

INSIDE JEB

Intrepid lice survive extreme pressure when hitching rides on elephant seals



An electron micrograph of a louse (*Lepidophthirus macrorhini*) collected from an elephant seal pup. Photo credit: Martín Brogger and Mauricio Luquet (ALUAR SAIC).

Lice usually have a pretty cushy existence. Snuggled up warm in the pelt of their host with a plentiful supply of fresh bodily fluids on tap, the worse many have to deal with is an irritated swat or drenching from a shower. But not the lice that choose to reside on walruses, seals and sea lions. These flightless parasitic insects are taken on rollercoaster rides beneath the waves whenever their host plumbs the depths; and, in the case of the lice (*Lepidophthirus macrorhini*) that reside on southern elephant seals, this can mean submersions down to 2000 m. It wasn't even clear whether the irksome pests could survive. Soledad Leonardi from the Instituto de Biología de Organismos Marinos (IBIOMAR), Argentina, and Claudio Lazzari from the University of Tours, France, explain that elephant seals pick up their first lodgers as pups, but no one was sure whether the insects that infest the adults are descendants of that initial population, or new arrivals that hitched a ride after earlier settlers had perished during deep sea excursions. Wondering just how much pressure these mini-beasts can take,

Leonardi, Ricardo Vera, Julio Rua and Florencia Soto travelled to the Peninsula de Valdés, Argentina, to collect adult lice and nymphs from elephant seal pups.

'Soledad's colleagues restrained the 150 kg pups with their bare hands, while she collected the lice with tweezers from the pups' flippers', says Lazzari, explaining that the insects were then immersed in sea water before being transported to IBIOMAR. 'They can cope with hypoxia [low oxygen], but they can't handle water loss when exposed to air', he says. Then Vera, Rua and Leonardi, rigged up a scuba air tank attached to a pressured chamber to simulate the experience of plunging to 300, 800, 1500 and 2000 m for 10 min. After retrieving the lice from the tank, the team found that the adults and nymphs began moving around and recovered instantly from simulated submersion to 300 and 800 m. However, the nymphs seemed to struggle more under higher pressure, taking 30 min to recover from the 1500 m simulated descent, although the

nymphs that experienced the pressure exerted at 2000 m began crawling within 10 min of returning to the surface. In addition, when the researchers simulated successive dives 40 min apart, the adult lice again recovered straight away, although the nymphs took 5 mins to recover after the equivalent of a 300 m dive preceded by a 2000m dive 40 min earlier. Even when the pressure was inadvertently turned up to 450 kg cm⁻², effectively submerging an adult louse to 4500 m, the insect recovered fine.

'Seal lice exhibit extraordinary pressure tolerance; in addition, they tolerate rapid changes in pressure corresponding to the rapid descent and return to the surface of a diving host', says Lazzari. But how do they pull off this remarkable feat? Leonardi and Lazzari suspect that scales on the insect's thorax and abdomen could reinforce the body, although they also point out that they carry less air in their tracheolar (air tube) system than mammals do in their lungs, making them less compressible. The researchers also suggest that the insects might carry a thin layer of air with them, which could act like a gill extracting oxygen from the water near the surface, and they may be able to reduce their metabolism to conserve oxygen.

Whatever the reason behind the itchy insects' impressive ability to withstand pressure, it seems that they have made a success of surviving where no other insects have ventured before, and understanding how they do so could hold the key to fathoming why insects usually fail to thrive in the sea.

10.1242/jeb.234260

Leonardi, M. S., Crespo, J. E., Soto, F. A., Vera, R. B., Rua, J. C. and Lazzari, C. R. (2020). Under pressure: the extraordinary survival of seal lice in the deep sea. *J. Exp. Biol.* **223**, jeb226811. doi:10.1242/jeb.226811

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