NORTHERN ILLINOIS UNIVERSITY

SEXUAL SELECTION AND THE MATING STRATEGIES OF NEW WORLD NATRICINE SNAKES

A DISSERTATION SUBMITTED TO THE GRADUATE SCHOOL
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSPHY

DEPARTMENT OF BIOLOGICAL SCIENCES

BY

THERESA L. WUSTERBARTH

DEKALB, ILLINIOS

MAY 2009

ABSTRACT

Analysis of mating systems, or numbers of mating partners per individual per breeding season, produces information regarding sexual selection and inheritance. The study of sexual selection is complex, involving both intrasexual (reproductive competition among same sex conspecifics) and intersexual selection (mate choice). This study utilized a hierarchical methodology to investigate New World natricine snake mating systems at the subfamily, population and individual levels.

At the subfamily level, microsatellite markers were utilized to identify the extent to which multiple paternity within litters occurs among species of New World natricine snakes. Seven species were selected to represent all three major clades of Natricinae, including all three subclades of the gartersnake clade. Microsatellite DNA genotyping of dams and litters belonging to seven phylogenetically widespread new world natricine species confirmed multiple paternity within litters of six species, including *Thamnophis radix*, *Thamnophis sauritus*, *Storeria dekayi*, *Storeria occipitomaculata*, *Nerodia rhombifer*, and *Regina septemvittata*. Multiple paternity was not evident in a litter of nine *Thamnophis melanogaster*. These results confirmed the widespread occurrence of multiple paternity among New World natricines in all three clades.

At the population level, DNA microsatellite markers were used to reveal details of the mating system of a plains gartersnake (*T. radix*) population at a site in DeKalb County, Illinois. A total of 12 wild-caught dams producing 21 litters were genotyped at six loci, and multiple paternity was documented in 17 of the 21 litters (81%). Paternity skew in multiply sired litters ranged from 38.7 to 96.3 %. Litters exhibiting multiple paternity were significantly larger than litters exhibiting single paternity. There were no significant differences in proportion of stillborn offspring, neonate mass, neonate snout-vent length, dam post-partum mass or dam post-partum snout-vent length between multiply sired litters and singly sired litters. Annual sperm carryover

was possibly responsible for multiple paternity within two litters. Polyandry within the DeKalb *T. radix* population was most likely due to intersexual conflict rather than genetic incompatibility. There was no evidence for inbreeding and minimal evidence for outbreeding within this population.

At the individual level, *Thamnophis butleri* (Butler's gartersnake) and *T. radix* sperm cells were analyzed for morphological characteristics and abnormalities. In both species, sperm head length, nucleus length, midpiece length, tail length and total length were variable among males. There was no species effect on these sperm characteristics, which is notable because *T. butleri* and *T. radix* are known to hybridize in nature. Both *T. butleri* and *T. radix* exhibited primary, secondary and tertiary sperm defects. There were significant differences in the frequency of sperm abnormalities among males in both *T. butleri* and *T. radix* individuals.

This is the first study to analyze New World natricine multiple paternity in a phylogenetic context and one of only a few such studies involving reptiles, which represent nearly one-third of all tetrapods.