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PCB4043c

Lab Report 8

Figure 1.1- This figure displays the simulation of stage structured population growth for 100 years of the turtle population

Figure 1.2- This figure shows the percentage of the stable stage distribution for the different turtle stages, as per the information in graph 1.1.

1a. Do you see any advantages of using a logarithmic scale?

A logarithmic scale is used normally in science and engineering when data has to be displayed precisely. It’s better to use a logarithmic scale when the data needs to be plotted varies far and wide. Since there is no distortion with a logarithmic scale, we can use this chart modification on only one axis. In this case we are using logarithmic values on the y- axis on Figure 1.1-5.2.

2a. What is the key assumption needed to project the long term population dynamics?

In Figure 1.2 you can see that there is a disproportionate amount of small juveniles. We can conclude that one of the key assumptions needed in the long term population dynamics will be maturation rate. The population will not grow if the turtles are in indefinite state of being juveniles. If the turtles mature quickly then they will be able to produce more hatchlings.

1c. At approximately what year in the 100- year simulation does λt appear to stabilize? It is easier to see this in the logarithmic or linear scale figure? Why?

Around years 15-20 we can see that the growing population stabilizes around a growth rate of .95%. You can locate the years easier using a logarithmic scale. In a linear scale you will see that the population peaks and then rapidly declines, without giving a clear point on there the growth rate stabilization occurs.

1d. What is the estimate for the finite rate of increase (λ)?

We will use this at the stabilization point 0.95 as λ.

1e. Given this values of λ, would you describe the population trajectory of the seas turtle population as stable, increasing, or decreasing.

According to λ since it is less than 1, we can assume that the population of the sea turtles is actually decreasing.

Figure 2.1- This graph shows the new population vector of sea turtles of 100 years.

Figure 2.2- This graph displays the stable stage distribution of sea turtles over 100 years, as per the data of Figure 2.1.

2a. How does the initial abundance vector affect λ?

The initial abundance vector affects λ by having the population growth rate stabilize at around 10-15 years.

2b. How does the initial abundance vector affect the stable stage distribution?

The initial abundance vector does not really seem to affect the stable stage distribution. We can see that Figure 1.2 and Figure 2.2 are very similar looking despite they had very different initial abundance vectors.

2c. How does the initial abundance vector affect λt, and the stage distribution prior to stabilization?

Since the initial vector abundance starts off with only hatchlings, we can see that before stabilization there are hardly any juveniles and adults. Then the hatchlings quickly mature, so there are more small/large juveniles and more small adults, and the numbers of hatchlings are decreasing. Since it takes a while to mature, we find that it stills takes a while for the turtles to mature so there are no new hatchlings being produced and hardly any adults. The initial abundance affects λt y having the stabilization rate occur at a quick time, in years.

2d. Do your results have any management implications?

Yes these results do have management implications. We find that there is no point in supplying only hatchlings to an environment. This population will start to fail at a faster rate and a population that is diverse in stage classes. As a management issue it is good to make sure all stage classes are surviving, or reproducing if applicable.

Figure 3.1- This graph shows the simulation of stage structure with TEDs over 100 years.

Figure 3.2- This graph shows the stable stage distribution of the sea turtles over 100 years, based on the information of graph 3.1.

3a. Describe how the use of TEDs affects the transition probabilities and the fertilities in the transition matrix?

The transition matrix is showing that as the turtles are becoming larger, the rate of the turtles being aided by the TEDs are increasing. This allows the large turtles to continue mating and reproducing. You can see this trend in Table 3.1.

3b. Compared to the baseline case, how does the use of TEDs influence population dynamics? Discuss in terms of population size, structure and growth.

TEDs influence population dynamics by allowing more mature turtles to reproduce. More hatchlings at different intervals will allow for other stages to stabilize their populations. When there are more small juveniles, large juveniles, and small adults, we can have a more stabilized population. Definitely hatchlings are more susceptible to predation, so older individuals will help the population structure. A healthy population requires good proportions of each stage class.

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| --- | --- | --- | --- | --- | --- | --- |
|  | **transitioning from->** | **h** | **sj** | **lj** | **sa** | **a** |
| **transitioning to ->** | **h** | 0 | 0 | 0 | 5.448 | 69.39 |
| **sj** | 0.675 | 0.703 | 0 | 0 | 0 |
| **lj** | 0 | 0.047 | 0.767 | 0 | 0 |
| **sa** | 0 | 0 | 0.022 | 0.765 | 0 |
| **a** | 0 | 0 | 0 | 0.068 | 0.876 |

Table 3.1- A matrix showing how the transition matrix might change if TEDs were widely installed in existing trawl nets.

Figure 4.1- This graph displays the stage structure of sea turtle fertility over 100 years.

Figure 4.2- This graph shows the stable stage distribution of sea turtle based on Figure 4.1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **transitioning from->** | **h** | **sj** | **lj** | **sa** | **a** |
| **transitioning to ->** | **h** | 0 | 0 | 0 | 50 | 80 |
| **sj** | 0.675 | 0.703 | 0 | 0 | 0 |
| **lj** | 0 | 0.047 | 0.657 | 0 | 0 |
| **sa** | 0 | 0 | 0.019 | 0.682 | 0 |
| **a** | 0 | 0 | 0 | 0.061 | 0.8091 |

Table 4.1- The transition matrix for turtle stage structure fertility.

4a. Nest protection would have to occur around the large juvenile and small adult transition. This seems where a lot of turtles are being consumed by predators. We can compare the values of Table 3.1 and Table 4.1 and we will see that the hatchling and adults will not need the same amount of conservation as the other stages. If TEDs are not used then the survival rates for the hatchlings will remain about the same. If we wanted the results to for both matrixes to be the same we would need to increase the egg survival rate times 5 so that we can achieve the same λ.

4b. Comparing both sheets I would say the TED method is better than the conservation methods. We have a higher amount of surviving adults, which can lead to more hatchlings. Essentially both Tables 3.1 and 4.1 have the same growth rate percentage but the population with TEDs starts off at almost the stabilizing number and continues to stay at that number. The population that was being conserved starts off really high and then tapers off.

Figure 5.1- This graph shows the stage structure density dependence of the sea turtles over 100 years.

Figure 5.1- This graph shows the stable stage distribution of the sea turtle population based on Table 5.1

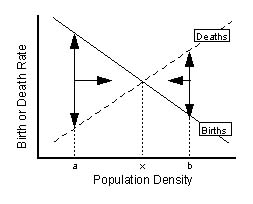


Table 5.3- Shows a standard density dependence model.

5a.

On Figure 5.3 we see that the birth rate and the death rate are increasing/decreasing simultaneously or at the same rate. This is the point where births > deaths and “growth is without bounds”. As birth rate decreases and approaches K, death rates increase. At k births= deaths and “population doesn’t change”. And as we pass K the birth rates continue to drop while the death rates continue to rise. This is where births< deaths and “decay is toward extinction. Death rates increasing is a normal instance in a population. In a linear density dependence model normally the birth rate will start off higher than the death rate. It seems as though after carrying capacity the birth rate will continue to drop, so the turtles cannot handle to gather resources or support their population size after carrying capacity.