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Freies Thema

## Hyperphalangy and intraspecific variation in ichthyosaur limbs

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Adaptation to an aquatic habitat results in profound changes to tetrapod limb morphology as limbs take on the roles of propulsion and steering and lose their weight-bearing function. Changes include enclosure of the limb in a soft-tissue flipper, and proportional lengthening of the distal limb, often accomplished through the addition of de novo skeletal elements (hyperphalangy). Alteration of the developmental architecture allowing for hyperphalangy and the flipper structure itself are thought to increase limb variability, based on a cetacean model. The objective of this study was to examine the roles of hyperphalangy and morphological differentiation of limb regions on intraspecific variation. I addressed these questions using the ichthyosaurs *Stenopterygius* and *Mixosaurus*. *Mixosaurus* is a basal ichthyosaur from the Middle Triassic, with a large, well-preserved sample of available specimens originating from the area around the Italian-Swiss border. *Stenopterygius* is a derived ichthyosaur from the Lower Jurassic of Europe, with the largest available sample originating from the region around the village of Holzmaden, in southwestern Germany. *Mixosaurus* differs from *Stenopterygius* in retaining more digits and a greater degree of proximal-distal differentiation of elements, but the limbs of both genera were modified as flippers and exhibit hyperphalangy.
Large amounts of variation in phalangeal count were observed in *Stenopterygius* and *Mixosaurus*, consistent with the hypothesis that hyperphalangy increased observed variation in the limb skeleton. However, the amount of variation was related to functional digit length, not the number of phalanges per digit. Additional sources of variation (digital duplication, phalangeal fusion, interdigital ossicles) were frequently observed in the forefins of *Stenopterygius*, but never in the forefins of *Mixosaurus*, indicating that the loss of proximal-distal differentiation was more closely associated with the presence of these qualitative variants than was hyperphalangy. These results suggest that although variation, both in phalangeal count and qualitative anomalies, may be retained in a population due to enclosure in a soft-tissue flipper, the presence of the flipper does not itself predict either high levels of qualitative variation or the degree of variation in phalangeal count.

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Freies Thema

## Coral reef diversity after rapid warming: the Last Interglacial

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The Last Pleistocene Interglacial (LPI, 130–120 ka) was the result of rapid global warming culminating in temperatures two to four degrees warmer than today. To explore the ecological impact of such warming, we compared coral distributions and coral reef diversity between the LPI and today at global and regional scales. Global scale comparisons were done using the Paleobiology Database for the Pleistocene and OBIS (Ocean Biogeographic Information System) for the Recent. The warmer LPI showed a pronounced equatorial diversity depression of reef corals, due to range retractions away from the equator. These retractions were far more profound that high-latitude range expansions, confirming the deleterious consequences of global warming.
At regional scales we analyzed and compared quantitative community data from LPI coral reefs in the Red Sea and the Caribbean. Caribbean Pleistocene reefs have been extensively studied, while Indo-Pacific reefs are poorly explored. Accordingly, we used previously published material from the Caribbean and generated new data from taxon-quantitative line-transects from the Red Sea Gulf of Aqaba region. Just as today, Pleistocene coral diversity was much lower in the Caribbean than in the Red Sea, in spite of much more comprehensive sampling