Population isolation and Stress Tolerance in Rock Pool *Daphnia*

Yi-Fan Liao

The increasing human population and its activities change environments to be more stressful to organisms. For example, habitat disappearance and fragmentation cause small and isolated populations, which face the consequences of loss of genetic variability because of inbreeding. The loss of genetic variance may cause the fitness loss of populations. It means the adaptive potential of populations to cope with changing environments may reduce. This effect is more serious when under stressful environmental conditions. However, previous studies show variable results, one of the reasons may be that most studies were done on laboratory populations and lacking a connection to natural variances.

Daphnia are commonly called water fleas, which are a kind of small planktonic crustaceans and live in water areas. I used rock pool *Daphnia* as research species because rock pools are semi-permanent structures, thus *Daphnia* populations living in rock pools were considered as different isolated populations. Moreover, *Daphnia* are highly inbreeding species and need imported individuals to increase the genetic variability. The ability that *Daphnia* mate with imported individuals is restricted by the limitation of *Daphnia* dispersal ability (isolation distances). These two factors make *Daphnia* suitable for investigating the relationship of isolation and fitness. Thus, in this study, I used field populations of three *Daphnia* species (*D. longispina*, *D. magna*, and *D. pulex*) living in rock pools, and high salinity as a stress to investigate how habitat isolation affects the mean fitness and the population growth.

I expected that populations which are more isolated would have lower fitness under high environmental stress. I collected *Daphnia* from Ugglan, a peninsula of the island Gräsö situated at the Baltic Sea coast of Sweden, and brought *Daphnia* back to do experiments at Uppsala University. The first experiment I did was to put *Daphnia* in different salinity water to observe when the population went extinct. The second experiment was adding salt into boxes with *Daphnia* everyday and observe at which salinity level populations went extinct. Through these two experiments I can understand the tolerance and adaptability of different populations to salinity stress.

My study shows that the isolation only affected *D. manga* populations but not *D. pulex* and *D. logispina*. Instead, in general, the field salinity that populations just and/or have experienced seems more important for their adaptabilities to tolerate high salinity conditions. The result indicates that the natural environmental conditions that a population experienced strongly influence the populations' responses and increase their potential to tolerate stress.

For conservation implications, although the *Daphnia* species may partially differ in their biology to other species threatened by fragmentation, my result suggests that in not extremely inbreed populations, a "natural" variation in disturbances can be as important as increasing genetic variability to persist a population under stressful conditions. Thus, besides genetic components, the natural variation in disturbances is also important to be included when considering conservation strategies of species.

Degree project in biology, Master of Science (2 year), 2012
Examensarbete i biologi 30 hp till magisterexamen, 2012
Biology Education Centre and Department of Population and Conservation Biology, Uppsala University
Supervisor: Örjan Östman