Do tadpoles adapt to their local environment?

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Tadpoles can grow up in many different environments: in the cool forest or in a warm open field, in a safe pond or in a place full of predators, in stable waters or in a marsh that is about to dry out. The way a tadpole should grow up, for example how fast they should grow, depends on their environment. Growing fast is important to become large and strong and to transform into a frog before your pond dries out, but can also be dangerous because in order to do so you have to eat a lot which exposes you to predators. Do tadpoles use strategies that match their local environment, and can they change these if they are moved somewhere else?

I studied these questions using tadpoles of the moor frog, which came from a network of ponds close to Uppsala. The moor frog is a small brown frog which lives in many different places. In early spring, just after they come out of their winter sleep, the frogs mate and the females lay their eggs in shallow water. I collected frogspawn from six different ponds, hatched the tadpoles in the laboratory and then carried out two experiments. In the first experiment, I let the tadpoles grow up in special field cages in their own pond and in three other ponds, to see whether they grew and survived best in their own environment. Meanwhile I let tadpoles from the same, plus two extra, ponds grow up in the laboratory, to see whether there were any inborn differences in growth between the tadpoles from the different ponds. In the laboratory I also studied how the tadpoles reacted to predation risk, by letting half of them grow up in the presence of a caged dragonfly larva, a natural predator of tadpoles. At the end of the experiment I tested how well the different tadpoles survived when a predator was released with them.

There were differences in growth rate in the field and in the lab between the tadpoles which originated from different ponds. However, it did not matter in which pond the tadpoles were raised in the field experiment, indicating that the ponds were similar environments for tadpole growth. Tadpoles from one particular pond grew fastest. This could be because they were adapted to their temporary pond with few predators. Fast growth is important because the pond can dry out, and tadpoles can forage a lot because the predation risk is low. However this explanation was hard to prove, because of the limited number of ponds in my experiment and the many environmental differences between them. It is most likely that the tadpoles from this pond grew fastest because they had a later hatching date than the others and had to compensate for this delay. The importance of breeding time should therefore be a topic of future studies.

Tadpoles from all ponds reacted strongly to clues that a predator was present. The tadpoles that grew up with a caged dragonfly larva were less active, grew more slowly and had a higher survival rate when the predators were released than the tadpoles that grew up without a predator. Overall, larger tadpoles also had less chance of being eaten, indicating that growing fast can be an advantage if you can reach a safe size quickly. If a high growth rate has so many advantages, why don't all tadpoles grow fast? This is probably because there may be short-term (*e.g.* predation risk) and long-term costs of fast growth, for example for the quality of the body or for the reproduction of the frogs. Which strategy is best will depend on the habitat of the tadpoles. It is important to understand which factors promote and constrain the adaptation of tadpole growth to the local environment, to be able to protect frog populations in fragmented landscapes.

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