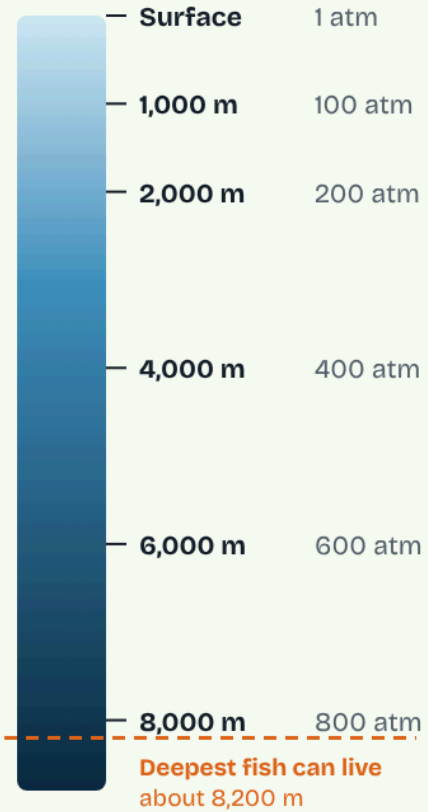
That is why

Why don't deep-sea fish implode?

Pressure only crushes air. Deep-sea fish carry none, and three adaptations keep their bodies working.

A Pressure rises with depth



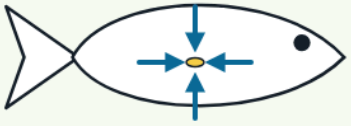
+1 atmosphere for every 10 m of water.
At 8,000 m: nearly 6 tons per square inch.

B The problem is air

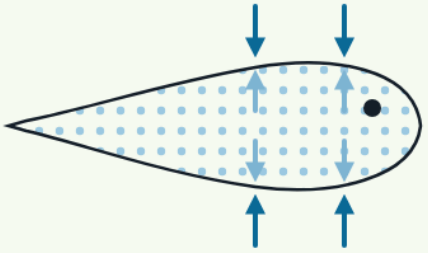
Surface fish at 1 atm: swim bladder full of gas



Same fish at 1,000 m (100 atm): gas squeezed
to 1/100 of its size, so the bladder collapses



Deep-sea snailfish: no swim bladder,
a body of water and jelly



Dark arrows: water pressing in.
Light arrows: the fish's own water pressing back.

C How deep-sea fish cope

1 Bodies made of water



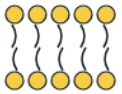
Water barely compresses, so there is nothing inside to crush.

2 TMAO keeps proteins folded



A small molecule that braces proteins. The deeper the fish, the more it carries.

3 Fats that stay liquid



Flexible cell membranes keep working in near-freezing, high-pressure water.

Why there is a limit: past about 8,200 m, the TMAO needed would make cells saltier than seawater, and water would flood in.

Remove the air, and the ocean has nothing to squeeze.

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