# Migration of Eastern North American monarch butterflies via the South-east and the Atlantic: evidence from stable isotopes, thin layer chromatography, DNA and phenotype

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#### Abstract

Monarch butterflies, Danaus plexippus (L.), from eastern North America are well known for their incredible autumn migration to Mexico; however, not all monarchs follow this route. There is evidence of monarchs overwintering and reproducing in Florida, arriving to insular and continental Caribbean, and roosting by the thousands in the Yucatán, Mexico. This work aims to present evidence that these monarchs are part of two current migratory routes, that we consider as the south-eastern and the Atlantic routes, routes that were probably more prominent in the past. Monarchs were collected for 12 months in south Florida, for 4 years in Cuba in November and once in March, in the Yucatán and Guatemala at different times, and once in northern Venezuela. We used two independent techniques, stable hydrogen isotope (6°H) analyses of the wings and/or thin layer chromatography (TLC), to trace the monarch's natal grounds. We analysed the DNA of monarchs collected in St. Marks in the Florida Panhandle, Cuba and Guatemala, and compared those data against previously-

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area of research There are lots of new articles and many of the articles that appeared in the first edition have been updated to reflect advances in knowledge since 2006 when the original articles were written The second edition will contain about 375 articles written by leading experts around the world This major reference work is richly illustrated with more than 3 000 illustrations most of them in colour Research in the Quaternary sciences has advanced greatly in the last 10 years especially since topics like global climate change geologic hazards and soil erosion were put high on the political agenda This second edition builds upon its award winning predecessor to provide the reader assured quality along with essential updated coverage Contains 357 broad ranging articles 4310 pages written at a level that allows undergraduate students to understand the material while providing active researchers with a ready reference resource for information in the field Facilitates teaching and learning The first edition was regarded by many as the most significant single overview of Quaternary science ever yet Editor in Chief Scott Elias has managed to surpass that in this second edition by securing even more expert reviews whilst retaining his renowned editorial consistency that enables readers to navigates seamlessly from Hearings, Reports and Prints of the House Committee on Interstate and Foreign one unfamiliar topic to the next **Commerce** United States. Congress. House. Committee on Interstate and Foreign Commerce, 1967 Gaither's Dictionary of Scientific Quotations Carl C. Gaither, Alma E. Cavazos-Gaither, 2012-01-04 This unprecedented collection of 27 000 quotations is the most comprehensive and carefully researched of its kind covering all fields of science and mathematics With this vast compendium you can readily conceptualize and embrace the written images of scientists laymen politicians novelists playwrights and poets about humankind s scientific achievements Approximately 9000 high quality entries have been added to this new edition to provide a rich selection of quotations for the student the educator and the scientist who would like to introduce a presentation with a relevant quotation that provides perspective and historical background on his subject Gaither's Dictionary of Scientific Quotations Second Edition provides the finest reference source of science quotations for all audiences The new edition adds greater depth to the number of quotations in the various thematic arrangements and also provides new thematic categories The Energy Industry, Organization and Public Policy Some Things Considered Bryan W Ball, 2024-11-28 In Some Things Considered Bryan Ball offers his readers a .1974 unique selection of distinctive essays on topics of theological and historical significance Designed as stand alone essays across the volume Ball nevertheless explores the core beliefs fundamental to Christianity and key principles of biblical interpretation allowing readers to come to his later chapters with a thorough grounding in biblical theology and interpretation Ball then explores a variety of topics from the geological and geophysical evidence of the Genesis Flood to the seventeenth century controversy about the Sabbath day Honing in on oft misunderstood verses such as Daniel 8 14 and Genesis 1 16 he offers nuanced interpretations He culminates the collection with a discussion of the biblical context surrounding the The Decline of the West Taxonomy of Australian Mammals Stephen Matthew Jackson, Stephen

Jackson, Colin Groves, 2015-06-16 Taxonomy of Australian Mammals utilises the latest morphometric and genetic research to develop the most up to date and comprehensive revision of the taxonomy of Australian mammals undertaken to date It proposes significant changes to the higher ranks of a number of groups and recognises several genera and species that have only very recently been identified as distinct This easy to use reference also includes a complete listing of all species subspecies and synonyms for all of Australia s mammals both native and introduced as well as terrestrial and marine This book lays a foundation for future taxonomic work and identifies areas where taxonomic studies should be targeted not only at the species and subspecies level but also broader phylogenetic relationships This work will be an essential reference for students scientists wildlife managers and those interested in the science of taxonomy

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