INSIDE JEB

Elderly common bottlenose dolphins show signs of ageing like humans

A dolphin performing a high energy task, leaping out of the water. Photo credit: Dolphin Research Center, FL, USA.

Anyone who has tried their hand swimming in open water in northern locales knows that first dip can be excruciating; it feels as if every stinging ounce of warmth is being stripped from your skin. Yet, warm blooded whales, dolphins and seals must continually defend and stoke their warmth to maintain their temperature, impacting the amount of energy they must consume. 'Determining their daily energy requirements will help us to better understand where they go, find food and whether they influence their prey', says Rebecca Rimbach from Duke University, USA. However, measuring the amount of energy used by freely roaming creatures is notoriously difficult. Some researchers have successfully recorded the metabolic rate of resting seals, porpoises and dolphins, but that is a far cry from the total exertion of these animals as they scour the sea. Fortunately, Herman Pontzer and Brian Hare (both from Duke University) knew of an alternative technique – when animals consume so-called 'heavy' water – that can be used to monitor their total energy expenditure over an extended period, which they hoped could provide a glimpse into the cost of an aquatic lifestyle for common bottlenose dolphins.

Hannah Salomons, Ahmad Amireh and Chana Kaufman (all from Duke University) joined Emily Guarino at the Dolphin Research Center (FL, USA), while Austin Allen (Duke University) travelled to Dolphin Quest (HI, USA) to measure the mammals' energy use, providing 10 common bottlenose dolphins – ranging in age from 10 to 45 years – with a drink of heavy water enriched with deuterium (^{2}H) and with heavy oxygen (^{18}O). Guarino explains that the dolphins regularly drink water from a tube, 'so that even if they become ill and reduce their food intake, they can still receive their necessary hydration'. Then, the team kept track of the dolphins' activity as the animals cavorted in their lagoons, how much fish they consumed and their body weight. In addition, they collected blood and urine samples over 9 days to keep track of how much heavy water the animals lost. 'The dolphins already cooperate in their own health care, so voluntarily give blood and urine samples', Guarino explains, adding with a smile, 'One of the dolphins, Talon, was so proud of himself after giving samples, that he always raced around the lagoon in a giant victory lap!'. Knowing that the cetaceans would gradually lose heavy oxygen in the form of water and carbon dioxide, while the deuterium would only be lost as water, the team could use the heavy water measurements to keep track of how much carbon dioxide the animals exhaled and, consequently, how much energy they used.

Back at Duke University, Rimbach calculated the dolphins' total energy expenditure and, sure enough, the animals were consuming more energy than terrestrial mammals to fuel their warm-blooded aquatic lifestyle; however, they were using 17% less energy than other similarly sized aquatic mammals. Most surprisingly, the older dolphins used significantly less energy than the youngsters when their size had been taken into account. 'We were surprised to find this age difference in energy expenditure because this pattern has not been reported in other long-lived species, other than humans', says Rimbach. In addition, the oldest dolphins were also carrying 8.4% more fat than their younger leaner pod-mates and had lost muscle, again much like elderly people.

So, ageing common bottlenose dolphins appear to experience some of the same symptoms of physical decline as older humans, and Rimbach says that she would love to follow individual dolphins over the course of their lives, to track how their energy expenditure alters as they age; although she admits that would be challenging, thanks to their decades-long lifespans.

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