

## Birds can remember what, where, and when

Struggling with the temporal cognitive challenge posed by leftovers going bad in the fridge, people may not be so superior to other animals after all.

Scrub jays can remember when they cached a particular kind of food in a particular place, report Nicola S. Clayton of the University of California, Davis and Anthony Dickinson of the University of Cambridge in England. The birds tend not to bother recovering a perishable treat stored long enough to have rotted.

This pickiness “has many of the hallmarks of episodic memory,” Clayton says. That’s the kind of memory that lets a person mentally time-travel back to recall the suite of details of a particular experience, like stashing a casserole behind the milk. Are the scrub jays doing an avian version of the same thing?

“I can’t ask them,” Clayton laments. However, when she and Dickinson focus on bird behaviors, they find that the cache-recovery pattern of scrub jays fulfills the “‘what,’ ‘where,’ and ‘when’ criteria for episodic recall.” The jay study “provides, to our knowledge, the first conclusive behavioural evidence of episodic-like memory in animals other than humans,” the researchers say in the Sept. 17 NATURE.

That birds have keen abilities for re-

covering food does not surprise Clayton because their skill has “life-or-death” consequences. For instance, chickadees that tough out the winter in Siberia must find many of the half-million seeds they hide each year. In the worst of the season, the chickadees have only about 3 hours of daylight for foraging.

Previous work has indicated that birds find their stashes not by smelling hidden food but by remembering the location. In laboratory tests, birds called Clark’s nutcrackers have recalled where they buried something 9 months earlier. Birds also remember what they’ve stored. Black-capped chickadees, for example, retrieve favorite foods first.

To test for memories of specific events and their timing, Clayton and Dickinson let some scrub jays discover that waxmoth larvae, a favorite food, will rot after a few days. The researchers then gave the birds fresh larvae to bury in ice-cube trays full of sand. After five days, the jays cached peanuts.

When these birds later had a chance to harvest their treats, they mostly probed for the peanuts and ignored the larvae locations. Birds that did not know about the decay, however, spent more effort looking for the larvae than the peanuts.

Larry R. Squire, who studies primate



A scrub jay takes memory tests by hiding food in ice cube trays. Researchers add Lego toys to make each tray distinctive.

memory at the University of California, San Diego, says he was already convinced that monkeys and rats could recall what happened when and where. “I think it’s exciting that the bird work is so consistent with the mammals,” he says.

The scrub jay study is more convincing than the work on mammals, says Endel Tulving of the Rotman Research Institute of Baycrest Centre in Toronto, a founder of episodic-memory theory. In the mammal demonstrations to date, “there are other ways that the animals could have solved the problems,” he cautions.

Clayton’s jay work strikes Tulving as “inventive and very clever.” He says, “I think that she’s got something there.” —S. Milius

## PIC and choose—a toxic-imports accord

Last week, representatives of 62 nations signed onto a United Nations protocol to control the proliferating export of toxic chemicals to countries that have decided they cannot ensure safe use. Once ratified by 50 countries, this new convention—adopted in the Dutch city of Rotterdam—will become a binding treaty and make it illegal to export a listed chemical without an importing country’s prior consent.

The accord requires that whenever a participating country bans or “seriously restricts” the use of a chemical, it must alert the convention’s secretariat—its administrative body—and pass along data documenting the compound’s toxicity. Once two such designations arrive for any chemical, the secretariat must add the agent to the list of compounds regulated by the convention.

Each country will receive details of a newly listed compound’s toxicity and then have 9 months to decide whether to accept imports of the chemical. The secretariat will compile and publish a list of all unwilling recipient countries. This procedure is the heart of the new treaty, known as the Convention on Prior Informed Consent (PIC).

The secretariat has run a voluntary

PIC program since 1989, in which 154 nations have participated. Their efforts led to a PIC list of 27 chemicals, including chlordane, DDT, lindane, crocidolite asbestos, and polychlorinated biphenyls.

However, compliance has sometimes been a bit sketchy, notes Jim Willis, who works for the secretariat at the U.N. Environment Programme (UNEP) in Geneva. For instance, he notes, “not everyone provided the notifications that they were banning or restricting a chemical” or offered timely decisions on their willingness to accept certain imports.

Tougher, though still voluntary, procedures agreed to last week will remain in effect until the treaty becomes law. “We actually have time frames for all of these responses and actions, so that things become much more predictable—and almost mandatory,” Willis says.

The low cost of many older toxic compounds, such as DDT, encourages their continuing use in developing countries long after many industrialized countries have limited or eliminated them (SN: 3/16/96, p. 174). Further jeopardizing the safe use of these chemicals in many developing countries, United Nations studies show, are the poor labeling typical of many toxic imports and the inadequate

instruction of workers on their safe use.

The United States, a major manufacturer of such compounds, exported pesticides at an average rate of 936 tons per day in 1996, the most recent year for which data are available, according to an analysis of customs records published this spring by the Los Angeles-based Foundation for Advancements in Science and Education. Notes Carl Smith, who directed the analysis, a large share of these exports went to developing countries.

To date, Smith observes, PIC’s process has largely ignored products whose use requires extreme safety precautions. They “wouldn’t necessarily be banned but still are extremely hazardous.”

He points to the pesticide aldicarb as one example; it is so potentially lethal that applicators “basically have to put on a moon suit to use it.” Few developing countries would be able to provide such gear. Nonetheless, in 1996 the United States exported 2.58 million pounds of aldicarb, Smith notes, “mostly to developing countries.”

Under the new accord, Willis says, countries will be able to nominate for PIC controls such “severely hazardous,” but not banned, pesticides. More than 200 chemicals are now “waiting in the queue” for PIC consideration, he told SCIENCE NEWS, and some fall into that category. —J. Raloff