Down Here Is Also Work.** Complementary roles: above the surface and below it.
4	**The Cleanup Sergeant.** Bottom-feeders, waste, ammonia, and the helpful bacteria in a filter.
5	**Refraction Lessons.** Light bending (refraction) and water pressure (force ÷ area).
6	**The Audience Grows.** Biological control and the idea of a habitat as a connected system.
7	**Greta and the Thank-You.** Decomposers and cleanup crews — the unseen work that keeps water healthy.
8	**The Boots and the Visitor.** Observation and record-keeping as core scientific skills.
9	**The Hidden Nursery.** The mosquito life cycle and where each stage happens.
10	**The Shot That Cannot Be Made.** The physical limits of one tool — and why systems need variety.
11	**What the Small Fish Does.** Filling a niche — the right helper in the right place.
12	**The Quietest Applause.** Ecosystem balance and the value of unseen, essential work.

Chapter by chapter

Each note explains the concept for you, the teacher, so you can pitch it to the class at the right level. None of these reveal what happens in the story.

Chapter 1 — A Small Bright Commute

Science focus: *A quick refresher on adjusting to salinity, and where mosquito larvae gather.*

The chapter reminds us that crossing a salinity gradient takes a brief, real adjustment in the body. It also sets the ecological scene: mosquito larvae hang near the surface of still, sheltered water — exactly the places a small surface-feeding fish can patrol.

In the classroom: Ask where in a schoolyard rain might sit still for days. Still water is mosquito water — a clue students can use outdoors.

Chapter 2 — The Air-Show

Science focus: *Specialised feeding above the water — the archerfish's water jet.*

An archerfish forms a narrow channel using a groove in the roof of its mouth and its tongue, then snaps its gill covers to fire a jet of water that knocks insects from leaves above the surface. It is a beautiful example of structure and function: a body shaped for one remarkable job.

In the classroom: Discuss other animals built for one special task (a woodpecker's skull, a hummingbird's tongue). Form follows job.

Chapter 3 — Down Here Is Also Work

Science focus: *Complementary roles: above the surface and below it.*

Pest control can happen in more than one place at once. Some hunters work the air above the water; others work the still water below. The chapter sets up the idea that a habitat is handled best when different specialists cover different zones.

In the classroom: Sort a habitat into zones (surface, mid-water, bottom) and ask which kind of helper each zone needs.

Chapter 4 — The Cleanup Sergeant

Science focus: *Bottom-feeders, waste, ammonia, and the helpful bacteria in a filter.*

A corydoras catfish uses whisker-like barbels to find food on the bottom — a natural cleanup crew. When uneaten food rots, it clouds the water and raises ammonia, which is dangerous to fish; helpful bacteria in the biofilter break it down. Overfeeding is one of the most common ways a tank goes wrong. (Watch, too, for an air-breathing gourami using its labyrinth organ to gulp air at the surface.)

In the classroom: Connect ‘too much food’ to ‘dirty water.’ Less is usually more — a rule that surprises students.

Chapter 5 — Refraction Lessons

Science focus: *Light bending (refraction) and water pressure (force ÷ area).*

Refraction returns in depth: light bends crossing air and water, so a target appears displaced from where it truly is. The chapter pairs this with pressure — force divided by area, measured in pascals. Water has weight, so the deeper you go, the more pressure presses on you (hydrostatic pressure); even the air above us presses down (atmospheric pressure, about 101,000 pascals at sea level).

In the classroom: Press a thumb gently, then a pencil tip, with the same push — the point hurts more. Same force, smaller area, bigger pressure.

Chapter 6 — The Audience Grows

Science focus: *Biological control and the idea of a habitat as a connected system.*

Using a living helper to manage a pest is called biological control. It works more slowly than spraying poison, but it spares the rest of the web — the dragonflies, frogs, bees, and small fish. The lesson: remove one piece of a system carelessly and you often harm many others.

In the classroom: Build a simple food-web string diagram, then ‘remove’ one species and trace which strings go slack.

Chapter 7 — Greta and the Thank-You

Science focus: *Decomposers and cleanup crews — the unseen work that keeps water healthy.*

Some of the most important workers in any ecosystem are the ones that process waste and leftovers. Their job is rarely noticed, yet without it the whole system clogs. The chapter honours this quiet, essential labour.

In the classroom: Ask: who has the most important job in a system — the one everyone sees, or the one no one notices? Defend both.

Chapter 8 — The Boots and the Visitor

Science focus: *Observation and record-keeping as core scientific skills.*

Good fishkeeping is good science: walk the system, check each part, write down what you see. The chapter models routine inspection and careful notes — the habits that catch small problems before they become big ones.

In the classroom: Start a class observation log for a plant or classroom animal: one honest line a day.

