

Nets That Let the Right Animals Go

Learning target: I can use evidence from a passage to explain how fishing-net designs reduce by-catch and to judge them by scientific, economic and social criteria.

Reading with evidence

About 40 min

Individual

MS-LS2-5 · practice

MS-ETS1-1 · practice

reading

writing

discussion

Standards connections

MS-LS2-5 (practice): Students compare two real design solutions (larger-mesh nets and turtle excluder devices) for protecting fish and turtle populations, using scientific, economic and social considerations named in the PE's clarification statement. The reading builds the evaluation skill that W6 and W9 assess.

MS-ETS1-1 (practice): Students identify the criteria and constraints each design had to meet, including impacts on the people who use the nets, which practices defining a design problem precisely.

Purpose: build · **Time:** about 40 minutes · **Format:** individual

Answers with reasoning

Nets That Let the Right Animals Go

[1] Every fishing net is a kind of filter. The size of the openings in its mesh decides which animals stay inside and which slip out. A net with tiny holes keeps almost everything, including young fish that have not yet had a chance to breed. Animals caught by accident while people fish for something else are called **by-catch**. By-catch can include undersized fish, sea turtles, dolphins, sharks and seabirds. Some are thrown back alive, but many are already injured or dead by the time the net comes up.

[2] Lake Malawi, in southeastern Africa, is home to hundreds of species of fish called cichlids, more than almost any other lake on Earth. Families along its shores depend on fish for food and income. As the number of people living near the lake grew, so did the fishing, and near some villages the small cichlids that eat snails became scarce. Those snails carry the young stage of a parasitic worm that causes bilharzia (also called schistosomiasis), a disease that can make people sick for years. When researchers compared sites along the shore, they found that where snail-eating fish were common, snails were fewer and fewer children were infected. Where the fish had become scarce, snails and infections were more common.

[3] One design response is a net with larger holes. Bigger fish are still caught for food and sale, but small snail-eaters can swim through and survive. The design had to fit tight constraints. It had to be cheap, easy to make and repair, and it had to let families keep fishing, because many have no other source of food or money. Notice, though, what kind of evidence supports the plan. The shoreline comparisons show a pattern, not the result of a controlled experiment, so other differences between sites might also matter. The real test is to keep counting snails and infections after the nets change.

[4] Far from Africa, shrimp fishers along the southeastern coast of the United States and in the Gulf of Mexico drag cone-shaped nets called trawls through the water near the sea floor. For years, sea turtles

swam into the trawls and drowned. Engineers, working with fishers, developed the **turtle excluder device**, or TED: a grid of bars sewn into the neck of the net. Shrimp are small enough to pass between the bars into the bag at the back, but a turtle bumps into the grid and slides out through a flap. U.S. rules have required many shrimp trawlers to use TEDs since the late 1980s. To be approved, a new design must let out at least 97 percent of the turtles in official tests.

[5] The story of the TED shows that a solution is judged by more than one kind of criterion. **Scientific** criteria ask whether it protects the species and the ecosystem. **Economic** criteria ask what it costs and whether people can still earn a living. **Social** criteria ask whether people will accept it, whether it is fair and whether it can be enforced. Many shrimpers opposed TEDs at first because they feared losing part of their catch, and some early designs really did let shrimp escape. Designers kept changing the spacing of the bars, the angle of the grid and the size of the opening. Better designs also push out sticks, trash and some unwanted animals such as rays, which can make the catch cleaner.

[6] No net is perfect. A larger mesh still catches some small fish, and a TED only works if it is installed and kept in good shape. Turtles also face threats that nets cannot fix, such as plastic trash and the loss of nesting beaches. That is why engineers compare competing designs with data, choose the best one for now, and keep testing. Healthy fish and turtle populations are part of the biodiversity that keeps ecosystems working, and those ecosystems feed people and, at Lake Malawi, even help hold back a disease.

Part A: Find the evidence

1. As it is used in paragraph 1, **by-catch** means:

Answer: B. Animals caught by accident while fishing for something else.

