

Some Thoughts on Time- or Spatially-Varying Selectivity

Andre E. Punt

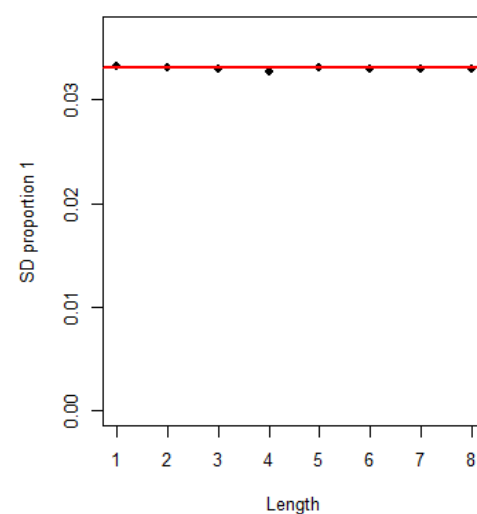
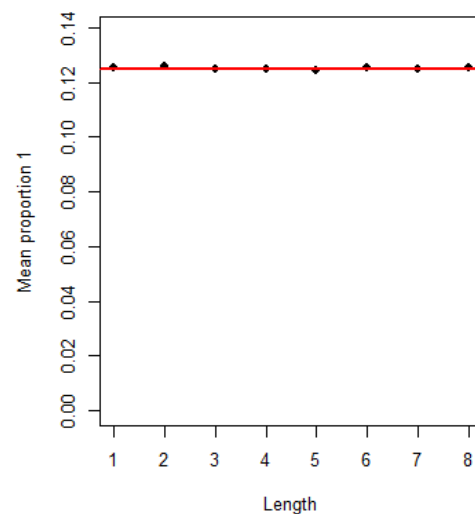
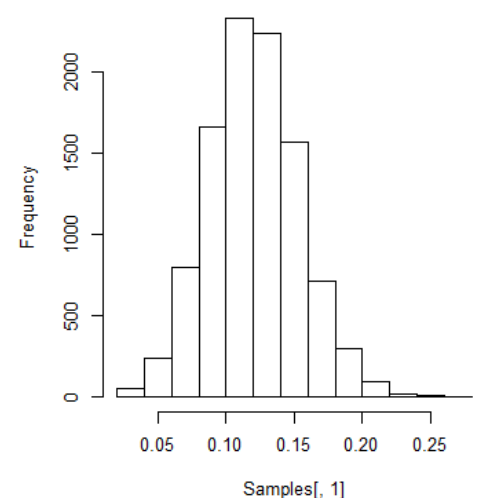
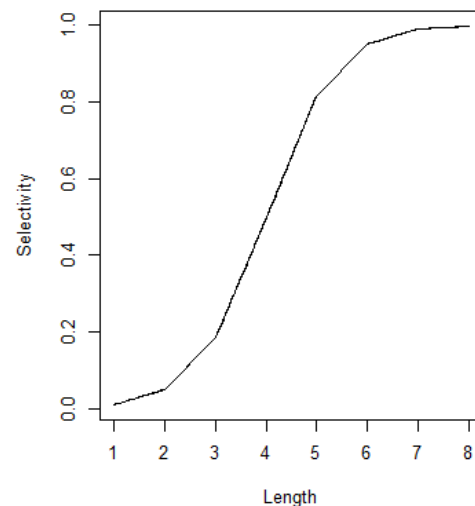
Basic Outline

- 8 “length-classes”
- Selectivity is logistic (but may be stochastic)
- Population numbers are such that Selectivity * N = Constant (0.125)
- There are 10,000 replicates (shots...), each replicate is a multinomial sample of size 100.

1: All is good

In this case, selectivity is the same for all lengths – we have a traditional binomial process.

