GENETICS OF NORTHERN WOLF POPULATIONS: SUMMARY

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Genetics of Northern Wolf Populations

A DNA Study by: L.E. Carmichael, J. Krizan, J.A. Nagy, M. Dumond, D. Johnson, A. Veitch, and C. Strobeck

Introduction

Grey wolves have lived in Canada's boreal forest, mainland barren-ground tundra and the arctic islands for thousands of years. Because these environments are very different, wolves have developed different strategies for living in them. Tundra and island wolves tend to have lighter fur than forest wolves, probably so they can hide from prey while hunting in the snow. Tundra and forest wolves also have different behaviours because they use different kinds of prey. Forest wolves hunting moose and deer use the same territory all year round; tundra wolves eating barren-ground caribou have to migrate to stay close to their moving food supply. Wolves on arctic islands tend to be more territorial, like forest wolves, but like tundra wolves, island wolves can move to other places (and cross sea ice) when prey populations near their home ranges start to decline.

Objectives

Wolf furs are a valuable source of income for many northern residents. Genetic analysis using wolf DNA can help us understand how wolves move between populations, so we can develop better management plans. This is especially important for island wolves, which have smaller populations and may be isolated from mainland wolves, increasing their chance of extinction. The major goals of this project were to find out 1) how prey influences the way wolves move, 2) whether island wolves are as healthy as mainland wolves and 3) how island wolves are related to mainland wolves. We did this by comparing the DNA of wolves from different areas.

Methods

We asked hunters from communities in the Northwest Territories and Nunavut to give us skulls, small pieces of fur, or meat from wolves they had harvested. Extra samples were collected from museums, fur auctions, and other research projects. Certain pieces of DNA have different sizes in different individuals; we compared the sizes of fourteen different pieces for each wolf collected. Then we combined the results for all wolves in each area, and checked whether different areas had different DNA.

Results

The DNA of different tundra wolf populations was more similar than the DNA of different forest wolf populations. This probably occurs because tundra wolves travel over greater distances in search of prey, and therefore mix their DNA over larger areas. We also found differences between the DNA of wolves living in the forest and the DNA of wolves living in the tundra. This suggests that adult wolves prefer to live in habitats similar to the one where they were born. Wolves probably use two different signals to help them recognize the "right" habitat: vegetation cover (tundra versus forest), and

whether they encounter prey types they have already learned how to hunt (migratory caribou versus non-migratory species like deer and moose). Since tundra and forest wolves also tend to differ in fur colour, it's possible they use these differences to help them find mates who like the same kinds of habitat.

Arctic island wolves had less genetic variation (fewer sizes per DNA piece) than wolves living in large mainland populations. Banks Island and High Arctic wolves (Ellesmere and Devon Islands) had the least variation of all, because both of these populations lost DNA types during previous population declines (on Banks Island due to wolf control in the 1950s, in the High Arctic due to collapse of prey populations early this century). Wolves on Banks Island, Victoria Island, the High Arctic, and Baffin Island all had similar DNA, so migration between islands is probably common. Island wolves probably migrate for two reasons: when prey disappears on their home island, or when food is plentiful but there aren't enough denning sites for all the wolves. This second reason might explain why lots of wolves are moving from Banks Island to Victoria Island, but few are going the other way.

Arctic island wolves were also very different from wolves on the mainland, suggesting that migration and mixing of DNA between these groups is relatively rare. However, some island-mainland migration does occur, through Baffin Island in the east and through Victoria Island in the West. Wolves probably move between Victoria Island and the mainland while following the migration of the Dolphin-Union caribou herd.

Implications and Future Research

Our results show that mainland wolf populations are healthy and should be able to survive for a long time. However, the treeline is moving northwards as the climate warms, and eventually, there may be no more tundra on the mainland. If this occurs, there could be no habitat differences for wolves to recognize, and differences between mainland wolf populations could also disappear.

Climate change may also affect wolves on the arctic islands. Prey species in the High Arctic may have declined in part due to deep winter snow, and similar events in the future may again result in decline of wolf populations. Island wolves already have less variation than mainland wolves, which means they could be less able to adapt to changes in their environment. Migration of mainland wolves into the arctic islands introduces new DNA, helping to keep island wolves healthy. If sea ice disappears and this exchange of DNA can't happen, island wolves could have a higher risk of going extinct. In the western arctic, human activity in the Northwest Passage could be restricted in months when the Dolphin-Union caribou migrate, so that wolves can migrate too.

For this study, we examined fourteen pieces of DNA that don't directly affect the appearance or behavior of wolves. If we could look at a greater number of pieces, we might find ones that control things like coat colour in wolves. This could help us understand the ways wolves change to deal with changes in their environment.