Archaeology

Gone fishing in Stone-Age Africa

Excavations at a site in southern Africa's Kalahari Desert suggest that the area's inhabitants caught and consumed freshwater fish from what was once a nearby lake for much of the past 25,000 years. Fishing expeditions to nearby rivers during spawning runs probably began more than 40,000 years ago, contend Lawrence H. Robbins of Michigan State University in East Lansing and his colleagues.

Until now, evidence of fishing at that time emerged only at African sites located at least 1,400 miles north of the Kalahari, many near the Nile River or East African lakes.

Discoveries in the Kalahari and elsewhere "increasingly document the importance of fish as a food resource in African prehistory," the researchers write in the summer JOURNAL OF FIELD ARCHAEOLOGY.

Fieldwork in 1991 at the White Paintings Rock Shelter in Botswana uncovered 15 barbed bone fragments, pointed at the end, similar to previous finds in East Africa; a few more of the carved implements emerged in 1992. Robbins and his co-workers suspect that the artifacts served either as spear or harpoon points, most likely for catching fish.

Radiocarbon analysis of associated charcoal and animal bones places most of these artifacts at 4,000 to 5,000 years old, but several date to approximately 20,000 years ago. Numerous fish bones, mainly from catfish and perch, studded the soil layers in which the carved bones lay.

A large, seasonal lake apparently formed just south of the Botswana site during particularly rainy periods, the researchers assert. Lake-produced sediment containing freshwater shellfish and algae occurs throughout the area. Radiocarbon dating of this material indicates that exceptionally humid conditions likely to result in lake formation occurred between 22,500 and 19,200 years ago, between 17,500 and 11,700 years ago, and around 7,500 years ago.

Abundant remains of wetland animals at the rock shelter also date to as old as 17,000 years.

Some fish bones turned up in sediment assigned a provisional minimum age of 40,000 years, the scientists note. More precise dating of this soil is now under way.

Seasonal highs and lows in Jordan

Fieldwork in the mountains of southern Jordan over the past decade has uncovered clues to a seasonal migration strategy practiced for the past 70,000 years by the area's inhabitants, from prehistoric hunter-gatherers to modern pastoralists.

A survey of data from 109 archaeological sites indicates that the region's occupants regularly returned to long-term camps during the winter rainy season, when food and water availability hit their peak, according to Donald O. Henry of the University of Tulsa. As these resources became scarcer in dry summer months, smaller groups fanned out to short-term outposts, where they sought readily obtainable provisions.

Long-term settlements were built as close as possible to water sources at elevations where nighttime temperatures stayed above freezing, Henry contends. Until about 12,000 years ago, a cooler, rainier climate allowed long-term camps to spring up at low elevations, with warm-season sites situated higher in the mountains, he asserts in the July 15 SCIENCE. Warmer, drier conditions then fostered a reversal of this pattern, with long-term camps moving to higher ground.

However, Natufian hunter-gatherers, who lived in the region from about 12,800 to 10,300 years ago, apparently stayed in one long-term camp for much of both the wet and dry seasons. Data from Israeli sites suggests that the Natufians spent most of the year in villages, where they specialized in gazelle hunting and gathering cereals, perhaps leading to the beginnings of agriculture, holds Daniel E. Lieberman of Harvard University.

Computers

Could recombination drive evolution?

The dominant model of evolution, known as the modern synthesis, holds that species variety arises mostly from point mutations, or changes in the individual nucleotides that make up DNA. Yet this model tends to ignore genetic recombination, a source of variation that occurs when an entire cluster of nucleotides is shuffled among chromosomes.

So Gene Levinson, a molecular biologist at the Genetics & IVF Institute in Fairfax, Va., devised a computer simulation of an evolutionary process that takes into account the effects of recombination.

"I represented DNA sequences in a genetic algorithm and subjected them to recombination or mutation to see how they evolved," Levinson says. "What I find is that recombination is more potent than mutation as a source of evolutionary change. With recombination, changes show up faster."

To look at the synergistic effects of natural selection and recombination, Levinson created three such algorithms. Each subjected representations of a DNA sequence to a specific type of recombination. For comparison, he allowed the same sequences to undergo point mutations. In addition, to simulate natural selection pressures, he varied the survival and attrition rates of the new DNA sequences.

With recombination, Levinson found, "the attrition rate, which is a weeding-out process, doesn't have to be nearly so extreme as it does with mutation to see evolutionary changes survive. Even a slight attrition rate with recombination can produce a dramatic effect, whereas with mutation, a small attrition rate produces only a small effect."

Natural selection, he believes, may even favor recombination. Recombination may also help explain how sexual reproduction has furthered evolution by diversifying species.

"A synergism between recombination and natural selection may have played a major role in Darwinian molecular evolution," Levinson says, "a role that is obscured by the semantics of the modern synthesis" theory.

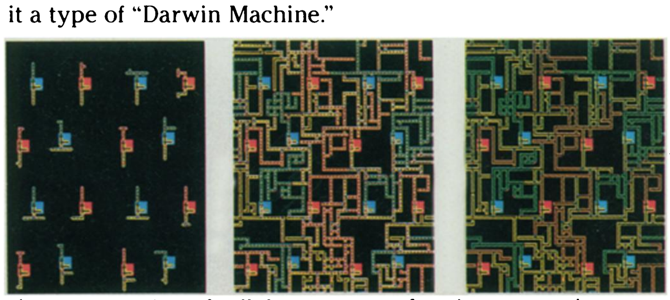
A big silicon brain

Researchers at ATR laboratories in Kyoto, Japan, are building an "artificial brain." To be completed in 2001, the lab's CAM-Brain Project aims to produce a silicon brain with more than 1 billion artificial neurons, according to Hugo de Garis, an ATR computer scientist.

The brain will come in the form of a neural network and will exist within a massively parallel computer. To create such a complex system, the researchers will have the network build itself. "Cellular automata," each one a distinct computer program, will actually forge their own linkages.

De Garis calls this approach "evolutionary engineering." The neural net grows when cellular automata send "growth signals" to each other, then connect via "synapses." Currently, the brain's logical innards are forming in two dimensions, though they will soon begin to interconnect in three dimensions, de Garis says.

Since the network will evolve its own structure, de Garis calls it a type of "Darwin Machine."



de Garis/ATR Laboratories

A representation of cellular automata forming connections.