[,]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]
0.0011	-0.0001	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
-0.0001	0.0011	-0.0002	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002
-0.0001	-0.0002	0.0011	-0.0002	-0.0002	-0.0002	-0.0002	-0.0001
-0.0002	-0.0002	-0.0002	0.0011	-0.0001	-0.0001	-0.0001	-0.0002
-0.0002	-0.0001	-0.0002	-0.0001	0.0011	-0.0002	-0.0001	-0.0002
-0.0002	-0.0002	-0.0002	-0.0001	-0.0002	0.0011	-0.0002	-0.0002
-0.0002	-0.0002	-0.0002	-0.0001	-0.0001	-0.0002	0.0011	-0.0001
-0.0002	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002	-0.0001	0.0011

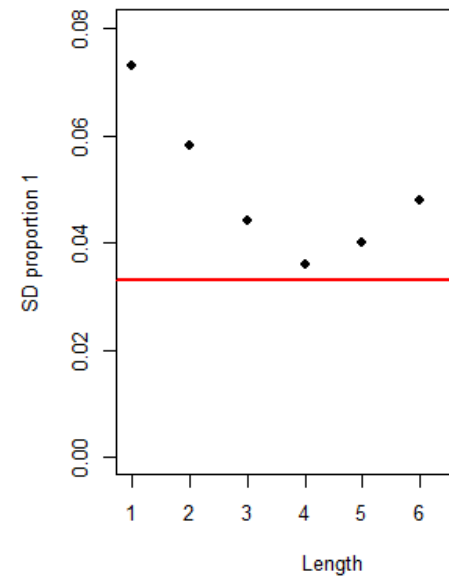
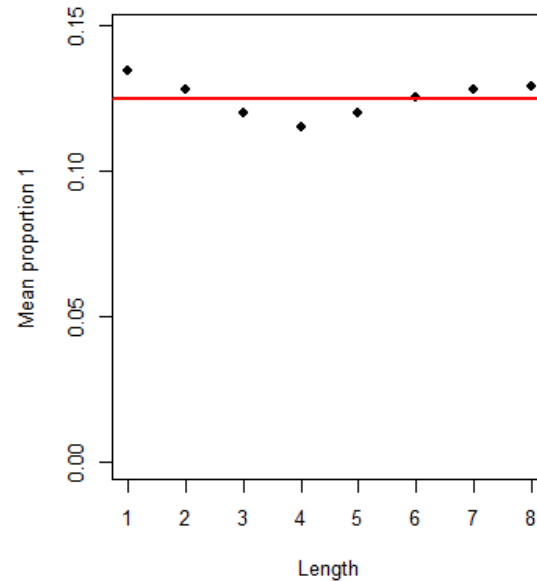
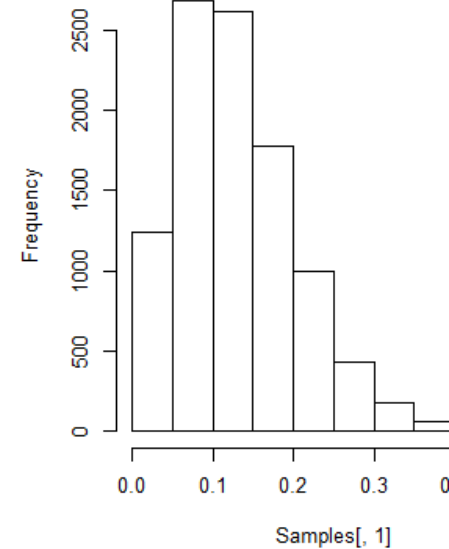
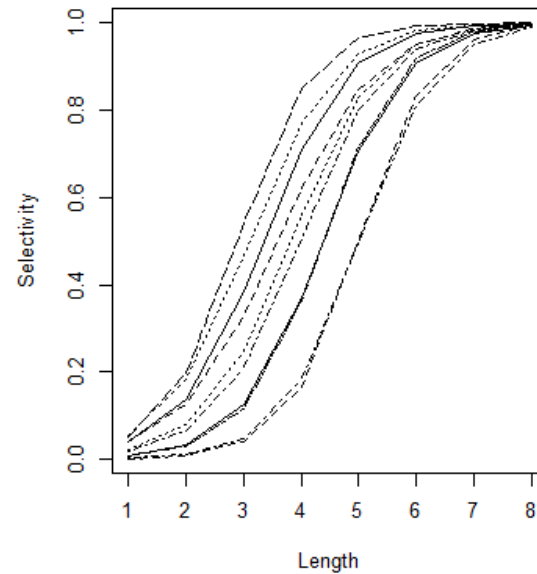


