Problem Set #1

1. Historical populations of cod were dimorphic for a trait which influence the age at which first reproduction occurred. The life tables for cod with each of these two phenotypes were:

x	l_x	m_x
1	1.00	0.00
2	0.75	1.00
3	0.50	3.00
4	0.25	4.00

x	l_x	m_x
1	1.00	0.87
2	0.75	0.67
3	0.00	0.00
4	0.00	0.00

A. During this historical period, which of these two phenotypes do you think would have predominated? Why?

Within recent history, intense fishing pressure has resulted in a significant change in the structure of cod population life tables. Specifically, selective fishing gear has greatly reduced the probability of survival for large cod in the older age classes, resulting in the two phenotypes now having the life tables shown below:

x	l_x	m_x
1	1.00	0.00
2	0.60	1.00
3	0.10	3.00
4	0.00	4.00

x	l_x	m_x
1	1.00	0.87
2	0.60	0.67
3	0.00	0.00
4	0.00	0.00

B. Which phenotype do you think will now predominate? Why?

C. What fundamental shifts in life history have been caused by fishing pressure?

D. What would have happened to the cod population had evolution and adaptation not occurred?

2. The breeder's equation can be written in any of the forms below:

$\Delta\bar{z} = G\beta$ (1a)

$\Delta\bar{z} = h^2(\bar{z}_S - \bar{z}_T)$ (1b)

$\Delta\bar{z} = h^2 Cov(z, w)$ (1c)

A. What is the relationship among these different expressions?

B. For which type of data might each be most appropriate?

3. In the lecture notes I assumed the relationship between phenotypes of parent and offspring was:

$$z^o = \bar{z}^p + h^2(z^p - \bar{z}^p) + \varepsilon$$

A. What does this imply/assume about the mode of reproduction/inheritance?

B. What if instead the relationship between phenotypes of parent and offspring is:

$$z^o = z^p + \varepsilon$$

How would evolutionary change differ? What does this assume about reproduction/inheritance?

C. What if instead:

$$z^o = \bar{z}^p + h^2\left(\frac{z_m^p + z_f^p}{2} - \bar{z}^p\right) + \varepsilon$$

How would evolutionary change differ? What does this assume about reproduction/inheritance?