Lights Out, Hatchlings

Use a revised simulation to evaluate a biodiversity solution.

HS-LS4-6 "Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each simulation input or condition that is changed, circle each outcome used to judge the light rule, and number the model limitations or follow-up checks. These marks show how the team tests and improves a solution with a simulation.

Testing Beach Lighting Rules

1 On a Florida beach, green sea turtle hatchlings usually crawl toward the relatively bright, open ocean horizon, away from the darker dune silhouette. Hotel lights can pull hatchlings inland, where they may die from dehydration, traffic, or predators. A conservation team built a computer simulation of one nesting season. The model begins with 200 nests and uses local records for hatchling number, beach width, light brightness, and survival. It predicts how many hatchlings reach the water under current lighting. Because weather and nesting dates vary, the team runs the model 100 times and records the average result.

2 First, the team tested a proposed rule requiring oceanfront hotels to use fully shielded, amber lights during nesting season. They changed only the hotel-light setting, then compared results with the current-lighting model. In the simulation, the rule raised the average number reaching water from 8,400 to 11,100 hatchlings. However, the model assumed every hotel followed the rule and did not include lights from homes or vehicles. The team revised the simulation by adding compliance levels of 50, 75, and 100 percent and by adding nearby road lighting. This revision lets the team test whether the rule still works when real conditions are less controlled.

③ To judge the solution, the team set a success criterion before examining new results: the rule should increase the average number of hatchlings reaching water by at least 20 percent compared with current lighting. They will compare each compliance level with a current-lighting control and graph the average across repeated runs. If 75 percent compliance meets the criterion but 50 percent does not, the town could pair the rule with inspections or incentives. The simulation cannot prove what will happen on every beach, so biologists should later compare its predictions with field counts. Still, it helps leaders choose a testable action that can reduce a human-caused threat to a population.

2 ANSWER WITH EVIDENCE

Use the passage

1. What inputs does the original simulation use, and what outcome does it predict?

2. What single condition did the team change in its first test, and why is changing only that condition useful?

3. Name two limits of the first model and explain how the revision addressed them.

4. What is the team's success criterion, and what action might the town take if 75 percent compliance succeeds but 50 percent does not?

3 YOUR TURN

Your own words

In exactly 3 sentences, create a simulation plan for a threatened or endangered species affected by human activity. Identify the impact, proposed solution, inputs, changed variable, control, outcome, repeated runs, success criterion, and one limitation or revision. Then create and run a working dice simulation of the beach-light solution on separate paper. Write the rules and a results table before rolling. Use one fair six-sided die; each roll represents one hatchling. Control: 1–3 reaches water, 4–6 does not. Fully compliant shielded-light solution: 1–4 reaches water, 5–6 does not. Run three trials of 20 hatchlings for each condition; record every trial count and both means. Judge success by solution mean at least 1.20 times control mean.

Revise your simulation to represent only 50% hotel compliance: for each hatchling first roll the die, with odd meaning compliant and even meaning not compliant; roll again for its outcome using the matching rule above. Run three more 20-hatchling trials, compute the revised mean, and compare it with the same control criterion. Report whether the solution still meets the criterion, explain how your revision changes the model, and propose one further improvement. These probabilities are invented classroom assumptions. Keep all actual results, including failures; do not substitute expected counts.

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PART 1 · READ AND MARK

Underline each simulation input or condition that is changed, circle each outcome used to judge the light rule, and number the model limitations or follow-up checks. These marks show how the team tests and improves a solution with a simulation. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What inputs does the original simulation use, and what outcome does it predict?	**It uses local records for hatchling number, beach width, light brightness, and survival. It predicts how many hatchlings reach the water.**
2	What single condition did the team change in its first test, and why is changing only that condition useful?	**The team changed the hotel-light setting to fully shielded, amber lights. Changing only that setting helps isolate the effect of the proposed lighting rule.**
3	Name two limits of the first model and explain how the revision addressed them.	**The first model assumed every hotel followed the rule and omitted lights from homes and vehicles. The revision added 50, 75, and 100 percent compliance levels and included nearby road lighting. Road lighting partly addresses the omitted artificial light, but the revision does not explicitly model every home or vehicle light.**
4	What is the team's success criterion, and what action might the town take if 75 percent compliance succeeds but 50 percent does not?	**The rule must increase the average number reaching water by at least 20 percent compared with current lighting. The town could pair the rule with inspections or incentives.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

A simulation of California condor foraging will model lead exposure from ammunition fragments, with food availability, condor numbers, and carcass locations as inputs. It will compare a current-use control with 25, 50, 75, and 100 percent use of nonlead ammunition, run each condition 100 times, and measure the average number of condors surviving one year. The solution succeeds if 75 percent nonlead use raises survival by at least 15 percent, but the model should be revised with field data because it may miss illegal ammunition use. For the completed dice model, inspect the learner's written rules and nine actual trial counts. Compute each mean from its three counts and compare each solution mean with 1.20 times the control mean. Results vary. The initial solution has success probability 4/6, control 3/6, and the 50%-compliance revision $0.5\times4/6+0.5\times3/6=7/12$; these are model expectations, not required observed outcomes. A limitation is the invented probabilities or omitted road/home lighting; a further revision could use field-calibrated probabilities.

Accept equivalent descriptions of inputs, variables, controls, outcomes, and limitations that match the passage. For Part 3, accept different valid species and solutions if the student includes all requested simulation elements in exactly three sentences. The exactly-three-sentence requirement applies to the original species plan, not the separate operational simulation record. Require rule creation, three actual trials per condition, means, an implemented compliance revision and evidence-based evaluation. Nine 20-hatchling trials are required in total; the revised condition uses two rolls per hatchling. Accept either success or failure supported by the recorded data. If control mean is zero, report that the relative comparison is uninformative and collect more control trials; do not divide by zero. Reaching water is an early-life outcome that may help the population, not a direct measurement of overall biodiversity or lifetime survival.