

Day 2 – MTH 490.433

Dying Flies

The following data is from a study on antler flies. Antler flies live on the discarded antlers of moose. In this study, 496 flies were recorded on the first day of their life. Each day, the number of remaining flies was recorded. The question is, do flies die at a constant rate, or does the rate of death change as flies get older? In other words, do flies senesce?

You can download this data set at <http://www.msu.edu/~brassilc/ELME/flies.csv>.

Day	0	1	2	3	4	5	6	7	8	9	10	11	12
alive	496	438	375	324	280	223	193	173	150	124	106	89	71

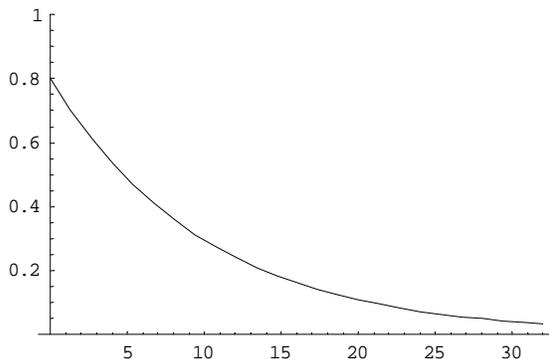
13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
61	57	49	44	38	31	28	21	16	14	10	7	7	4	3	3	3	2

Plot the data and spend some time thinking about it. I recommend a plot of the probability that flies survive from one day to the next day. This is the best way to visualize the above question.

Assume the recorded number of flies that lived from one day to the next day is the actual number of flies that lived and died in the field. The random quality in the data was due to the flies themselves living or dying.

Notice that these data are discrete. Is there a discrete distribution from above that can be applied to these data? I'll give you a hint--Each day, a fly does one of two things, lives or dies. That same outcome is repeated for each fly on each day. Another hint, the exponential decay function can be useful because it approaches zero but never becomes negative. A negative probability has little biological meaning and can send your model fit flying off into infinity.

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Plot[0.8 Exp[-0.1 i], {i, 0, 32}, PlotRange -> {0, 1}];
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Note: more analysis of this data set can be found in (Bonduriansky, R., and C.E. Brassil. 2002. Senescence: rapid and costly ageing in wild male flies. *Nature*. 420:377.) and (Bonduriansky, R., and C.E. Brassil. 2005. Reproductive ageing and sexual selection on male body size in a wild population of antler flies (*Protophila litigata*). *Journal of Evolutionary Biology*. 18:1332-1340.)