Understanding how patterns of ecomorphological and lineage diversity are influenced by biotic and abiotic factors and the interaction between them is of fundamental importance. Only by understanding the regulators of biodiversity in the past can we begin to predict future responses to global change. The successful synthesis of phylogenetic and paleontological information has the potential to vastly improve our understanding of macroevolution as separate analyses of the fossil record and extant phylogenies frequently infer different factors as important drivers of diversification. To identify macroevolutionary patterns of biodiversity and their drivers requires an integrative approach, tapping the vast reserves of scientific data in museum collections and the published scientific literature data and thus combining traditional ecomorphology and phylogenetics with data-science techniques. I illustrate how this approach can identify repeating themes and general principles governing the evolution of vertebrate diversity using my recent work on dietary evolution and its impact on mammalian diversification and the ecological drivers of fish body shape diversity.