

GENETIC AND DISEASE MANAGEMENT OF SMALL POPULATIONS: QUESTIONS AND DISCUSSIONS

Moderator: Kent Prior

Rich Seigel - Lisle, can you clarify the time scale for the development of these genetic differences you found?

Lisle Gibbs - Mutation rate is about 10^{-4} , so you're talking thousands of years there. But I don't think mutation has a lot to do with the differences you see... I think it has a lot to do with drift. That's why I say that these differences have likely taken a substantial amount of time to arise, probably longer than humans have had a significant impact on the environment. Three hundred years is really a fraction of what we're talking about.

Rich Seigel - Following what was said before about translocation... the immediate impression I would get from this is that if this is true on a wide scale, then translocations are a bad idea... unless you feel that mixing genetically doesn't matter.

Lisle Gibbs - Well, that's the point. It could be that these are just differences that arise from drift and they really don't matter in any sense, because these are neutral genetic markers; they're junk DNA, they don't code for anything. If that's the case then translocation shouldn't matter in the genetic sense. On the other hand, if they actually reflect functional differences between the populations in traits that I haven't actually measured but that will matter to the snake, then yes it would matter significantly.

Rich Seigel - But since we don't know that...

Lisle Gibbs - So maybe we should be conservative and assume the second.

Rich Seigel - Right. Until we have reason to think that they are neutral, and since we know the genetic differentiation is there, I guess my argument would be that that should make us very conservative about moving things until we know what it is we're doing.

Lisle Gibbs - But I think also in the data that Bob Johnson has collected on mortality in translocated snakes, whether or not these differences are there, there may in fact be some sort of behavioural adaptation that goes on in which animals learn an area, and if you pull them out of that area they're not going to know where to go, say to hibernate. It might have nothing to do

with genetics but there might be other reasons why snakes become familiar with an area, and so translocation might be a bad idea independent of what the genetics are. So there's two reason why not to do it.

Bruce Kingsbury - Do you think that even though these genes are neutral, could the variance that you see in different sites be correlated with differences that are not neutral?

Lisle Gibbs - Well, that's the question, and if I had given this talk twenty years ago that would have been number one on my list of what genetics can do for conservation. But I think people are shying away from that, because in general people have no idea about how variations in neutral markers correlate to actual functional variations in things that matter to the animals. Sometimes it does, sometimes it doesn't... and so essentially conservation has backed away from that. I can tell you that levels of variation are quite high in these populations, they're not genetically depauperate, but there's no consensus over what relationship we should find. What we need to do is look for variation in traits that matter, and that's something that will happen in probably about ten years, but we certainly can't do that yet. That's why I would like to look at other surrogate things like variations in ethology or whatever else will matter to a snake, and that we can measure on an empirical basis.

Bob Johnson - Can panmixis be achieved through the migration of one individual per ten generations... is that accurate?

Lisle Gibbs - It's one individual for each generation.

Bob Johnson - So given the mobility of the individuals in Killbear for example, can you explain why you wouldn't see that?

Lisle Gibbs - They may move, but what I'm showing is the actual mixing of the gene pool. So they may move, and they may in fact interact, but if they don't actually breed and those young don't actually successfully recruit to the population, then you can get this difference. So there may be a real difference in terms of behavioural dispersal of the animals, they may be mixing all over the place during the summer, but when it

actually comes to choosing a mate and reproducing, for whatever reason there doesn't seem to be any mixing occurring. The best explanation at present is that there seems to be some sort of isolation. Again, I find it amazing, but there it is.

Kent Prior - Could it also just be different survivorship as well? There could be mating that takes place that doesn't actually accomplish anything... what does the behavioural data say about these two samples? Is there enough known about their movements to say that they are mixing or that they're relatively isolated?

