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ORIGINAL PAPER

Large-scale movements in the oceanic environment identify important foraging areas for loggerheads in central Mediterranean Sea

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Abstract Loggerhead sea turtles (*Caretta caretta*) are known to display a wide range of movement patterns during the different stages of their life cycle, but empirical information to document this extensive behavioural plasticity is still limited. This is especially true for large, adult-sized individuals, that are thought to mainly forage in neritic areas. In the present paper, eight adult-sized loggerhead turtles were tracked using satellite telemetry to identify the location of their foraging grounds in the seas along the western coast of the Italian peninsula. Tracked turtles mostly stayed in the region between the Italian peninsula and the islands of Sicily and Sardinia, that was reached following quick, directed movements by the turtles from a release site to the north. In this area, two turtles took up residence in spatially limited neritic sites along the coast, while the remaining six alternated circumscribed coastal stays with long-distance, circuitous movements in the oceanic environment. An utilization distribution analysis clearly identified an area, mostly comprising oceanic waters, that was continuously used by turtles in different seasons and years. The present results contribute to the still-limited knowledge of the spatial ecology of loggerheads frequenting the Western Mediterranean Sea and highlight the presence of a potentially important oceanic region in the Southern Tyrrhenian Sea where adult-sized turtles forage for extended periods. These findings increase our knowledge of complex life history traits of loggerhead turtles and provide important information to be considered for evidence-based conservation measures.

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Introduction

Satellite telemetry has provided a wealth of information on the movements of marine turtles which is radically changing our view of turtle movement ecology and spatial behaviour. This is especially true for loggerhead turtles (*Caretta caretta*), whose original life history model (Musick and Limpus 1997; Bolten 2003), largely accepted until a few years ago, is being questioned (e.g. McClellan and Read 2007; Casale et al. 2008). According to this model, after an initial phase of pelagic living in the oceanic environment, late juvenile loggerheads recruit to neritic areas where they remain until adulthood, while adults are thought to shuttle between residential neritic foraging grounds and the breeding sites. This view has been challenged by satellite telemetry findings that have shown a large amount of behavioural plasticity in both juvenile and adult loggerheads. In particular, large juveniles have been found not to always reside in neritic zones, but were rather often shown to display prolonged movements also over oceanic waters (e.g. McClellan and Read 2007; Arendt et al. 2012a; Varo Cruz et al. 2016). Adults, too, have been sometimes observed foraging in oceanic zones while displaying wandering movements, either when tracked soon

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