Harbor seals' whiskers as good at detecting fish as echolocating dolphins

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Common Seal. Image: Wikipedia.

When a hungry harbour seal sets off in pursuit of a fish diner, the animal has a secret weapon in its tracking arsenal: its whiskers. Detecting hydrodynamic trails in water with their sensitive whiskers, seals easily track passing fish even in the most turbid conditions.

Wolf Hanke from the University of Rostock, Germany, explains that blindfolded seals can track passing mini-submarines for a distance of 40m before the wake peters out. However, the hydrodynamic trails left by subs are different from those produced by fish fins, so how long could a seal track a trail generated by a moving fin before the turbulence became too faint to follow? Hanke and his colleagues publish their discovery that the seals can pick up fin trails as long as 35s after the fin passed by on 11 June 2010 in The Journal of Experimental Biology.

PhD student Sven Wieskotten, together with Hanke, Guido Dehnhardt, Björn Mauck and Lars Miersch, decided to find out how 6-year-old Henry, a harbour seal living at the Marine Science Centre, Germany, would respond to ageing hydrodynamic trails. Isolating a section of calm water in a subsurface enclosure, Wieskotten and Hanke covered Henry's eyes with a blindfold and trained him to poke his head into the Perspex box a few seconds after they had swept a small rubber fin through the still water. Then they trained Henry to indicate which direction he thought the fin had moved by rewarding him with a tasty fish snack whenever he was correct.

After 2 months of training, Henry was ready to tell the team which direction he thought the fin was moving. Guided only by his whiskers, the team allowed Henry to swim into the enclosure 5s after the fin swept through the water and was delighted when Henry successfully identified which direction the fin had moved with over 90% accuracy. Gradually increasing the length of the delay, Wieskotten and his colleagues were amazed that even after a 35s delay Henry was able to tell them which direction the fin had passed with 70% accuracy. However, after a 40s delay, Henry lost the trail.

Curious to find out more about the fin's decaying trail, the team added microscopic spheres to the water and filmed them as they swirled through a plane of laser light. Analysing the particles' movements, they found spinning vortices producing jets of water that were very similar to those found in genuine fish wakes. Also, the wake became more dispersed as it decayed, covering a width of 20cm 5s after the fin swept past and expanding to 50cm 30s later. And when the team filmed the wake's interaction with Henry's whiskers, they could see Henry twitch his head in the direction that the fin had moved within 0.5s of the plume touching his whiskers. The wake only had to brush over the seal's whiskers for him to know which direction the fin had passed.

The team suspects that harbour seals sense the structure of the wake's vortices and jets to determine which direction a fin moved and is amazed that the animals can still detect a fin's motion over half a minute later. 'A fish can cover tens and hundreds of metres in that time, so vibrissae [whiskers] compare well with the performance of whales and dolphins by echolocation,' says Hanke.

More information: Wieskotten, S., Dehnhardt, G., Mauck, B., Miersch, L. and Hanke, W. (2010). Hydrodynamic determination of the moving direction of an artificial fin by a harbour seal (Phoca vitulina). J. Exp. Biol. 213, 2194-2200. jeb.biologists.org/

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