Chris Parent - They are almost completely isolated and I think that what's happening is that you're dealing with a relatively small population size to begin with, so unlike some of the adders where we have two or three males arriving at a female and the female waiting to mate with one, we've never seen that at Killbear, we've never seen two or three males arriving to mate with a female. We have limited numbers and a low density to begin with. The other thing you have with this population is that both the hibernation sites and the rookery sites act as anchor points. The snakes show high site fidelity to hibernation sites, so that hibernation site acts as an anchor point for the behaviour of the snake. They do disperse away from the hibernation site during the summer, and at about mating time they're about as far away from that hibernation site as they're going to be - but they eventually have to return to it. That limits how far they'll actually disperse because at some point they have to start returning to that hibernation site. So there's this constant pull back towards the hibernation site away from the periphery of the population. You may actually have an individual from the Blind Bay population move further than most snakes and actually enter into the Twin Points population, but unless there's another snake of the opposite sex that's receptive to mating in that area at the exact same time, you're not going to get mating between the two populations. That's compounded by the fact that there's now a road running down the middle of the park, and every year two or three snakes end up being hit on that road. So there's a human impact as well.

Bruce Kingsbury - Can someone comment on any experience with road crossings of telemetred snakes? My impressions from what I've done so far is that it acts as a barrier.. does anyone else feel the same way or not?

Rich Seigel - A complete barrier?

Bruce Kingsbury - A relatively complete barrier to them, so they're not even crossing the road.

Chris Parent - We have some evidence of our transmitter-equipped snakes hitting the edge of a road and then skirting the edge for a distance. But our snakes regularly cross roads, and in fact for every year of telemetry we've had at least one road crossing fatality. Similar to Goran Nilson's situation on Milos, we've also identified these 'snake crossing areas' where we get high levels of mortality. They're not quite as narrow as what has been identified on Milos, but they're 100 to 200 metre areas where snakes regularly cross back and forth. You can actually map road mortalities of snakes in the park and it's quite clear where it happens.

[UNKNOWN] - I've had telemetred snakes crossing roads too, and it didn't appear to be a barrier... they cross the road at the same point in successive years, using the same area to cross.

Rob Willson - I've seen many come out onto roads... they will cross roads to go to certain habitats, some of the park's areas... One of these times one of the females came out onto the road, we went to try and find the female and found a male crossing the road as well... we followed her along the road, and she was meandering across the road... during that time period about 15 cars came by and there's no possible way they would have survived if we hadn't been there. And also, when the telemetred snakes do cross the road, they cross one year and then the next... that's where they do seem to get hit. It seems like there's not a very high success rate for road crossings. But they do seem to stop at the side of the road and look for bit, but once they decide to go, they're so slow at crossing roads that once you get those 15 cars coming they're going to get run over.

Chris Parent - Rob, the one snake you were telling me about that took up to 5 minutes to cross the road, and during that time I think you said you saw 8 cars... so had you not been there that snake would almost certainly have been hit.

Rob Willson - Yes..they don't dart across the road... they meander across stealthily. If it's on a corner I find that's where they get run over more often than on a straightaway, in the park anyway. In other locations it might be straightaways where they get run over more often.

Rich Seigel - One comment to further complicate things... in Missouri snakes used to cross one road routinely and got hit with very high frequency, but since the flood they don't do it anymore - you no longer see massasaugas crossing the road. And I really have no explanation for that.

Ron Black -Do they still occupy habitat adjacent to the roads?

Rich Seigel - 20 metres... the only ones you'll see crossing the roads are neonates... we've seen two adults in two years crossing the road, and that's out of 370 total captures, 20 adults out there.

Rob Willson - Can capture myopathy cause death?

Kay Mehren - I have not heard of it... that doesn't mean it doesn't exist. Capture myopathy is usually associated with overheating and severe overexertion.... reptiles can certainly put up a fight, but I can't imagine that that would be a major concern. It is something that should be minimized as much as possible.

Rob Willson - Have you heard anything about an injectable anaesthetic called Propofol?

Kay Mehren - Yes, I have worked with it here. We know when we use it in mammals it is extremely fast, and if you're good at hitting a vein and keeping it long enough to do the injection it should be quite effective. It does have some rather strong physiological effects in mammals, and I really don't know how that compares with what is experienced by reptiles, whether it may be severe respiratory depression, there may be cardiac depression as well. The snake is probably quite capable of going for a while without breath; it does give better relaxation and it's much more trustworthy.