Chapter 9 — The Hidden Nursery

Science focus: *The mosquito life cycle and where each stage happens.*

Mosquitoes have a four-stage life cycle: eggs on still water, wriggling larvae, resting pupae, then flying adults — two stages in the water and one in the air. Larvae hang head-down at the surface film, breathing through a tiny snorkel. Because surface-feeders and bottom-feeders have mouths pointing different ways, they reach different parts of the problem.

In the classroom: Sequence life-cycle cards (egg → larva → pupa → adult). Mark which stages you could interrupt, and where.

Chapter 10 — The Shot That Cannot Be Made

Science focus: *The physical limits of one tool — and why systems need variety.*

Even a brilliant specialist has limits: angle, distance, and dim light can put a target out of reach of the water jet. The chapter shows that no single tool or animal solves every problem, which is exactly why complementary helpers matter.

In the classroom: Discuss a job your best tool can’t do alone. What second tool finishes it? Variety is strength.

Chapter 11 — What the Small Fish Does

Science focus: *Filling a niche — the right helper in the right place.*

The quiet, below-the-surface eater reaches what the dramatic, above-the-surface shooter cannot. Each fills a different niche, and together they cover the whole problem. Small and unseen is not the same as unimportant.

In the classroom: Define ‘niche’ as the exact job-and-place an organism fills. Have students name their own niche in a class team.

Chapter 12 — The Quietest Applause

Science focus: *Ecosystem balance and the value of unseen, essential work.*

The book closes on balance: a healthy habitat depends on many roles, including the ones nobody claps for. Combined with the recirculating water system underneath it all, the message is that steady, modest, well-placed work keeps the whole thing alive.

In the classroom: List the ‘unclapped’ jobs that keep your school running. Notice how many are essential and quiet.

Key vocabulary

Teacher-facing definitions. Introduce the words your class is ready for; the book itself defines them gently in context.

- **Biological control —** managing a pest with a living helper (such as a larva-eating fish) instead of poison; slower, but gentler on the whole system.
- **Metamorphosis / life cycle —** the staged change from egg to larva to pupa to adult; for mosquitoes, two stages are aquatic and one is aerial.
- **Larva, pupa, adult —** the wriggling young stage, the resting in-between stage, and the flying mature stage of an insect.
- **Surface film —** the thin top layer of water where mosquito larvae hang head-down, breathing through a snorkel-like tube.
- **Barbels —** the whisker-like feelers a catfish uses to taste and find food along the bottom.
- **Detritivore / decomposer —** an organism that feeds on waste and dead material, recycling it and keeping the system clean.
- **Ammonia —** a chemical that builds up from waste and rotting food; harmful to fish until bacteria break it down.
- **Biofilter —** the part of a system where helpful bacteria convert harmful waste into safer substances.
- **Recirculating Aquaculture System (RAS) —** a fishery design that filters and reuses the same water over and over, saving large amounts of water.
- **Labyrinth organ —** a special air-breathing organ in fish like gouramis, letting them gulp air at the surface.
- **Refraction —** the bending of light between air and water, which displaces how a submerged or surface target appears.
- **Hydrostatic pressure —** the pressure water exerts by its own weight; it increases with depth.
- **Pascal (Pa) —** the unit of pressure — one newton of force spread over one square metre (pressure = force ÷ area).

Big ideas & curriculum connections

- Ecosystems are connected systems: changing one part affects many others.

- Biological control vs. chemical control: trade-offs between speed and harm to the wider web.
- Life cycles: where and when an organism is vulnerable shapes how it can be managed.
- Structure and function: bodies (and tools) are shaped for specific jobs, each with limits.
- Physics in the water: light bends (refraction) and pressure grows with depth.

Connects naturally to elementary life-science and engineering strands — for example, NGSS-style topics such as interdependent relationships in ecosystems, life cycles and traits, structure and function, and waves and information (how light behaves). Treat these as starting points, not a checklist.

Extend it: simple classroom activities

Low-prep, safe, and matched to ages 7–10. Each one makes one of the book's invisible ideas visible.

Life-cycle sequence — Give pairs four cards (egg, larva, pupa, adult) to order, then mark which stages happen in water. Ask where control is easiest. Links to Chapter 9.

Food-web string — Stand students in a circle as bog organisms and connect them with string for ‘who needs whom.’ Drop one role and watch the strings sag. Links to Chapter 6.

Pressure squirt — Poke holes at different heights in a tall plastic bottle, fill it over a sink: the lowest hole squirts farthest. Deeper water, more pressure. Links to Chapter 5.

Same force, different point — Push a flat hand, then one finger, into clay with equal effort. The point sinks deeper — smaller area, greater pressure. Links to Chapter 5.

Spot the helper — Sort animal cards into ‘works above water’ and ‘works below water,’ then discuss why a healthy habitat needs both. Links to Chapters 3 & 11.

The science in this companion is drawn from a working fishery and nearly five decades of real observation. Slow, my friend, slow — the water will change with you.