Why: Paragraph 1 defines by-catch directly and lists examples such as sea turtles and undersized fish.

Also acceptable: None; the other options are not supported by the passage.

2. Paragraph 2: describe the pattern researchers found when they compared sites along Lake Malawi's shore. Include both what they found where snail-eating fish were common and where they were scarce.

Answer: Where snail-eating fish were common, there were fewer snails and fewer children were infected. Where the fish had become scarce, there were more snails and more infections.

Why: This is the comparison described in paragraph 2. It matches a published study of Lake Malawi (Stauffer and others, 2006), which found infection in children was lower where snail-eating fish were more abundant.

Also acceptable: Accept a quotation of the paragraph's final two sentences.

- Describes the pattern where fish were common
- Describes the pattern where fish were scarce
- Mentions both snails and infections

3. Use paragraphs 2 and 3 to write the cause-and-effect chain that starts with 'more people near the lake' and ends with 'more children infected'. Use at least four arrows.

Answer: More people near the lake → more fishing → fewer small snail-eating fish → more snails → more parasitic worm larvae in the water → more children infected with bilharzia.

Why: The chain comes from paragraph 2. The parasite's young stage lives in snails before it can infect people.

Also acceptable: Accept 'more nets with small holes' as a step between more fishing and fewer snail-eaters.

- Starts with more people and ends with more infections
- Includes fewer snail-eating fish and more snails in the right order
- At least four arrows

4. Paragraph 4: explain how a TED keeps turtles out of the bag while letting shrimp in. What difference between the two animals does the design depend on?

Answer: The grid of bars in the neck of the net is spaced so shrimp can pass between the bars into the bag, but a turtle is too big, hits the grid and slides out through a flap. The design depends on the difference in body size.

Why: Paragraph 4 describes the grid and flap. Size separation is the same principle as mesh size in paragraph 1.

Also acceptable: Accept 'turtles are bigger and stronger than shrimp'.

- Describes the grid and the escape flap
- Names size as the difference used

5. True or false: According to the passage, a controlled experiment has proven that larger-hole nets reduce bilharzia at Lake Malawi. Correct the statement if it is false.

Answer: False. The passage says the evidence comes from comparing sites, which shows a pattern but is not a controlled experiment; the real test is to keep counting snails and infections after the nets change.

Why: Paragraph 3 says this directly. The textbook reports that bilharzia fell after the change but gives no data; published work shows the fish-and-infection link as a correlation.

Also acceptable: Accept 'False: the evidence is a pattern or correlation, not proof.'

- Marks false
- Corrects it using paragraph 3

Part B: Judge the designs

6. Use the passage to fill in how each design does on each kind of criterion. Write 'not stated' if the passage gives no evidence.

Answer: Larger-mesh nets: Scientific: protects small snail-eating cichlids, which keeps snail numbers and bilharzia down (disease control as an ecosystem service). Economic: cheap, easy to make and repair; families can still catch bigger fish to eat and sell. Social: lets families keep fishing because many have no other food or income; acceptance or enforcement is not stated. TEDs: Scientific: approved designs must let out at least 97 percent of turtles in tests, so fewer turtles drown; also push out some rays. Economic: shrimpers feared losing catch; early designs lost shrimp; better designs make a cleaner catch. Social: many shrimpers opposed TEDs at first; U.S. rules require them (enforcement).

Why: Each cell should be backed by a specific sentence in paragraphs 3, 4 or 5. 'Not stated' is the honest answer where the passage is silent.

Also acceptable: Accept 'protects biodiversity' in the scientific row if a species is also named.

- At least five of six cells filled with accurate passage evidence
- Uses 'not stated' or leaves no invented claims where the passage is silent
- Scientific row names a species or service

7. Paragraph 5: why did many shrimpers oppose TEDs at first, and how did designers respond? Explain what this shows about testing and revising a solution.

