

## Heading South or North: Novel insights on European silver eel (*Anguilla anguilla* L.) migration in the North Sea

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The European eel (*Anguilla anguilla* L.) is a catadromous fish species which migrates from coastal and freshwater habitats to the Sargasso Sea to spawn. During the last decades, recruitment of the European eel has declined by as much as 90 to 99 %, making it a critically endangered species according to the IUCN Red List. Various causes likely contribute to this decline, such as migration barriers, habitat deterioration, pollution, human-introduced parasites, fisheries and changes in ocean climate. To aid conservation and recovery of European eel stocks, the European Union adopted a Council Regulation (European Eel Regulation; EC no. 1100/2007) which imposes a management system that ensures 40 % escapement of the spawning stock biomass, defined as the best estimate of the theoretical escapement rate if the stock were completely free of anthropogenic influences. Consequently, unraveling the migration routes and determining the number of eels reaching the North Sea aids in evaluation of the regulation. However, exact migration routes and destination of European eel are still unknown. We explored European silver eel migration by acoustic telemetry in the North Sea. Within the LifeWatch observatory, a network of 163 permanently installed acoustic receivers is present since 2014 in Belgian rivers, canals, Schelde Estuary and the Belgian part of the North Sea. Cooperation between separate projects in Belgium, Germany and The Netherlands allowed us to cover a wide geographical range of this species. Eels were tagged with acoustic transmitters in four different river catchments in Western Europe and swam to the Dutch-Belgian coastal zone during their spawning migration. We are the first to observe southward migrating silver eels in the North Sea.

Therefore, we conclude that at least part of the Western European eels migrate towards the English Channel, in contrast with the Nordic migration route hypothesis (i.e. eels migrate over Scotland to reach the Atlantic Ocean). Different migration routes may have different bio-energetic implications: some routes may be energetically more demanding, leaving less energy for spawning. As such, management may need to focus more on areas where eels take an energetically favourable route and contribute more to spawning. Therefore, increasing our knowledge on marine eel migration contributes to achieving a sustainable eel stock management. The results also emphasize the importance of international cooperation in order to address these large-scale fish migration issues, and the efficacy of acoustic telemetry as a technique to track fish over large distances, including in coastal marine environments.

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