

**Elaborate: Nest Checks**

Let’s focus on 2009, the “normal” year, when population counts showed that 33% of the active nests in July had failed by September, and 67% had succeeded. In that year, Dr. David Hyrenbach marked 31 nests in July 14th, and followed them until November 14th. Analyzing this sample of 31 nests, we can learn about the when and why nests fail: how many eggs hatch, how many chicks survive, how many chicks fledge?

The table below shows the outcome of different eggs and chicks at four snapshots over time:

* July 14: the first population census (egg laying period)
* September 14: the second population census (chick-rearing period)
* October 14: chicks are developing and start growing their wings
* November 14: chicks are ready to fledge and leave the nest

Active nests have an adult incubating a viable egg or a chick. Once the egg is lost, broken or predated the nest becomes inactive. Nests where chicks die, are predated, or disappear are also inactive. Notice that every month, the total number of nests (active plus inactive) is 31 – the number we marked in July 14. In the table below, we track the proportion of active nests out of the total we tagged at the start of the season (31).

**Table 1: Shearwater Nest Check Data (July 14 – November 15, 2009).**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **July** | **August** | **September** | **October** | **November** |
| Number of Eggs | 31 | 13 | 3 | 0 | 0 |
| Number of Chicks | 0 | 17 | 21 | 21 | 21 |
| **Total # Active Nests** | **31** | **30** | **24** | **21** | **21** |
|  |  |  |  |  |  |
| Broken Eggs | 0 | 0 | 2 | 2 | 3 |
| Predated Eggs | 0 | 1 | 2 | 2 | 3 |
| Lost Eggs | 0 | 0 | 2 | 5 | 3 |
| Dead Chicks | 0 | 0 | 1 | 1 | 1 |
| Predated Chicks | 0 | 0 | 0 | 0 | 0 |
| Lost Chicks | 0 | 0 | 0 | 0 | 0 |
| **Total # of Inactive Nests** | **0** | **1** | **7** | **10** | **10** |
|  |  |
| **% Active Nests** | 31 / 31 = 100% | 30 / 31 =  96.7% | 24 / 31 = 77.4% | 21 / 31 = 67.7% | 21 / 31 = 67.7% |
| **% Inactive Nests** | 0 / 31 =  0% | 1 / 31 = 3.3% | 7 / 31 = 22.6% | 10 / 31 = 32.3% | 10 / 31 = 32.3% |

With this information, we can calculate the proportion of successful eggs and chicks in every month:

**Table 2: Monthly proportion of successful eggs and chicks.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **July** | **August** | **September** | **October** | **November** |
| # Unhatched Eggs | 31 | 13 | 3 | 0 | 0 |
| # Hatched Eggs | 0 | 17 | 22 | 22 | 22 |
| # Dead Eggs | 0 | 1 | 6 | 9 | 9 |
| % Successful Eggs | 100% | 96.7% | 80.6% | 70.9% | 70.9% |
| # Alive Chicks | 0 | 17 | 21 | 21 | 21 |
| # Dead Chicks | 0 | 0 | 1 | 1 | 1 |
| % Successful Chicks | 0% | 100% | 95.4% | 95.4% | 95.4% |

With the information in table 1 and 2 to answer these questions below:

1. Figure out the overall success rate of eggs (proportion of eggs that successfully hatch):

The egg success rate, also called the hatching rate = 100% \* (22 hatched eggs / 31 laid eggs).

Hatching Success = 70.9 %

1. When do most eggs fail? What happens to the unhatched eggs in September?

One egg failed between July and August.

Most eggs (5) failed between August and September.

The 3 unhatched eggs in September never hatched, and also failed.

1. Figure out the overall success rate of chicks (proportion of hatched chicks that survive to November):

The chick success rate, also called the fledging rate = 100% \* (21 fledged chicks / 21 hatched eggs).

Fledging Success = 95.4 %

1. When do most chicks die? What happens to the chicks who survive to September?

One chick died between August and September.

All the chicks who survived until September, fledged in November.

1. Overall, what was the shearwater reproductive success, calculated as the proportion of the eggs laid (31) that became chicks who successfully fledged (21)? Note that this value is equal to the product of the egg success rate (%) and the chick success rate (%)

Reproductive Success = 100% \* (Chicks fledged in November / Eggs Laid in July)

= 100% \* (21 / 31) = 67.7%

= egg success rate \* chick success rate = (70.9%) \* (95.4%) = 67.7%