

Soaring metabolic rates place sea otter moms at risk

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The idyllic sight of a sea otter mum with a pup clasped to her chest, basking in the peaceful waters of Monterey Bay suckling her youngster can conceal the true extent of her devotion. Lactation is one of the most demanding physiological processes that animals can experience, but for sea otter mums, the challenge can be life threatening.

"We had been seeing a disproportionately high amount of adult female southern [sea otter](#) mortality at the end of lactation", says Nicole Thometz from the University of California, Santa Cruz, USA, adding, "This suggested that lactation was a particularly difficult life stage for females, but we had no idea exactly how costly it was".

Having previously measured the metabolic rates of sea otter pups in a bid to evaluate the cost of parenting, Thometz, Terrie Williams and colleagues had already estimated that sea otter mums might have to double their consumption of food to see the pup through to independence; however, the team needed to measure the resting metabolic rate of a lactating sea otter mother directly to find out exactly how much energy it took to raise a sea otter pup. Yet, with a moratorium on sea otter breeding in captivity, there seemed little chance that they would have the opportunity. That was until a pair of young sea otter females - Mollie and Clara - arrived at the Monterey Bay Aquarium. Thometz recalls that vet Mike Murray gave the animals a physical when they arrived and discovered that Clara was pregnant. "Mike called me to let me know what an amazing opportunity we had on our hands", recalls Thometz excitedly.

Having relocated the sea otters to Santa Cruz, Williams, Thometz, Traci Kendall and Beau Richter trained Mollie to enter the acrylic dome where they could record her oxygen consumption while resting. However, as the team intended to return Clara's pup to the wild, it was essential that humans altered her behaviour as little as possible, so they gently transferred her into the dome using a net, successfully repeating the manoeuvre when Clara was suckling her pup after the birth. Clara had also caught the team off guard when she gave birth a month early. "Beau asked one of our other trainers to take a look at Clara and by the time the trainer got over to her, she was pulling the pup out from between her flippers", Thometz remembers.

Comparing Mollie and Clara's metabolism over 12 months, the team saw that Clara's resting metabolic rate at the end of the pregnancy was 16.6% lower than her resting metabolic rate after weaning the pup - similar to the metabolic rate drop that has been found in other pregnant marine mammals. They speculate that this reduction could allow sea otters to accumulate fat reserves in preparation for milk production. However, after the birth of her pup and as it grew, Clara's daily energy demands soared - more than doubling to over 21 MJ day⁻¹ by the time that the pup was 4 months old - while her resting [metabolic rate](#) increased by 51%. "We found the cost of pup rearing to be significantly higher than previously estimated", says Thometz, adding, "This represents a substantial energetic burden for a species with already high baseline energy demands and minimal energy reserves and is likely one of the underlying reasons why we are seeing high mortality rates for prime age females at the end of lactation".

The team publishes their discovery in *Journal of Experimental Biology*.

More information: Nicole M. Thometz et al, The high cost of reproduction in sea otters necessitates unique physiological adaptations, *The Journal of Experimental Biology* (2016). [DOI: 10.1242/jeb.138891](https://doi.org/10.1242/jeb.138891)

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