Answer: Shrimpers feared the devices would let part of their catch escape and cost them money, and some early designs really did lose shrimp. Designers kept changing the bar spacing, the angle of the grid and the size of the opening until the devices kept more shrimp while still freeing turtles. This shows that a first design is rarely the final one: engineers test it, learn from the results and from the people who use it, and revise it.

Why: Paragraph 5 gives both the concern and the response; the point is the iterative cycle of testing and modifying.

Also acceptable: Accept answers that also mention that better designs remove trash and rays as an added benefit.

- States the economic concern (losing catch)
- Names at least one design change
- Explains the test-and-revise idea

8. Paragraph 3 says the evidence for the larger-mesh nets 'shows a pattern'. Why does the author say the real test is to keep counting snails and infections? Name one other difference between sites that could also affect infections.

Answer: A pattern between fish and infections could have other causes, so only measuring what happens after the nets change can show whether the nets actually help. Other differences between sites: how often people wade or wash in the lake, whether villages have clean water or toilets, access to medicine, water depth or plants where snails live.

Why: Paragraph 3 warns that other differences between sites might also matter; this is the difference between correlation and a tested cause.

Also acceptable: Accept 'some villages may get treatment for bilharzia' as the other difference.

- Explains that a pattern does not prove the nets cause the change
- Names one plausible other difference

9. Paragraph 6 says 'No net is perfect.' Give one limit of each design that the passage names.

Answer: Larger mesh still catches some small fish. A TED only works if it is installed and kept in good shape, and nets cannot fix other threats to turtles such as plastic trash and lost nesting beaches.

Why: Paragraph 6 lists these limits; every design solves part of a problem.

Also acceptable: Accept 'turtles face other threats' as the TED limit.

- One limit for the mesh
- One limit for the TED

10. Paragraph 6 links healthy fish and turtle populations to ecosystem services. Name one ecosystem service from the passage, explain how a net design protects it, and explain why protecting biodiversity matters for that service.

Answer: Example: Fish for food is an ecosystem service. Larger-mesh nets let young and small fish survive and breed, so the lake keeps producing fish. Another service is disease control: snail-eating fish keep snails down, so protecting those species protects people. Many different species each do different jobs, so losing species can mean losing services.

Why: The PE links design solutions to maintaining biodiversity and ecosystem services; this item asks students to make that link explicitly.

Also acceptable: Accept 'turtles help keep ocean ecosystems working' if the student explains a role, such as sea turtles grazing seagrass or eating jellyfish, and says it goes beyond the passage.

- Names a service from the passage (food, disease control, or a working ecosystem)
- Explains how the design protects it
- Links biodiversity to the service

Teacher notes

The passage is original. Lake Malawi facts: the lake holds more fish species than nearly any other lake, most of them cichlids; bilharzia (schistosomiasis) is spread by parasite larvae released from freshwater snails. The textbook states that larger-hole nets reduced snails and infections but gives no data; the published support (Stauffer et al., EcoHealth 2006) is correlational, which is why the passage frames the nets as a design response still being tested. TED facts follow NOAA Fisheries: a grid installed in the trawl's neck, U.S. requirements since the late 1980s, and a standard that a new design must exclude at least 97 percent of turtles in testing before it is approved. Use q6 to introduce the three kinds of criteria that W6, W8 and W9 use.

Scaffold offered to students: A criteria sorter for the margins

As you reread, write S, E or So in the margin next to each sentence that names a scientific (S), economic (E) or social (So) concern. For q6, copy those margin notes into the table. For q3, start with 'more people near the lake → more fishing →' and keep going one step at a time until you reach children.

Extension: Design a test for the Lake Malawi nets

Plan a study that could show whether larger-mesh nets really lower bilharzia, not just match it. Decide which villages would switch nets and which would keep their old nets, what you would measure (snail-eating fish, snails, infections in children), how often, and for how long. Explain how your plan handles one other difference between villages, such as how often people wade in the water or whether they have clean water at home.