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Project: Illuminating the early evolutionary history and cranial eco-morphology of neopterygian fishes

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TRACING THE EVOLUTIONARY HISTORY OF RAY-FINNED FISHES THROUGH MAJOR EXTINCTION EVENTS

With over 33,000+ living species, ray-finned fishes (Actinopterygii) constitute the most diverse clade of backboned animals. All living actinopterygians belong to three evolutionary lineages, which trace back to the late Paleozoic Era (~330 million years ago) and have 'swam through' major mass extinction events. Actinopterygians exhibit the richest fossil record of all backboned animals. Yet, the informativeness of this record is not always guaranteed, due to its poor preservation quality. At the same time, actinopterygians from major extinction intervals have been historically understudied, or underrepresented in fossil collections. As a result, our understanding of their evolutionary history and paleobiology of this exceptional vertebrate clade lags far behind that of e.g., their terrestrial counterparts.

Tracing the deep-time origins of modern ray-finned fish lineages is a frontier in vertebrate paleontology, due to the lack of conclusive data from fossils. To address this knowledge gap, I study fossils from the critical time-interval surrounding the deadly end-Permian Extinction (~252 million years ago), which is thought forms that are 'ancestral' to modern lineages. In this talk, I will show how the application of modern anatomical investigation techniques (e.g., microCT-scanning) on exquisitely-preserved fossil examples allowed me to reconstruct their internal skeletal anatomy (e.g., brain and sensory organ cavities, feeding structures). Information from such structures is critical for reconstruction the actinopterygian portion of the tree of life. Furthermore, I will present case studies on how the rare preservation of delicate structures (e.g., intestinal traces, embryos) in fossils can open windows into the mode of life of long-extinct organisms.

Finally, I will briefly introduce my second line of research, which explores the major turnover in marine fish faunas caused by the End-Cretaceous Mass Extinction. The latter was triggered by a meteorite that hit the Earth ~66 million years ago, and devastated global ecosystems through a rapidly induced climate crisis. New paleontological expeditions in fossiliferous localities in Greece led to the discovery of complex marine deep-water faunas from the immediate extinction interval. These promise to help us trace patterns of 'fish' extinction and recovery in the marine realm.