2: Time-varying selex

case, length-at-50%-selectivity is
) and the selectivity width is log-
 with mean 2 and CV 0.1

	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]
0053	0.0027	0.0012	-0.0004	-0.0016	-0.0022	-0.0024	-0.0025
0027	0.0034	0.0011	-0.0002	-0.0012	-0.0018	-0.002	-0.002
0012	0.0011	0.0019	0.0001	-0.0007	-0.0011	-0.0012	-0.0013
0004	-0.0002	0.0001	0.0013	0	-0.0002	-0.0003	-0.0003
0016	-0.0012	-0.0007	0	0.0016	0.0006	0.0006	0.0007
0022	-0.0018	-0.0011	-0.0002	0.0006	0.0023	0.0012	0.0012
0024	-0.002	-0.0012	-0.0003	0.0006	0.0012	0.0027	0.0014
0025	-0.002	-0.0013	-0.0003	0.0007	0.0012	0.0014	0.0028

s are much larger than would be
 pected under a multinomial.
 e expected proportions are
 ased".



3: Case 2 plus offset

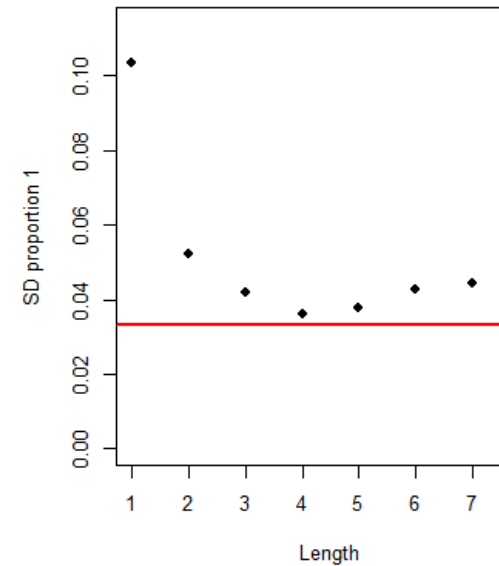
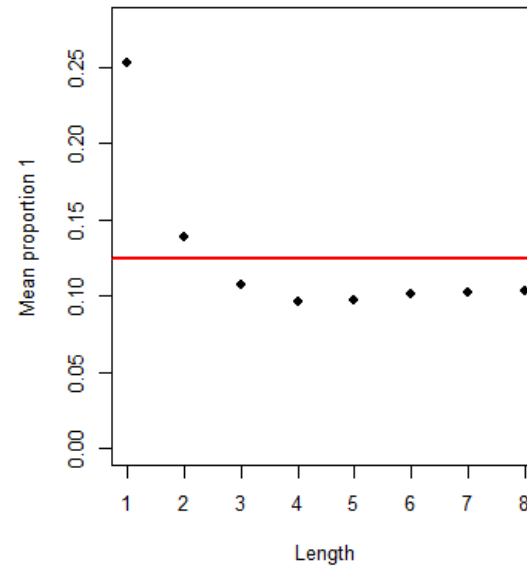
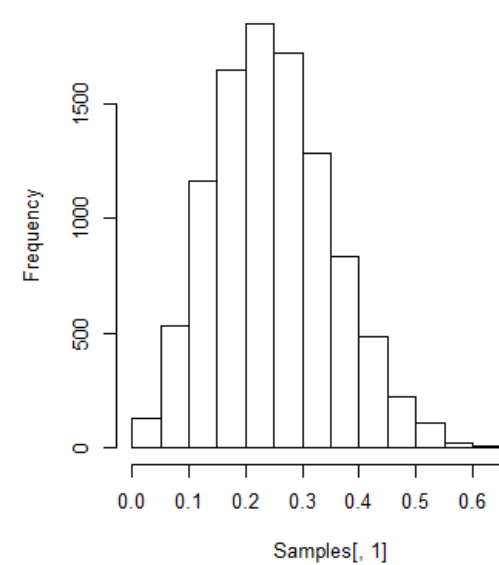
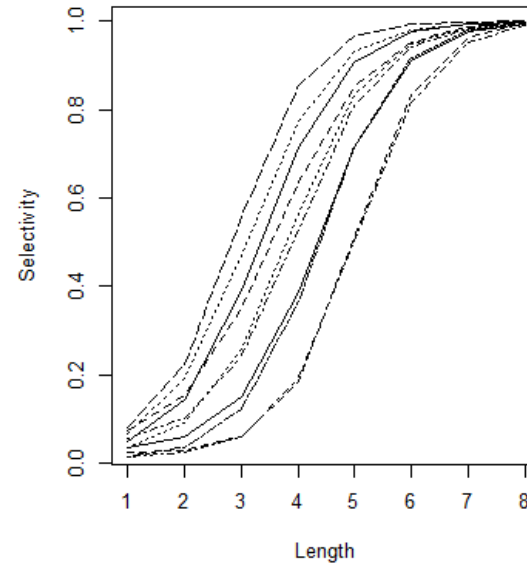
Case:

