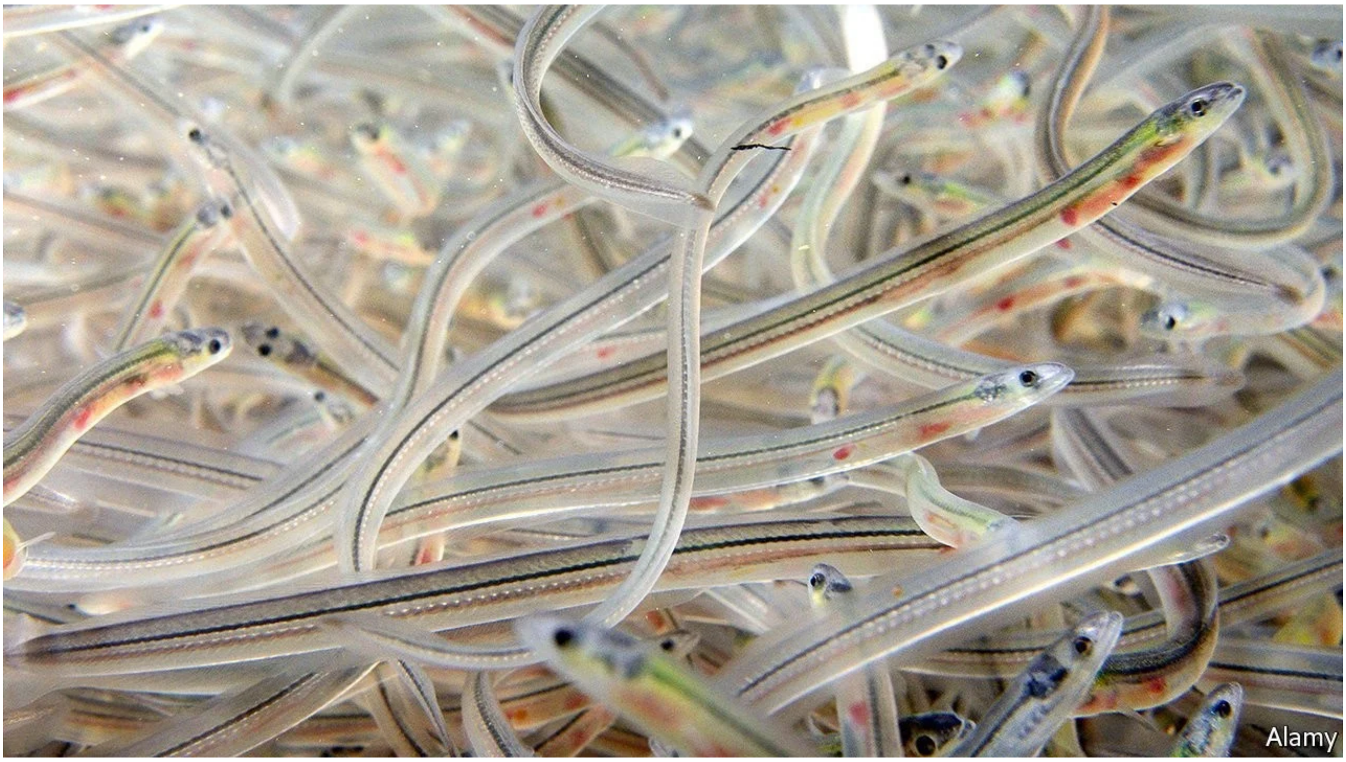
Eel migration

# Eels are guided by Earth's magnetic field

They can tell its strength as well as its direction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FROM ARISTOTLE to Sigmund Freud, eels' reproductive habits have puzzled observers of the natural world. In a life-cycle the opposite of a salmon's, they grow from youth to maturity in rivers and ponds and then go to sea to spawn. Exactly where they do this spawning, though, was a mystery—until, a century ago, a Danish marine biologist called Johannes Schmidt painstakingly trawled eel larvae from the depths of the Atlantic Ocean and found that they got smaller and smaller until he arrived at the Sargasso Sea, which thus seemed to be European eels' *fons et origo*.

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Subsequent work traced American eels to the Sargasso, too, while those from East Asia and some other parts of the Pacific spawn near Guam. Even with all this to go on, however, no one has yet captured a sexually mature eel from the wild, nor observed the species in the act of spawning. And there also remains the question of how adult eels, having left their riparian homes, find their way to these spawning grounds in the first place. To investigate that, Caroline Durif of the Institute of Marine Research in Bergen, Norway, has been studying eels' magnetic sense.

Dr Durif knew from previous work that, like many other animals which migrate long distances, eels can sense Earth's magnetic field. But the details were obscure. Her hypothesis was that the fish must be able to detect not only the direction of the field (as this previous work had shown they could), but also its strength—or "flux", to use the technical term. Since the flux of Earth's field varies with latitude, being weakest at the equator and greatest at the poles, flux detection would provide a way for European eels (for example), to know how far south they were. That, combined with their established ability to know the direction of north, would be enough for them to find their way back to the Sargasso by swimming more or less south-west.

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In a study published in *Fish and Fisheries* Dr Durif and her colleagues tested this idea by comparing geomagnetic flux with existing tracking data for five eel species. They showed that eel larvae do indeed travel to regions of higher flux (which tends to propel those from the Sargasso northward) while adults do the opposite. Her hypothesis is that eels retain both a memory of the flux at their hatchery and a

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If true, this has implications for eel conservation. A crash in the Baltic eel population, for example, led to attempts, which began in 2007, to replenish that body of water each year with incoming youngsters collected from the densely eeled Atlantic coast of France. The hope was that these transplants would flourish in their new home, to the benefit of local fisherfolk, and that those fish not taken by people or other predators would ultimately find their way back to the Sargasso to spawn future generations of European eels.

The success of the second of these aspirations is in doubt, however. Recent studies suggest that only 13% of transplanted eels manage to escape from the Baltic. If Dr Durif is right, that may be because, first, the fish have been confused by the sudden shift in magnetic flux caused by their enforced journey north, and second, being predisposed by their internal compasses to head south-west—an appropriate direction of travel to the Sargasso from France—they have been unable to find their way out of the Baltic through the Danish archipelago, which requires an initial detour north. Only eels that made this journey in reverse as youngsters will carry an instinct to go the right way. Most of the involuntary migrants presumably perish, frustrated, on the shores of Poland and Germany. ■

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