Advances in telemetry technologies have provided new opportunities to reveal the often-cryptic spatial ecology of anguillid eels. Herein we review 105 studies published between 1972 and 2016 that used a variety of telemetry technologies to study the movements of eels in a variety of habitats. Eight anguillid species have been tracked in three main geographical locations: Western Europe, the north-eastern part of North America and Australasia. Telemetry has proven to be an effective method for determining patterns of yellow eel movements in continental waters. It has also been used extensively to investigate the migratory behaviour of maturing eels as they leave fresh water to reach the sea. Among recent findings is the observation that downstream migration in continental waters is quite discontinuous, characterised by extended stopovers. Reconstructed migration routes in the open ocean obtained from satellite tags have provided indications of spawning areas, extensive vertical migrations and initial clues about the orientation mechanisms at sea. Telemetry studies have also revealed apparent evidence of predation by marine mammals and fish at sea, suggesting a significant natural source of mortality during the eel spawning migration. Finally, we discuss some limitations of telemetry technology and future directions, as well as associated challenges, to the developing field of eel spatial ecology.