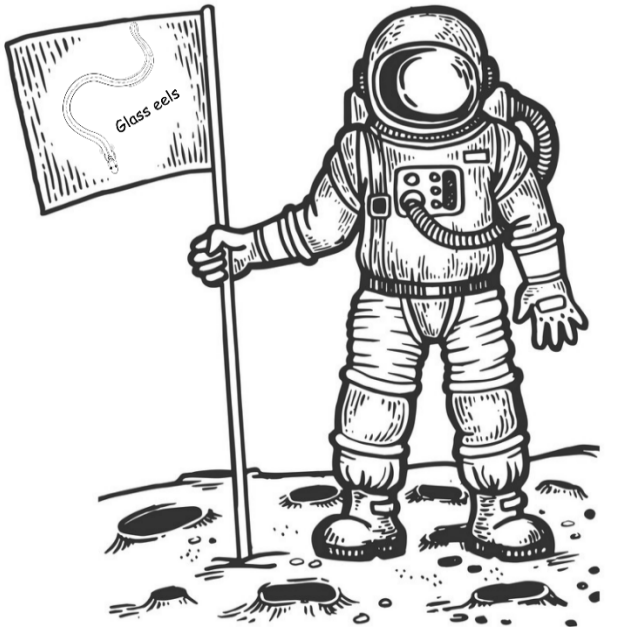
Institute of Marine Research, Norway

University of Miami, Rosenstiel School of Marine and Atmospheric Science, USA

Glass eels follow the moon across the sea

On the 50th anniversary of the first manned landing, scientists discover a new connection between the moon and the migration of glass eels.



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The European eel (*Anguilla anguilla*) migrates thousands of kilometers across the Atlantic Ocean; one of the longest and most challenging migrations undertaken by any animal. Eels hatch in the Sargasso Sea, far from the American and Bahamian coasts. A few-millimeters long, these leaf-shaped leptocephalus larvae drift with the Gulf Stream across the Atlantic until they reach the margin of Europe's continental slope. Here, leptocephali transform into completely transparent snake-like "glass" eels, which are a few centimeters long. Glass eels then swim over the continental shelf for hundreds of kilometers until they reach the coast. There, some of them recruit to estuaries and start their migration inland into fresh water where they grow into yellow eels and, after some years (sometimes 50 years or more), eventually into silver eels, which then undertake the long journey back to the Sargasso, where they spawn and then die.

How tiny glass eels manage to navigate across the continental shelf is still an open question. How do glass eels find their way?

To answer this question, a team of scientists at the Norwegian Institute of Marine Research's Austevoll Research Station, in collaboration with the Physical-Biological Interactions Laboratory at the University of Miami's Rosenstiel School of Marine and Atmospheric Science, investigated the possibility that the moon could play a role in guiding the migration of glass eels.

Eels spawn and alter their depth in the water column, their swimming speed and their activity according to the phase of the moon. However, whether the moon also serves as a directional cue during migration is unknown. In their latest research "The relationship between the moon cycle and the orientation of glass eels (*Anguilla anguilla*) at sea", published in the *Royal Society* journal

Open Science, the team revealed that the orientation direction of glass eels at sea changes according to the phase of the moon. Glass eels orient towards the direction of the moon azimuth at new moon, when the moon rises above the line of the horizon but is invisible to the eye of an observer.

Glass eels were observed in the Norwegian coastal North Sea using a transparent behavioral chamber (Drifting *in situ* Chamber, DISC, developed by Professor Claire Paris at the University of Miami) so that they could orient while drifting with the current. Tests were conducted during the 4 main lunar phases: full moon, third quarter, new moon and first quarter.

The team found that new moon is the phase during which glass eels orient towards the moon. This behavior is still present during first quarter but is less precise, and it disappears when the moon moves below the horizon. Thus, lunar-related orientation depends on both lunar phase and whether the moon is above or below the horizon. Interestingly, during new moon the average direction of the moon azimuth is South and glass eels swam (on average) to the South during this phase. “This could have important implications for the arrival of glass eels at the European coast. Over the European shelf, the main currents flow mostly East-Northeast, and swimming to the South would increase the chances of reaching land” says Alessandro Cresci, lead author of the study and a Ph.D. student at the University of Miami and a visiting scientist at the Norwegian Institute of Marine Research.

The authors hypothesize that global-scale disturbances in electrical fields caused by the motion of the moon around the earth may serve as a signal that glass eels can detect even when the moon is not visible. “During new moon, the moon is between the Earth and the Sun and, by deviating the sun’s radiation, creates a sort of electric “shadow” that is detectable at the Earth surface” says Cresci. The hypothesis that glass eels could follow electric fields is plausible considering that glass eels are very sensitive to electric currents. “We already knew that glass eels can do incredible things to orient during migration, such as using the magnetic field of the Earth, and lunar-driven orientation adds to the list of their ‘superpowers’” – says Cresci.

As Armstrong might say, That’s one small step for a man, but a super-gigantic leap for a glass eel!

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Institutional Media Contacts

Torny Aarbakke
Communications Director
Institute of Marine Research
Bergen, Norway
E-mail: torny.aarbakke@imr.no
Tel: +4790854462
Institutional Twitter account: @Havforskningen

Diana Udel
Director of Communications
University of Miami
Rosenstiel School of Marine and Atmospheric Science
Miami, FL, USA
Tel: +17862564446
Email: dudel@rsmas.miami.edu
Institutional Twitter account: @UMiamiRSMAS

Author Contacts and Biographies

Alessandro Cresci (Main contact - English and Italian)
Department of Ocean Sciences
Rosenstiel School of Marine & Atmospheric Science
4600 Rickenbacker Causeway, Miami, FL 33149-1098, USA
E-mail: alessandro.cresci@rsmas.miami.edu; alessandrocresci90@gmail.com
Tel. +1(786)602-2992
Twitter: @AlessandroCre90
Biography online

Howard I. Browman (Institute of Marine Research contact - English and French)
Institute of Marine Research
Marine Ecosystem Acoustics Research Group
Austevoll Research Station, Sauganeset 16, 5392 Storebø, Norway
E-mail: howard.browman@imr.no
Tel. +4798860778
Twitter: @HBrowman
Biography online

Caroline M.F. Durif (Institute of Marine Research contact - Norwegian, French and English)
Institute of Marine Research
Marine Ecosystem Acoustics Research Group
Austevoll Research Station, Sauganeset 16, 5392 Storebø, Norway
E-mail: caroline.durif@imr.no
Tel. +4797627269
Twitter: @durifcaroline
Biography online

Anne Berit Skiftesvik (Institute of Marine Research contact - English and Norwegian)
Institute of Marine Research
Marine Ecosystem Acoustics Research Group
Austevoll Research Station, Sauganeset 16, 5392 Storebø, Norway
E-mail: anne.berit.skiftesvik@imr.no
Tel. +4791866526
Biography online