

CONSERVATION SCIENCE

Hunting the cause of a population crash

The enigmatic spoon-billed sandpiper *Eurynorhynchus pygmeus* is famed for its bizarre cutlery-shaped appendage and the challenges of observing it.

Sadly, it's also known for its perplexing plunge towards extinction. It is estimated that only 120–220 pairs remain. The bird's summer breeding grounds on the Russian Chukotskiy peninsula are inaccessible to all but a few ornithologists, and — despite occasional sightings across a vast range from India to Malaysia — the main wintering sites were unknown. Zöckler and colleagues, however, now show both what the likely threats are to the overwintering birds and how those threats might be reduced (C. Zöckler *et al.* *Wader Study Group Bull.* **117**, 1–8; 2010).

With no apparent sign of habitat degradation at the breeding site, Zöckler and colleagues searched for the birds' wintering area. In January 2010, they found an estimated half of the global overwintering population in the Bay of Martaban in Myanmar. The team identified one bird that had been tagged with a leg flag on the breeding grounds in 2003. Analysis of carbon and nitrogen isotopes from the few, winter-grown, feathers collected when the bird was tagged showed that this individual was in the centre of the densest data cluster, implying that it was in the heart of the wintering area.

Zöckler *et al.* went further. On making enquiries, they found that local hunters use mist nets to catch birds for the pot: an

estimated 30,000 shorebirds are killed annually in this single bay, which harbours up to 150,000 migratory shorebirds. Most of the 26 hunters from 15 villages who were interviewed were familiar with spoon-billed sandpipers, and reported regularly catching them.

Paradoxically, this second discovery could be good news. Only five of the interviewees were full-time professional hunters and their main targets are much larger birds. The authors propose that incentives should be offered to the villagers to conserve the birds; village elders may then ensure that there is no hunting. Such mechanisms have worked elsewhere in Myanmar.

Zöckler *et al.* say that, without



C. SCHENK/FN/MINDEN/FLPA

intervention, the spoon-billed sandpiper could become extinct within 10–20 years. But now, thanks to their persistent investigation and willingness to engage with local people, it may not. The story illustrates how conservation is as much a social science as a biological one. When the two come together, there is hope for real change.

Tamás Székely & William J. Sutherland
e-mail: t.szekely@bath.ac.uk

of the chlorine atom in the aryl chloride by a trifluoromethyl group.

An interesting aspect of this work is that every step of the reaction cycle shown in Figure 1 was already known to work in isolation. Researchers had discovered that complexes such as the first palladium intermediate could be made²; that trifluoromethyl groups could be attached to palladium^{3,4}; and that carbon–trifluoromethyl bonds can be formed from palladium complexes^{3,4}. Similar trifluoromethylation reactions of simple molecules have even been reported^{5–7}. But for productive catalysis to make complex molecules, all the individual steps need to work in synergy in the same reaction flask, and in the presence of complex

molecules. Rationally designing new catalytic cycles by bringing together many individual steps is one of the most challenging aspects of reaction development, akin to piecing together the most fiendish of jigsaw puzzles.

For Cho *et al.*¹, the particular challenge was to develop a palladium catalyst that could support all the individual steps of the cycle, while avoiding unproductive side reactions such as the destruction of the trifluoromethyl donor, or the disintegration of the catalyst itself. The key to their success was the use of special ligands — molecules that bind to palladium to modify the properties of the catalyst. The research lab involved in this work, headed by Stephen Buchwald, has a history of developing ligands

for cross-coupling reactions. Collectively known as Buchwald ligands, these are widely used because they work well for several different cross-coupling reactions. They are effective in the new trifluoromethylation reaction¹ because they strike the right balance between making the palladium centre of the catalysts reactive enough to accelerate reactions, but stable enough not to decompose.

Cho and colleagues have launched a Sputnik shot in the field of trifluoromethylation. There is no doubt that their work will have an immediate impact by allowing the preparation of new fluorinated molecules. There is, nevertheless, still a long way to go to make the reaction truly practical: the reaction conditions need to become milder; cheaper trifluoromethylating reagents need to be identified; and the amount of catalyst used must be lowered. But this initial success¹, combined with knowledge about the reaction mechanism, will guide the future development of this exciting area of science. ■ Tobias Ritter is in the Department of Chemistry and Chemical Biology, Harvard University, Cambridge, Massachusetts 02138, USA. e-mail: ritter@chemistry.harvard.edu

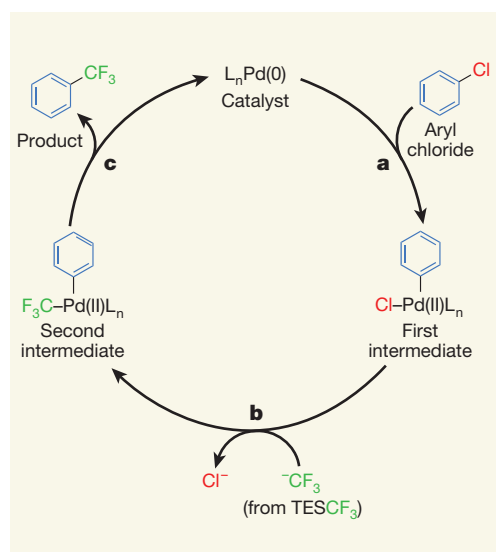


Figure 1 | Catalytic cycle for a trifluoromethylation reaction. Cho *et al.*¹ report a general catalytic reaction for adding trifluoromethyl groups (CF₃) to aromatic rings. **a**, The catalytic cycle begins when the palladium atom of the catalyst inserts itself into the carbon–chlorine bond of an aryl chloride (such as chlorobenzene, shown here), to form an intermediate in which a chloride ligand and an aromatic ring is bound to the palladium. Pd is palladium; L_n represents ligands that are attached to the palladium atom, but which do not come from the reactants; numbers in parentheses represent the oxidation state of the palladium atom. **b**, The chloride ligand is displaced by trifluoromethyl groups derived from triethylsilyltrifluoromethane (TESCF₃), forming a second intermediate. **c**, This breaks down to yield the desired product, regenerating the catalyst so that it can take part in another catalytic cycle.

1. Cho, E. J. *et al.* *Science* **328**, 1679–1681 (2010).
2. de Meijere, A. & Diederich, F. (eds) *Metal Catalyzed Cross-coupling Reactions* 2nd edn (Wiley-VCH, 2004).
3. Grushin, W. V. & Marshall, W. J. *J. Am. Chem. Soc.* **128**, 12644–12645 (2006).
4. Ball, N. D., Kampf, J. W. & Sanford, M. S. *J. Am. Chem. Soc.* **132**, 2878–2879 (2010).
5. Dubinina, G. G., Furutachi, H. & Vicić, D. A. *J. Am. Chem. Soc.* **130**, 8600–8601 (2008).
6. Oishi, M., Kondo, H. & Amii, H. *Chem. Commun.* 1909–1911 (2009).
7. Wang, X., Truesdale, L. & Yu, J. Q. *J. Am. Chem. Soc.* **132**, 3648–3649 (2010).