PANEL 2

PANEL DISCUSSION (ASHLEY, GIBBS, HOLSINGER, LACY)

Don Melnick: I'm going to ask that the speakers for this session take their seats as quickly as possible, so that we can maximize the amount of time we have for questions.... (Pause)

Okay. One of the genes that's been lost in the New York City population is the gene for shyness. So I hope we won't see too much reticence in asking questions. That's why we have the panel here. I hope you will feel free to pepper them with the most difficult questions you can possibly imagine. Who wants to start it off? Okay, we have a question here.

Question: [Inaudible.]

DM: Did everyone hear that question? Yes? Okay. I think it was probably directed to James—that'll be my guess.

James Gibbs: Okay, yes.... In truth, I think those species may be pushed to the margins of their former ranges. I agree with you entirely. What is the original range, and how you define that, all depends on when you want to start history. And I know in this part of the world, even turtles, for example, seem to have been moved around a huge amount by Native Americans—and what is a natural range?

But from my reading of Lomalino's work, they may be pushed to the margins of their ranges, but they're not being pushed to the better habitats. There actually are species that do better in the center—in their core ranges—in terms of just habitat quality. But they're pushed up into more arid areas, higher-elevation areas. Just simply because that's the land that humans have yet to co-opt, or just haven't gotten there yet. So it's not that they're going to the better habitat—they're just going to what's left.

DM: Do we have another question?... Ah, in the back.

Q: ____________________.

DM: My guess is that that's addressed to Bob Lacy.

Robert Lacy: Theoretically, at least, by subdividing the captive population into separate units, you can do some nice things, as you said. You can reduce genetic drift; you can reduce the effects of selection. In practice, there are some problems that make me cautious about suggesting that approach. One is that the theory only works if you make the assumption that none of the subpopulations ever disappear on you. If you have any risk that the subpopulations will go extinct—because they are in smaller numbers, and having genetic problems of their own—then the whole theory collapses, and subdividing a population can be disastrous in terms of maintaining diversity.

It's also the case that most of the theory for how you can better maintain diversity in a subdivided population not only assumes that a subdivided population has no loss of its components, but that every subpopulation is fixed in size. There's no random fluctuation in size. When, in fact, once you subdivide, you expect higher fluctuation in size, due to just stochastic properties. And that in itself can contribute to your problems.

So it can, under some circumstances, lead to better retention and diversity. It can also cause massive collapse in genetic diversity. So you have to be really cautious about how you apply that approach.

DM: Another question.... I think I see one, all the way in the back again.

Q: [Inaudible.]

RL: The short answer is: People haven't looked much. We think those things are going on. Very few studies have been done to look at the physiological, morphological, or anatomical changes taking place in captivity. And of those studies that have been done, very rarely do they separate genetic effects from environmental effects.

For example, in many mammals you get changes in gut morphology due to changes in diet even within a generation, so it's clearly not genetic. But we need a lot more studies. I don't think we know yet how much it's a problem.

Kent Holsinger: There is at least one example I can think of—not from a zoo animal that we would be interested in, but from drosophila. Alan Templeton has, for many years, studied Hawaiian drosophila and maintained colonies of Hawaiian drosophila in his laboratory at Washington University. As a result of that, he has sort of standard protocols for how he raises drosophila—numbers of days between generations, and so on.

And he realized, at one point, about ten years ago, with one strain that he'd been maintaining, that in fact he seemed to be rushing their generation time, relative to what it was in nature. And in fact, when he looked more carefully, he found that he had inadvertently selected for rapid maturation in these lines he's been maintaining in the laboratory.

And I think it's just sort of a cautionary note—that when we're maintaining things in captivity, we may inadvertently be applying selection in a direction that's different from what it would receive in nature.

DM: There was another question, I think, from the middle?...

Q: [Inaudible.]

KH: My suspicion is that it differs between plants and animals. I'll be interested to see what some of the people who work with animals say. But in the plant-recovery plans I've reviewed, there's very little attention to genetics. Except to the extent that they may look at the breeding system—determine whether it's self-incompatible or not. In point of fact, I think, for most plant populations, that's not inappropriate—because the primary threats to their continued persistence are, in fact, demographic.

DM: Does anyone else want to add to that?

RL: Briefly. I think there is a bit more attention from the animal side. Although perhaps only because the most high-profile endangered species, once they get depressed, are the ones that are down to, you know, five and ten and twenty animals, where you're in a genetic crisis, as well as a demographic crisis. For the things that are still in a bit better shape-- hundreds of animals--there's been relatively little attention to genetics, because you don't have this fear of inbreeding effects. But that also means that no one's paying attention to the other genetic problems, such as was referred to in the last talk—or changes in adaptation, or other effects such as that.

