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TITLE: A century of research on the larval distributions of the Atlantic eels: a re-examination of the data

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ABSTRACT:

ABSTRACT The spawning areas of the Atlantic freshwater eels were discovered about a century ago by the Danish scientist Johannes Schmidt who after years of searching found newly hatched larvae of the European eel, *Anguilla anguilla*, and the American eel, *Anguilla rostrata*, in the southern Sargasso Sea. The discovery showed that anguillid eels migrate thousands of kilometers to offshore spawning areas for reproduction, and that their larvae, called leptocephali, are transported equally long distances by ocean currents to their continental recruitment areas. The spawning sites were found to be related to oceanographic conditions several decades later by German and American surveys from 1979 to 1989 and by a Danish survey in 2007 and a German survey in 2011. All these later surveys showed that spawning occurred within a restricted latitudinal range, between temperature fronts within the Subtropical Convergence Zone of the Sargasso Sea. New data and re-examinations of Schmidt's data confirmed his original conclusions about the two species having some overlap in spawning areas. Although there have been additional collections of leptocephali in various parts of the North Atlantic, and both otolith research and transport modelling studies have subsequently been carried out, there is still a range of unresolved questions about the routes of larval transport and durations of migration. This paper reviews the history and basic findings of surveys for anguillid leptocephali in the North Atlantic and analyses a new comprehensive database that includes 22612 *A. anguilla* and 9634 *A. rostrata* leptocephali, which provides a detailed view of the spatial and temporal distributions and size of the larvae across the Atlantic basin and in the Mediterranean Sea. The differences in distributions, maximum sizes, and growth rates of the two species of larvae are likely linked to the contrasting migration distances to their recruitment areas on each side of the basin. *Anguilla rostrata* leptocephali originate from a more western spawning area, grow faster, and metamorphose at smaller sizes of <70 mm than the larvae of *A. anguilla*, which mostly are spawned further east and can reach sizes of almost 90 mm. The larvae of *A. rostrata* spread west and northwest from the spawning area as they grow larger, with some being present in the western Caribbean and eastern Gulf of Mexico. Larvae of *A. anguilla* appear to be able to reach Europe by entering the Gulf Stream system or by being entrained into frontal countercurrents that transport them directly northeastward. The larval duration of *A. anguilla* is suggested to be quite variable, but gaps in sampling effort prevent firm conclusions. Although knowledge about larval behaviour is lacking, some influences of directional swimming are implicated by the temporal distributions of the largest larvae. Ocean-atmosphere changes have been hypothesized to affect the survival of the larvae and cause reduced recruitment, so even after about a century following the discovery of their spawning areas, mysteries still remain about the marine life histories of the Atlantic eels.

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