$$D + (1 - O) / (1 + \exp(-\ell \ln 19(L - L_{50}) / \delta))$$

beta distribution(1,50)

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
0.0107	0.0014	-0.0007	-0.0017	-0.0022	-0.0025	-0.0025	-0.0025
0.0014	0.0027	0.0007	-0.0002	-0.0008	-0.0012	-0.0013	-0.0013
-0.0007	0.0007	0.0018	0.0003	-0.0002	-0.0005	-0.0006	-0.0007
-0.0017	-0.0002	0.0003	0.0013	0.0002	0.0001	0	0
-0.0022	-0.0008	-0.0002	0.0002	0.0014	0.0005	0.0005	0.0006
-0.0025	-0.0012	-0.0005	0.0001	0.0005	0.0018	0.0009	0.0009
-0.0025	-0.0013	-0.0006	0	0.0005	0.0009	0.002	0.001
-0.0025	-0.0013	-0.0007	0	0.0006	0.0009	0.001	0.002

The impact of an offset is NOT symmetric
 Usually this is not very different from the base analysis



4: Offset only

Case:

$$D + (1 - O) / (1 + \exp(-\ell \ln 19(L - L_{50}) / \delta))$$

beta distribution(1,50)

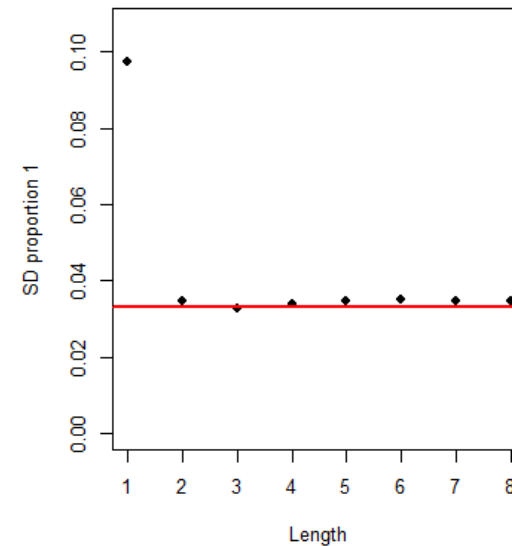
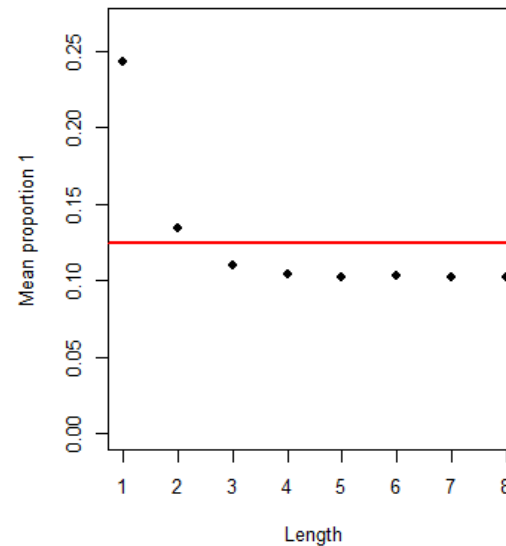
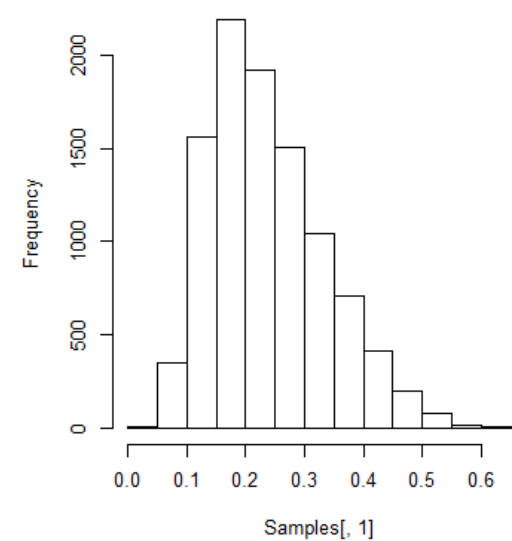
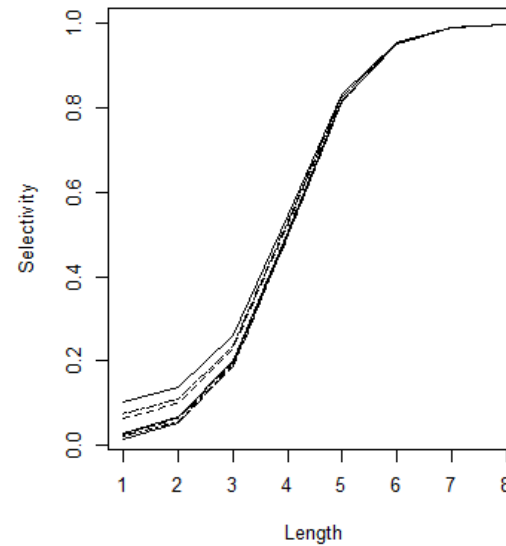
[1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]
0.0095	0.0003	-0.0013	-0.0016	-0.0017	-0.0017	-0.0017	-0.0017
