Answers to Exercise 13
Reproductive Value: Matrix Models

1. A graph of the various inoculates shows that age class 1 produces the highest population size over time.

2. In this population, age class 1 has the highest reproductive value, followed by age class 2. Age classes 3 and 4 have low reproductive values. If populations are to be kept at a high level, the older age classes should be harvested because removing these individuals will have little impact on future population growth. In contrast, if you were trying to introduce an endangered species to a new habitat, you would want to introduce the younger individuals to the area, since this group will reproduce and produce the greatest increase in population growth quickly.

	I	J	K	L	M
2	**Reproductive value**				
3	Inoculate method			Transpose method	
4	**Age class**	**Final pop size**	**RV**	**RV**	**Standardized**
5	1	1.64938E+19	1	0.54594587	1
6	2	1.18204E+19	0.71665214	0.39125327	0.716652136
7	3	1.89731E+18	0.11503129	0.06280086	0.11503129
8	4	0	0	0	0

3. Remember that type I survival curves indicate high survival of young right until old age, when mortality rates suddenly become high due to senescence. A Leslie matrix of type I survivorship might look something like this:

	B	C	D	E
5	0.0	0.3	6.0	0.0
6	1.0	0.0	0.0	0.0
7	0.0	0.8	0.0	0.0
8	0.0	0.0	0.8	0.0

With this life history schedule, age class 3 has the highest reproductive value. This occurs because its current contribution to the population's growth is high compared to the other age classes, even though its future contribution (in age class 4) is 0. Be careful to make sure the population has reached a stable equilibrium before computing the reproductive values. We have assumed that the population reaches a stable distribution within 50 years, and hence used the proportions of each age class at year 50 to compute reproductive values. However, depending on the Leslie matrix entries, this might not be the case, and you may need to project your population's growth well into the future. In some cases, the population may never stabilize.

4. A Type III survival curve indicates very high mortality in the young, such as occurs in spawning fish or among tadpoles. A Leslie matrix might look like this:

	B	C	D	E
3	Leslie Matrix			
4	*1*	*2*	*3*	*4*
5	0	30	100	0
6	0	0	0	0
7	0	0	0	0
8	0	0	1	0

With this life history schedule, adults are by far the most "valuable" for population growth because the mortality rates are so high for the younger age classes. Adults have made it past the critical mortality periods and have achieved the ability to reproduce with high fertility rates.