**Keystone Species In-class Project**

a. The fate of North American kelp beds is tied to that of its keystone species — the sea otter — and if kelp beds are lost, there will be a critical drop in the biodiversity of the ocean system. Scientists are always looking for ways to study the interventions that we can make to protect the biodiversity of ecosystems. Often, before making interventions, scientists will design simulations to study the impacts of any actions they plan to take to ensure that they do not have unintended negative consequences on the ecosystem.

*Think-Pair-Share*-As a class, our job is to **design** such a simulation. The simulation should help you to gather data about the impacts of human interventions designed to protect the biodiversity of the kelp beds by preserving sea otter populations. In planning your simulation, **identify** and **describe** the following:

* What major hazards do sea otters face and how will you model the severity of these hazards on sea otter populations?
* What minor hazards do sea otters face and how will you model the difference in severity of these hazards from that of the major hazards?
* What actions could be taken to mitigate one or more of these hazards and how could you model their impacts?
* How can you model random variables that impact the frequency and severity of the hazard, or the impacts of the interventions?

b. With your partner-Glacier National Park in Alaska has an offshore kelp forest with a population of about 100 sea otters. You will use the following spreadsheet to input some of the hazards, human interventions, and variables that you identified in **question a** and **collect** data on their efficacy. Your spreadsheet is designed to simulate these events occurring over the course of one year at the park. Since you are simulating an actual population of otters, make sure that your initial population is 100 sea otters.

Note that as you change the hazards, reproductive success, and interventions taken, the population after these impacts will continue to change. Only record the post-impact population **AFTER** you have made the necessary changes.

**Note: Make a copy of the Sea Otter Simulation:** <https://docs.google.com/spreadsheets/d/1GZraOznSKqWPEhIqwUSbW3v6I-SwTBDwEReLwJtfrRg/edit?usp=sharing> spreadsheet in your google documents *before* you add inputs. To do this, open the document and select File-->Make a copy. You must be signed in with a Google account. If you prefer to edit the simulation in Excel, click File -->Download as --> Microsoft Excel (.xlsx).

You will need to run your simulation several times in order to test out the impact of each hazard and potential intervention. **Report** your data to your teacher using a data chart like the one below to track the outcomes of your simulations. (Note: if you run the simulation more than four times, add lines to the data chart that you create):

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Trial Number | Initial Population | Major Hazard Chosen | Type of Reproductive year (Low, Avg, High) | Minor Hazard Chosen | Intervention Chosen | Population After Impacts |
| 1 | 100 |  |  |  |  |  |
| 2 | 100 |  |  |  |  |  |
| 3 | 100 |  |  |  |  |  |
| 4 | 100 |  |  |  |  |  |

c. With your partner, **Analyze** your simulation results by **explaining** the following:

* Were the results of the simulation what you expected? What factors might have contributed to your results? Did this meet your expectations or surprise you?
* **Describe**, using information from the prompt, how this simulation can be used as evidence that human intervention can preserve the biodiversity of the kelp forests in Glacier National Park.
* Provide an **analysis**, based on the simulation results, of how effective human interventions are at preserving sea otters and kelp forests.
* **Predict** any negative consequences that the human interventions from your simulation might have on the kelp forest or its organisms and **describe** whether or not these consequences outweigh the benefits of the interventions.

d. Think-Pair-Share-**List** and **describe** what is modeled well by the simulation and the things that are not modeled well by the simulation.

Then, with your partner-**list TWO** changes that you would make to your simulation if you were asked to create a sea otter simulation version 2.0. **Defend** the necessity of these changes.