Dolphins maintain round-the-clock visual vigilance

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Dolphins have a clever trick for overcoming sleep deprivation. Sam Ridgway from the US Navy Marine Mammal Program explains that they are able to send half of their brains to sleep while the other half remains conscious. What is more, the mammals seem to be able to remain continually vigilant for sounds for days on end.

All of this made Ridgway and his colleagues from San Diego and Tel Aviv wonder whether the dolphins' unrelenting auditory vigilance tired them and took a toll on the animals' other senses? Ridgway and his team set about testing two dolphins' acoustic and visual vigilance over a 5 day period to find out how well they functioned after days without a break. The team publish their results on May 1 2009 in the Journal of

Experimental Biology.

First Ridgway and his colleagues, Mandy Keogh, Mark Todd and Tricia Kamolnick, trained two dolphins to respond to a 1.5 s beep sounded randomly against a background of 0.5 s beeps every 30 s. Ridgway explains that the sounds were low enough for the dolphins to barely notice them as they swam through their enclosure, but the animals sprung into action every time they heard the 1.5 s tone, even after listening to the sounds for 5 days without a break. Their auditory vigilance remained as sharp as it had been 5 days earlier.

Next Allen Goldblatt and Don Carder designed a visual stimulus to test the dolphins' vigilance while they continued listening to the repetitive beeps. Knowing that the dolphins' binocular vision is limited because their eyes are situated on opposite sides of their heads, Kamolnick trained one of the dolphins, SAY, to recognise two shapes (either three horizontal red bars or one vertical green bar) with her right eye before training her to recognise the same shapes with the left eye, reasoning that if half of her brain was asleep during testing, the dolphin would only see the shapes through the eye connected to the conscious half of the brain. But the team were in for a surprise when they began training SAY's left eye. She already recognised the shapes, even though her left eye had not seen them previously. Ridgway explains that the information must be transferred between the two brain hemispheres and suspects that the dolphin's inter-hemispheric commissures, which connects the two halves, may transfer the visual information.

Having trained both dolphins to recognise the shapes, the hard part began: monitoring and rewarding the dolphins continually over a 5 day period while the team tested the animals' responses to both the sound and visual stimuli. Amazingly, even after 5 days of listening out for 1.5 s beeps amongst the 0.5 s beep background, the dolphins were still responding as accurately as they had done at the beginning of the

experiment. The team also enticed the dolphins into a bay at night where they could be shown the horizontal and vertical bar shapes, and found that the dolphins were as sharp at the end of the 120 hour experiment as they had been at the beginning. And when the team checked the dolphins' blood for physical signs of sleep deprivation, they couldn't find any. After 5 days of unbroken vigilance the dolphins were in much better shape than the scientists.

More information: Ridgway, S., Keogh, M., Carder, D., Finneran, J., Kamolnick, T., Todd, M. and Goldblatt, A. (2009). Dolphins maintain cognitive performance during 72 to 120 hours of continuous auditory vigilance. *J. Exp. Biol.* 212, 1519-1527. jeb.biologists.org

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