INSIDE JEB

Water traffic plays havoc with Lusitanian toadfish serenades

A Lusitanian toadfish (*Halobatrachus didactylus*) at low tide in the Tagus estuary, Portugal. Photo credit: Clara Amorim.

Which animals would you put at the top of your list of chattiest critters: crickets, bats, whales? Odds are there wouldn't be many fish on the list. But during spring, Lusitanian toadfish (*Halobatrachus didactylus*) suitors form choirs in Portugal's Tagus estuary to serenade the females, vibrating their swim bladders to produce a call, known as a boatwhistle, which sounds like a vibrating cell phone. 'Fitter males call more frequently and for longer periods and can also vibrate the swim bladder at faster rates', says Clara Amorim from Universidade de Lisboa and Mare-ISPA, Portugal, adding that males also listen in on each other to check whether anyone is intruding on their territory. But sadly, the males' performances are no longer conducted in hushed reverence. Revving motorboats and churning ferry propellors and engines fill the water with unwelcome noise, which made Amorim, Daniel Alves, Manuel Vieira and Paulo Fonseca, also from the Universidade de Lisboa, wonder whether human noise pollution is playing havoc with the garrulous fish's ability to communicate.

'We had previously measured how far toadfishes could communicate with each other. Now, we wanted to measure how much boat noise would reduce this distance', says Alves, who worked with local fisherman to collect the vocal fish. Once the fish were comfortable in the lab, Alves and Fonseca tested their hearing by playing boatwhistles, which were recorded at distances of 0.1–15 m, while logging the fish's brainwaves as they listened to the sound against a silent background. Then, the duo added the whine of an outboard motor or a rumbling ferryboat and rechecked the brainwaves, to find out whether the fish were still able to hear the serenades.

Unfortunately, the outboard motor almost completely drowned out the recordings of the males. One boatwhistle that had been clear up to 10.4 m away in absolute silence became inaudible over distances of more than 2.5 m and the range of another toadfish rumble fell to just 2.0 m. However, the ferryboat seemed to have less of an impact on the toadfish's hearing, cutting the range over which one boatwhistle could be heard by 4 m, to 6.3 m, while the other, which had been so badly affected by the outboard motor, could even be heard over slightly longer distances (6.7 m). Water traffic is clearly affecting the ability of these vocal fish to hear one another, but does the sound of passing vessels affect how harmonising toadfish croon together?

To find out, Vieira, Amorim and Fonseca crossed the Tagus to a quiet toadfish breeding ground, providing the serenading residents with 12 custom-built concrete nests, each equipped with an underwater microphone to record their boatwhistles as they settled into duetting with nearby males to attract females. In peaceful waters, the neighbours coordinated well, slightly advancing or delaying their responses to each other's calls depending on their proximity. However, when the scientists played recordings of passing ferries and motorboats to the courting males, the toadfish's coordination broke down entirely, with serenading duetters interjecting more randomly between their neighbour's timed rumbles.

'These results demonstrate that boat noise can severely reduce the distance at which the Lusitanian toadfish can communicate and affect how they produce sounds in their choruses', says Vieira, who warns that noisy human water traffic could dramatically affect the Lusitanian toadfish's love life.

10.1242/jeb.242830

Alves, D., Vieira, M., Amorim, M. C. P. and Fonseca, P. J. (2021). Boat noise interferes with Lusitanian toadfish acoustic communication. *J. Exp. Biol.* **224**, jeb234849. doi:10.1242/jeb.234849

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