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INSIDE JEB

Lumbering on land costs elephant seals dear

A male and female elephant seal on the beach at Año Nuevo State Park. Photo credit: Frank Fish.

In the transition from a terrestrial lifestyle to an existence beneath the waves, elephant seals (*Mirounga angustirostris*) are pretty far along. With a streamlined body, blubber for insulation and the ability to carry extensive oxygen supplies for lengthy dives, elephant seals are as well equipped as many whales and dolphins. However, when the colossal mammals haul themselves onto gently shelving beaches to mate and give birth, the tables turn against them. ‘There is an energetic consequence to becoming aquatic; it becomes easier to swim but harder to walk’, says Frank Fish from West Chester University, USA; the question was, how hard? Having previously filmed and analysed the movements of relatively diminutive harbour and grey seals, which are about one-tenth the size of elephant seals, Fish and graduate student Kelsey Tennett teamed up with Dan Costa from the University of California, Santa Cruz, USA, to get up close and personal with the gigantic mammals in California’s Año Nuevo State Park.

‘It was in January, the time when males are trying to mate with females and the females are pupping’, says Fish, recalling how the massive seals weren’t too bothered by the scientists and their cameras; they had other things on their minds. Setting up a camera about 6–12 m from a seal that was taking a brief rest after dragging itself across the sand, the team waited until the animal showed signs of moving again before filming. ‘We could tell when the animal was about to move because it would start to rise up with its head and chest’, says Fish. Having filmed the seals humping along before collapsing on the sand, Fish then dashed into shot behind the animal with a 0.5 m long stick, so that Tennett could calculate the size of the animal and measure its movements back in the lab.

Analysing the seals’ cumbersome manoeuvres, Fish realised that each elephant seal initially reared its head and chest up before allowing its torso to slump forward to initiate a charge. As its chest crashed down, the animal then flexed its body like an inchworm to shift its hindflippers forward, allowing it to push down on the sand with its pelvis as the wave of movement travelled forward along its body. This then allowed it to thrust its chest, head and neck back off the sand, using its foreflippers like crutches, ready to lurch forward once again and initiate the next cycle. Sometimes the animals could only manage a few ‘strides’ covering 5–10 m before grinding to a halt, while some males maintained speeds of up to 2.5 m s^{-1} over 30–40 m in pursuit of a female or rival.

But what did all of this mean for the giant animals’ efficiency as they thundered across the sand – were they more or less efficient than smaller seals? Fish and Tennett teamed up with physicist Anthony Nicastro, also from West Chester University, to answer the question. They calculated that the elephant seals were using approximately 40 times more energy at any instant to shuffle along at speeds of about 2 m s^{-1} (which equates to 0.6 times their body length), than smaller grey seals scuffling about at a similar speed – relative to their body size – of 1.3 m s^{-1}.

‘Bigger is not always better, particularly when you are highly adapted for swimming rather than terrestrial locomotion’, says Fish, adding that elephant seals are paying an energetic penalty for their aquatic lifestyle. And, having scrutinised the largest seals in the northern hemisphere, Fish is keen to visit their even more gigantic relatives in the south. ‘I want to see if they [southern elephant seals] have reached a limit in how big a seal can be’, he says.

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