DM: Anyone else want to add to this? No? Yes?

Mary Ashley: Well, I guess I'll put in a plug for Bob here. In population-viability analysis, his Programmed Vortex does consider —

DM: You have to bring it close.

MA: Bob's Vortex program, which is quite widely used in population-viability analysis, does incorporate both demographic and genetic considerations. So that's certainly a step in the right direction.

DM: Yes.

MA: [Inaudible.]

DM: Right. I guess if you think of government agencies as voting with their pocketbook, more and more money seems to be devoted to this, in agencies you wouldn't necessarily imagine doing it. Like the U.S. Fish and Wildlife Service and other groups like that are devoting more and more money to supporting genetic studies. So one imagines it is gaining greater attention in establishing policy.

Another question?... There's one right on the aisle there.

Q: [Inaudible.]

DM: I have to repeat the question, as it turns out. I think the question really is: For each particular species, or in general, what are the numbers below which a particular species, or other unit, is genetically in danger of losing its genetic variation?

RL: Well, instead of giving numbers, I'd actually take off from the last statement you made—it depends on the particular species and situation. I think what needs to be assessed in each case is: At what point do the genetic changes taking place interact with habitat changes, demographic changes, or other threats to contribute to the probability of decline, or the difficulty in recovery.

There's been some unfortunate debates about: Is the species in danger because of genetic or because of whatever—or because of something else? When, in fact, most of the factors are interactive. So you need to know when the genetics is starting to depress fecundity, and depressed fecundity is also resulting from habitat changes, where the genetics is preventing adaptation to modified habitats. It's a much more complicated situation.

I would certainly agree that, once you get down below, say, a hundred, even trivial things like—well, not trivial—but simple things like inbreeding depression can start to hit you. But even at much larger sizes, there can be interactions that are pretty nasty.

KH: Yes. And I actually think there's a second thing implicit in your question that didn't quite come out, but I would like to bring out. And that is, it should be clear that we should have much greater concern about populations which we know are declining, as opposed to those that have always been rare. Because those are very different situations. For those that are declining, we have evidence that they are having trouble and may continue to decline. Those that have always been rare, if they continue to exist, is prima facie evidence that they actually can deal with whatever the problems of life in small populations are.

DM: Another question. I saw hands ... right here.

Q: [Inaudible.]

JG: It depends on the organism. And I think something that's fairly mobile—that is basically reacting to the assaults, and is sort of moving away from it—is the case in, for example, some primates. We can actually get a situation where the final, last population is an amalgamation of not the entire species range, but many different populations. Others, that are poor dispersers, poor adapters—amphibians, plants—as the encroachment occurs, the populations are just snuffed out.

So I think that when you get down to those last two or three, those are the original of those particular sites. And you don't actually have any kind of larger gene pool represented there. So I think it depends, again, on the species—and especially dispersal abilities and mobility.

DM: Okay. We have time for one more question. Yes.

Q: [Inaudible.]

DM: Let me repeat that question. The question was: When these ranges collapse, do they always collapse to a single population? Or do they collapse to a number of populations that are out, even if on the periphery? And if those are genetically divergent from one another, do we know that, number one? And, number two, are we doing things to try to move— I assume you mean move animals or plants around, in order to, in a sense, "fool" nature, and simulate the gene flow that might once have existed.

RL: We could get Steve back up again. But one example is the Florida panthers, where the Florida panther population is just the corner of North America that still had the pumas that we shot out of the rest of eastern North America. And it had become genetically divergent and inbred. And the translocation to restore gene flow between populations that were isolated by people seems to have been very successful, although it's still a work in progress.

I worry more about some other cases, where we see remnant populations that now show genetic divergence. And sometimes, because they show genetic divergence, we rush in to make sure they don't mix because we wouldn't want to cross populations that are divergent. And in those cases we may actually be reinforcing the damage we already did.

There were proponents, for example, that we should never mix Florida panthers with Texas pumas, because they show some genetic differences. I think those genetic differences were human-caused and it's therefore appropriate to reverse those effects.

DM: If I could just add a little bit to that. One of the maps that James showed was the range of the Javan rhino. And of course the Javan rhino may be the most endangered large mammal. There are probably only 65 or so left in the wild—70 in the wild.

There are two populations. They are in different parts of the range, as he showed in his map. They're genetically very different from one another. But I think, right now, the problem is that, even conserving the animals that are in the places that they are, where they are, is extremely difficult. And the notion of moving them from one place to another at the moment seems almost impossible. And unless we can protect animals where they currently live, moving other animals into those areas doesn't seem like it's going to have, necessarily, a very positive impact.

And on that note I want to thank you, because you did ask some very great questions. But we do have to stop.

(Applause)