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Phylogeography and Conservation in a Nutshell

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Introduction

Phylogeography is the study of historical processes that may be responsible for the geographic distributions of genealogical lineages from the past to the present. This is done by taking into account the geographic distribution of people in light of genetics, particularly population genetics. This phrase was coined to explain genetic signals that are regionally structured both within and between species. Phylogeography differs from traditional population genetics and phylogenetics in that it focuses explicitly on a species' biogeography/ biogeographical past. In the absence of clear geographic constraints, climate, behaviour, ecology, and oceanography shape patterns of biodiversity in marine faunas. Marine turtles are migratory animals with deep evolutionary lineages and complex life cycles that span both terrestrial and marine settings. The Mitochondrial DNA Bridge between Population Genetics and Systematics, by John Avise, was the first publication to use the term phylogeography.

Description

Background

Historical biogeography is a multidisciplinary field that studies how historical, geological, climatic, and ecological factors influenced species distribution in the past and present. Researchers had been assessing the geographical and evolutionary links of organisms for years as part of historical biogeography. The expansion of cladistic thought and the development of plate tectonics theory were two major advances in the 1960s and 1970s that laid the framework for current phylogeography. The vicariance biogeography school of thought emerged as a result, explaining the formation of new lineages through geological processes such as continent drifting apart or the emergence of new species. The narrative character of early phylogeographic work has recently been critiqued for its lack of statistical rigour (i.e. it did not statistically test alternative hypotheses). Alan Templeton's Nested Clade Analysis, which used an inference key to determine the validity of a particular process in explaining the concordance between geographic distance and genetic relatedness, was the sole real method. Recent approaches to phylogeography have taken a more statistical approach than was previously used. Phylogeography examines biogeography from the perspectives of population genetics and phylogenetics. Population genetic studies shifted to mitochondrial markers in the mid-1970s. The development of phylogeography was aided by the invention of the Polymerase Chain Reaction (PCR), a method for replicating millions of copies of a DNA sequence.

Phylogeography preservation

Phylogeography can assist in the prioritisation of high-value conservation sites. Phylogeographic analyses have also been useful in defining Evolutionarily Significant Units (ESUs), which are conservation units below the species level that are based on geographic distribution and mitochondrial genetic patterns. A recent study on endangered cave crayfish in eastern North America's Appalachian Mountains demonstrates how phylogenetic analysis combined with regional distribution can help identify conservation priorities. The authors discovered an old and previously unknown species hiding within what was assumed to be a single, widely spread species using phylogeographical methodologies. Conservation decisions can now be made to safeguard the survival of both lineages. Phylogeography also provides historical context for community makeup. In two ways, history is relevant to regional and local variety. For starters, the regional species pool's size and composition are determined by the balance between speciation and extinction. Two, the interaction between local extinction of species populations and recolonization influences community composition at a local level. Regional patterns of species distribution and diversity in the Australian Wet Tropics are mostly driven by local extinctions and subsequent recolonizations matching to climate cycles, according to a comparative phylogenetic approach [1-5].

Conclusion

Phylogeography combines biogeography and genetics to investigate the lineal history of a species in relation to the planet's geoclimatic history. Phylogeography has also been valuable in deciphering the origins and distribution tendencies of Homo sapiens, our own species. Anthropologists proposed two competing hypotheses about human origins based primarily on observations of ancient human skeletal remains and age estimates. Because of their quick mutation rate and short generation period, viruses are useful in studying the processes of evolutionary change. Understanding the origins and spread of distinct viral strains can be done using phylogeography. Many illnesses that concern human health, such as dengue fever, rabies, influenza, and HIV, have been studied using a phylogeographic method.

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