Salamanders brave miles of threatening terrain for the right sex partner

December 20 2016, by Misti Crane

New research from The Ohio State University shows that some mole salamanders travel six miles or more to new breeding territory. This sheds light on an evolutionary mystery and could help in future conservation efforts. Credit: Kevin Fitzsimons, Ohio State

Most salamanders are homebodies when it comes to mating. But some of

the beasts hit the road, traversing miles of rugged terrain unfit for an amphibian in pursuit of a partner from a far-away wetland.

And when those adventurers leave home, they travel an average of six miles - and as far as almost nine miles - to new breeding sites, a new study has found.

That's a long haul on four squatty legs.

The scientists who unlocked this evolutionarily important information got there by cross-referencing genetic details from salamanders in various Ohio wetlands with the distance the animals would walk on a treadmill before tiring out.

The research, published online this month in the journal *Functional Ecology*, is the work of scientists at The Ohio State University who want to better understand how and where salamanders procreate and how that fits into work to preserve the animals, including land conservation efforts.

It is a mystery what prompts a salamander to cross rocks, fields, streams and roads to mate and, in the process, mix up the genetics of another salamander outpost far from home, said lead author Robert Denton.

"It has to be incredibly intimidating for these tiny salamanders. They could get eaten by a crow or a raccoon. They could dry out," said Denton, a presidential research fellow in Ohio State's Department of Evolution, Ecology and Organismal Biology.

"This is the first study to connect physiological factors - particularly how fast they get tired of walking - with genetics showing animal movement in the field."

Understanding these connections is critical to predicting how environmental and other changes can harm species, Denton said. Dispersal - leaving the birthplace for a new habitat - is a key element of keeping a species genetically healthy, he said.

Animal travel for breeding is a complex area of research, he said. There are a lot of factors to consider, including how they decide to move, why only certain animals hit the road and how they actually complete the journey - in a series of shorter trips or all at once, for instance.

And when it comes to salamanders, things get particularly tricky.

"They live these really mysterious lives - we only see them out for a couple days in the spring. They spend most of their time just hiding," Denton said.

Furthermore, they have fragile skin that prevents insertion of any kind of tracking device.

To shed light on the mystery, the researchers looked at genetic diversity and endurance in two types of mole salamanders (part of the Ambystoma genus.) One type is all-female and reproduces by cloning and sometimes borrowing sperm that males leave behind on twigs and leaves. The other type mates in a more traditional manner.

The "sexual" salamanders walked on the treadmill an average of four times longer before reaching fatigue than their all-female counterparts. Denton and his colleagues measured fatigue as the point where the salamander didn't "right" itself within a few seconds when removed from the treadmill and placed on its back.

Prompting a salamander to walk on a miniature treadmill isn't much of a challenge, Denton said. A small pinch of the tail or poke in the behind,

and they're off at a slow, steady pace. The treadmill - borrowed from another research team - is outfitted with plastic walls that ensure the animals don't take a spill off the side, as they tend to not walk a straight line.

"They're like endurance athletes. Some of them could walk for two-plus hours straight without tiring themselves," Denton said.

"That's like a person lightly jogging for 75 miles before wearing out."

Genetic information collected in the wetlands lined up with the treadmill tests. Sexual salamanders were found approximately twice as far from their birthplace as the all-female cloning animals. The DNA analysis included testing of tissue samples from all known breeding wetlands in a salamander-rich area of rural Ohio. The researchers collected samples from the tail tips of 445 salamanders.

Differences between the all-female and sexual salamanders could have multiple explanations, Denton said.

"Maybe the best explanation for why sexual salamanders travel so far is because they have to: On a large landscape with few places to breed, the animals that can cross that distance are the ones that survive and reproduce," he said.

"Perhaps the more interesting question is why the all-female salamanders don't go very far, and we think that has to do with the physiological costs of not having sex. Essentially, not mixing up your genomic material often enough likely causes some problems for genes that you need to make energy."

In a given wetland mating area, most of the DNA samples looked alike. But there were outliers.

"We looked for the ones that stood out like sore thumbs," Denton said.

About 4 percent of salamanders were out of sync genetically, and could be linked to other wetlands where they were born, Denton said. That information allowed him and his colleagues to map the distances some of the animals traveled to mate.

"It was surprising to us that they go really long distances - four, five, six miles - from home," Denton said.

Provided by The Ohio State University