sample points (hooks) and hundreds of millions of observations (fish caught). By stitching together several such datasets, and after correcting for variability in the data such as geographically unevenly distributed effort, Tittensor and Worm were able to detect changes in range. They found generally similar patterns across the Atlantic, Indian, and Pacific oceans, showing an apparent effect of life-history. Fishes that grew more slowly and to larger size and spawned in aggregations, such as the bluefin tuna (*Thunnus thynnus* and *T. orientalis*), showed decreases in range size; the range of *Thunnus thynnus* has contracted almost entirely from the South Atlantic, and populations are fractioning in the Pacific. In contrast, fishes that grow faster to smaller maximum size, such as the albacore tuna (*Thunnus alalunga*) generally have shown no change or an increase in range. Whether changing ocean climate or exploitation provide a more likely explanation is currently under investigation. Thus, we find consensus in the results of Davidson et al. and Tittensor and Worm in predicting, if human activities don't change, an ecological extinction of the marine megafauna that echoes the extinction of the terrestrial megafauna from the Americas thousands of years ago. While in many ways we are beginning to see parallels between marine and terrestrial systems, it would be heartening to see a difference in this respect.

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References

Barnosky, A.D., Matzke, N., Tomiya, S., Wogan, G.O.U., Swartz, B., Quental, T.B., Marshall, C., McGuire, J.L., Lindsey, E.L., Maguire, K.C., Mersey, B. & Ferrer, E.A. (2011) Has the Earth's sixth mass extinction already arrived? Nature, 471, 51–57.

Tyberghein, L., Verbruggen, H., Pauly, K., Troupin, C., Mineur, F. & De Clerck, O. (2011) Bio-ORACLE: a global environmental dataset for marine species distribution modeling. Global Ecology and Biogeography, doi:10.1111/j.1466-8238.2011.00656.x

Verbruggen, H., Tyberghein, L., Pauly, K., Vlaemick, C., Van Nieuwenhuyze, K., Kooistra, W., Leliaert, F. & De Clerck, O. (2009) Macroecology meets macroevolution: evolutionary niche dynamics in the seaweed *Halimeda*. Global Ecology and Biogeography, 18, 393-405.

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symposium summary

Palaeoecology

A contributed session at the 5th International Biogeography Society Conference – Heraklion, Greece, 7–11 January 2011

The IBS meeting is rapidly emerging as a critical meeting for those interested in paleobiogeography, and in particular for those interested in how past and present biogeographic patterns are shaped by the intersection of past environmental changes with ecological and evolutionary processes. Paleoecology was well represented at the Crete meeting, with 25 abstracts submitted, a packed oral session, and many cross-cutting talks. Several general themes emerged from the talks in the paleoecology session.

One running theme was species niches and their shifting manifestation over time in response to new species interactions and environmental conditions. Alycia Stigall ("Using ecological niche modeling to evaluate niche stability in deep time") applied GARP and Maxent analyses to Late Ordovician brachiopod species to show that niche conservatism decreased during and after a major invasion event (the Richmondian Invasion), suggesting that species responded to invasion pressure. Jack Williams and co-authors ("Apparent niche shifts and no-analogue climates in eastern North America during the Late Quaternary") tackled the problem of reconstructing 'truncated' niches, i.e. species' fundamental niches for portions of environmental space that do not exist at present, showing that different starting assumptions resulted in very different reconstructions of species fundamental niches, and hence very different pre-

dictions for the late-Pleistocene no-analog climates by species distribution models. This problem of reconstructing truncated niches was echoed in a talk by Ken Feeley in the global change oral session ("Extinction risks of Amazonian plants"), who developed a separate method for reconstructing the niche breadth of South American plant species for future climates warmer than any at present.

A second running theme was the effects of glacial-interglacial climate changes on past and current species distributions. Dan Gavin and Erin Herring ("Reconstructing a putative cryptic northern mesic refugia") reviewed the evidence for and against a northern mesic full-glacial refugia in the interior montane cedar-hemlock forests of northern Idaho and eastern British Columbia. Phylogeographic data suggest that this area was a full-glacial refugium for amphibians and plant species, yet fossil pollen records suggest that mesic forests formed in only the last 3000 years and niche models driven by paleoclimatic simulations also suggest unfavorable conditions for mesic taxa. This apparent paradox remains to be reconciled. Kristine Westergaard and co-authors ("Glacial survival may matter after all") presented convincing molecular evidence that some arctic-alpine plants must have survived on nunataks and other small refugia in formerly ice-covered portions of northern Europe, Svalbard, and eastern Greenland.

A related third theme was the ability of species to keep up with climate change. Rachid Cheddadi ("Revisiting Reid's Paradox by integrating genetic and topographic information: Abies alba (Mill.) – a case study"), used a combination of late-Quaternary fossil pollen data, topographic data, and current haplotype distributions to revise estimates of post-glacial colonization migration rates for *Abies alba*. His estimates of 50 to 150 m/year are substantially lower than earlier pollen-based estimates. In a related talk from the global-change session, Sandel et al. ("Climate change velocity since the Last Glacial Maximum and its importance") computed the velocity of climate change between the last glacial maximum and present and showed that a) the contemporary diversity of small-ranged species was negatively correlated with climate velocity and b) post-glacial climate velocity was a better (negative) predictor of small-ranged species than contemporary climate variables.

Not quite fitting into this neat 1-2-3 arrangement of themes, and thus extra-interesting, was the paper by Mariana Munguía-Carrara and co-authors ("Differential dispersal response of mammals during the Great American Interchange") who applied niche models to test hypotheses about why the Great American Interchange was so asymmetrical, with more North American species invading southward than South American species heading north. They found that North American species had a larger area of potentially suitable climates in South America than vice versa, and that successful colonizers tended to have a shorter migration distance to new climates.

As can be seen from the above, the talks in the paleoecology session tended to have a strong but not exclusive emphasis on late-Quaternary timescales and on climate-driven dynamics. This was counterbalanced by other talks at the meeting that had a strong phylogenetic emphasis and often emphasized evolutionary processes operating at longer timescales. Overall, these talks reinforced my growing impression that IBS offers an increasingly essential meeting place for the international community of paleoecologists, evolutionary biologists, macroecologists, and others studying biological dynamics at broad spatiotemporal scales.

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