Global biodiversity change through past climate change events evident in the geological record provides the best proxy to understand challenges facing the marine environment today. But comparisons in deep time merit some caution. One of the great challenges of the “big data” era is reconciling different approaches to measuring biological diversity: population genetics, ecology, systematics, and palaeontology.

Deep sea biodiversity includes many famously bizarre animals. These species are sometimes dismissed as “once off” evolutionary anomalies, but they challenge textbook ideas about the patterns and limits of evolution. The scaly-foot gastropod (*Chrysomallon squamiferum*) at hydrothermal vents in the Indian Ocean has the body form of a deep-sea snail but scales that are reminiscent of chitons, or Palaeozoic fossil stem molluscs. New evidence for rapid parallel evolution of sensory systems and armour in deep sea gastropods provides new insights that bridge fossil and living faunas.