Hot great white sharks could motor but prefer to swim slow

February 19 2019

Credit: CC0 Public Domain

Yuuki Watanabe has always been fascinated by speed and power. As a child, he recalls being transfixed by the raw strength of great white sharks (*Carcharadon carcharias*). 'They look cool' says Watanabe, from

the National Institute of Polar Research, Japan. However, he now has another reason for being in awe of these charismatic predatory sharks: 'they are an endothermic fish', he says. In other words, they maintain a warmer body temperature than the surrounding water—in contrast to most fish, which simply go with the thermal flow. This relatively warm-bodied lifestyle should allow them to swim at much higher speeds than their cold-blooded contemporaries. Yet, no one had successfully recorded the great white's behaviour to find out how their relatively warm lifestyle influences their activity. Would their warm muscles allow them to live up to their high-speed reputation? It turns out that although the fish could swim fast, they opt for lower speeds when hunting for fat seal snacks and the team publish this discovery in *Journal of Experimental Biology*.

Heading to the Neptune Islands Group (Ron and Valerie Taylor) Marine Park off South Australia—popular with tourists keen to dive with the great whites, which congregate there to dine on seals—Watanabe and his colleagues, Nicholas Payne, Jayson Semmens, Andrew Fox and Charlie Huveneers, prepared tags equipped with sensors to detect the sharks' movements, swim speeds and depth. However, Watanabe admits that tagging the colossal fish could be frustrating. 'They needed to swim nice and slow, close to the boat with their dorsal fins breaking the surface, but we rarely had such ideal situations', he smiles. And when the team wanted to get in alongside the sharks to determine their size and sex, Huveneers explains that they had to climb into a cage for protection. 'When seen from the boat, they look very aggressive, but I was surprised how elegantly they swim when seen underwater', says Watanabe.

After the tags detached automatically a couple of days later, the team successfully retrieved nine from the water, with the 10th eventually washing ashore several weeks later. Although one shark did manage to hit the higher speeds (2 m s?1) that the team anticipated—presumably when commuting between the islands—Watanabe was surprised that the

sharks that lingered near the seal colony were swimming quite sluggishly (0.8 to 1.35 m s?1). He adds that this was unexpected, because swimming becomes costly and inefficient at very low speeds. However, Watanabe suggests that the animals may benefit from their profligacy when moseying along by increasing their chance of encountering a fat seal to dine on.

'This strategy is as close to a 'sit-and-wait' strategy as is possible for perpetual swimmers, such as white sharks', says Watanabe, who also analysed the shark's manoeuvres when they dived. Noticing that the animals were clearly gliding as they descended, he compared the amount of energy consumed by the sharks during dives with their exertions when swimming at the surface, and it was clear that diving is a far more economical mode of transport than battling through waves at the surface. However, Watanabe suspects that instead of diving to conserve energy, sharks descend primarily in pursuit of seals.

So, even though great white sharks are capable of swimming fast thanks to their warm muscles, living fast may not always be a benefit when waiting for dinner, and Watanabe is now keen to find out how often the super predators successfully snatch a seal for a fat snack.

More information: Yuuki Y. Watanabe et al, Swimming strategies and energetics of endothermic white sharks during foraging, *The Journal of Experimental Biology* (2019). DOI: 10.1242/jeb.185603

Provided by The Company of Biologists