Risso's dolphins plan their dives

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Slipping beneath the surface of the water in pursuit of food sets the timer ticking for hungry dolphins; the pressure is on to locate food and make it back to the surface before they run out of oxygen.

So what strategies might a peckish dolphin use to forage efficiently on a tight time budget? 'Lab experiments that test the memory of animals for the location of food show that they have a similar ability to that of humans', says Patricia Arranz from the University of St Andrews, UK: which suggests that some foraging animals may plan ahead. However, it was unclear whether animals that are actively foraging in their natural surroundings would adjust their hunting strategy in response to the conditions that they encountered before and during a dive. Knowing that Risso's dolphins dive down several hundred metres to dine on shoals of squid, Arranz, Peter Tyack, also from St Andrews, Brandon Southall from the University of California, Santa Cruz, USA, and Kelly Benoit-Bird from the Monterey Bay Aquarium Research Institute, USA, decided to find out whether these mammals plan their submarine sorties. They publish their discovery that Risso's dolphins use information gather on previous dives to plan the next in *Journal of Experimental Biology*.

However, tracking the activities of wild animals is extremely challenging. 'It is really difficult to approach them and attach something to their backs; you need to be very patient!' says Arranz. She recalls how John Calambokidis from the Cascadia Research Collective, USA, and Ari Friedlaender from the Marine Mammal Institute, USA, cautiously observed the animals while carefully manoeuvring into place, before gently attaching the data loggers - which tracked the animals' depths and

movements, and the sounds they emitted - with a 5m-long pole. Then, Benoit-Bird and Southall tracked the location of shoals of squid beneath the surface with echosounders mounted on remotely operated underwater robots while the dolphins searched for food. 'In one of the experiments, we were extremely lucky as the group that the tagged animal was in stayed in the same area, allowing us to track the dolphin every time it was at the surface and observe the prey with the echosounder right where and when the dolphin was foraging', says Arranz.

Back in the lab, Arranz and Benoit-Bird analysed the recordings from 37 dolphin dives while tracking the location of the squid prey and realised that the dolphins began echolocating soon after leaving the surface, 'Probably to gain information on the depth distribution and availability of prey and to respond swiftly to rapid changes in habitat structure at different depths', says Arranz. And the descending dolphins seemed to match their echolocation range to the depth at which they had encountered the most squid during their previous dive, 'Which can be interpreted as dolphins recalling information to plan the next foraging dive', says Arranz. The team also noticed that the dolphins continued echolocating as they returned to the surface, even though they were no longer hunting, as if they were planning ahead and scouting out the best location for their next dive. And the animals seemed to be able to tailor their diving strategy as the conditions changed, sometimes targeting a shallow layer of squid at the outset, but shifting their attention to deeper, more plentiful squid patches later in the dive.

The dolphins were definitely planning ahead, pulling together information that they had gleaned during previous encounters and combining it with their present experience to optimise their dives and ensure that they made the most of each precious lungful of air while submerged.

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