0.0003	0.0012	-0.0002	-0.0002	-0.0002	-0.0003	-0.0003	-0.0003
-0.0013	-0.0002	0.0011	0	0.0001	0.0001	0.0001	0.0001
-0.0016	-0.0002	0	0.0012	0.0001	0.0001	0.0002	0.0002
-0.0017	-0.0002	0.0001	0.0001	0.0012	0.0002	0.0002	0.0002
-0.0017	-0.0003	0.0001	0.0001	0.0002	0.0012	0.0002	0.0002
-0.0017	-0.0003	0.0001	0.0002	0.0002	0.0002	0.0012	0.0002
-0.0017	-0.0003	0.0001	0.0002	0.0002	0.0002	0.0002	0.0012

The impact of an offset is NOT

symmetric

Good Luck seeing THIS difference in

selectivity..



Conclusions

Small changes in selectivity (between shots in this case, but also between years) can change:

- The expected value of proportions (especially those that are based on low selectivity and high abundance)
- The variance of the proportions is not independent of the length-class, but depends on the abundance to which the proportion relates and selectivity)

Next steps:

- We should probably consider multivariate normal likelihood functions.
- Someone (Bob) should plot the variances of the proportions from the surveys relative to that expected under a multinomial distribution (or even the robust normal for proportions).