

Atlantic puffin tagging report 2021, Skellig

Michael

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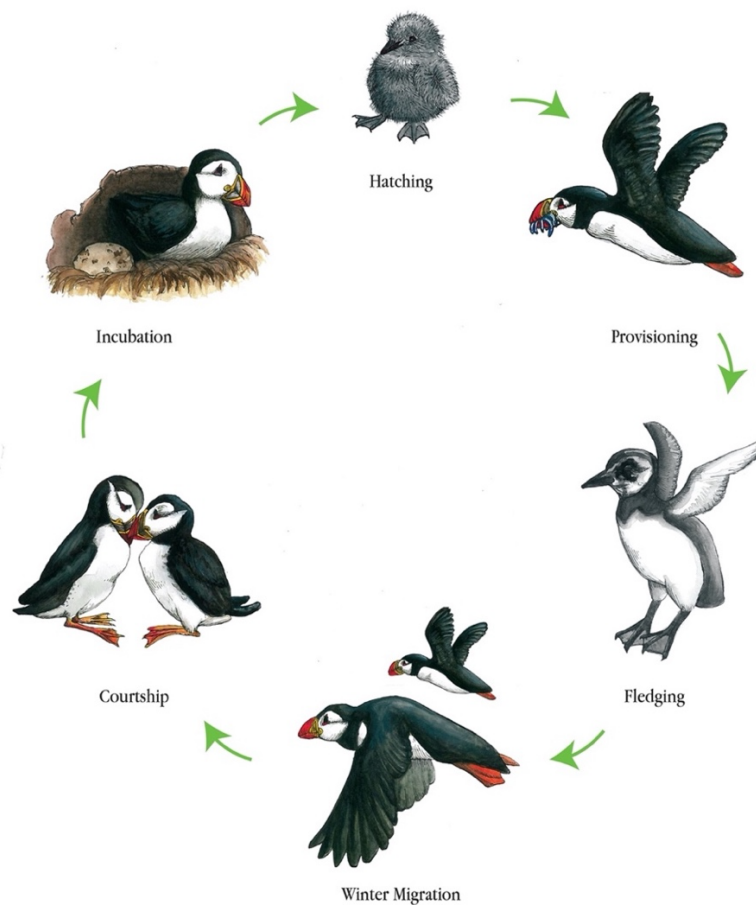


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Context

The Atlantic puffin (*Fratercula arctica*) is a seabird species found on several islands and high cliffs around the coast of Ireland. Puffins are typically monogamous and long-lived, with breeding delayed until 5 or 6 years old. A single egg is laid in early summer, which parents take turns incubating until it hatches, then taking turn provisioning the chick until it fledges in late July/early August. Once the breeding season is over, puffins migrate offshore until the next breeding attempt. Because of their low reproductive output, puffin populations are sensitive to impacts such as severe storms or oil pollution at sea, or invasive predatory species at the colony. In the 2000s, population declines led to the species being classified as Endangered in Europe by the IUCN. Despite the emblematic status of the puffin, our knowledge of their ecology in Ireland is limited, especially concerning their behaviour and distribution at sea.



Simplified life cycle of the puffin (credit: Terra Dawson)

Skellig Michael supports a large population of breeding puffins in addition to populations of Manx shearwaters, European storm petrels, northern fulmars, kittiwakes, razorbills and common guillemots. Skellig Michael's sister island, Little Skellig, hosts the largest gannet colony in Ireland with an estimated 35,000 breeding pairs (Newton et al 2015). Skellig Michael can support such numbers of seabirds due to its location on a productive expanse of continental shelf that benefits from shelf-edge upwellings from the nearby Porcupine Basin. Complex currents passing the peninsulas and islands of County Kerry act to congregate fish and plankton, further enriching the nearby habitat and increasing the availability of seabird prey.

Skellig Michael's cultural and natural heritage are often intertwined, with puffins, European storm petrels, and Manx shearwaters nesting in gaps in the stone walls, steps, and monastic structures. The number of visitors to the island is restricted to protect both natural and cultural features of the site. The regulation of visitors has helped keep the island free from rats and other introduced predators, which can quickly deplete breeding seabird numbers (Jones et al 2008). Tourists are restricted to well defined paths, which means that the natural burrows in the shallow soil are mostly safe from collapse from stray footfall.



Puffin burrows away from the stone steps are often quite shallow and would be liable to collapse were visitors given free reign of the island.

Ireland is required to expand its network of Marine Protected Areas (MPAs), with a process underway to identify, designate and manage new MPAs within the Irish Exclusive Economic Zone (EEZ). Ireland's marine area is expansive, varied and economically important. The allocation of MPAs must therefore be carefully thought out, and information on the at-sea distribution of seabirds is vital to ensuring newly designated MPAs are effective at meeting their conservation goals.

Tracking and acoustic studies

Aims and Methods

Having a better understanding of puffin spatial ecology during both the breeding and non-breeding periods is a key step towards improving conservation efforts for this species. As part of UCC research on seabird distributions, movement, and behaviour, we undertook fieldwork on Skellig Michael from 6th to 9th June and from 9th to 12th July 2021 with three major aims:

- To study the movements and fine-scale foraging behaviours of breeding adult puffins during the chick rearing period.
- To record the variety of sounds emitted and received inside and outside the colony by puffins in different environmental contexts.
- To describe the migratory behaviours and the areas used by puffins outside the breeding season.

To study the fine-scale movements and behaviour of puffins during chick rearing we deployed and retrieved 10 GPS tags (3.6 g, Nanofix, PathTrack) on breeding adults captured at burrow entrances. One of the adults was also equipped with an on-board microphone (4.5g, Edic-Mini, TS-Market), which unfortunately malfunctioned. A sound recorder (Song Meter SM4, Wildlife acoustic) was also placed in the colony to record the sounds made and received by puffins.

The study of puffins' movements outside the breeding season requires tags with a long battery life combined with a low weight. We used Global Location Sensors, or geolocators (1.5g, Lotek mk4083) that we attached to the legs of study puffins using a darvic leg ring. We successfully retrieved 14 of the 20 geolocators deployed in 2020, and at least two birds

equipped in 2020 were observed in the colony but evaded recapture. A further 20 tags were deployed with plans to recover these and any remaining tags deployed in 2020 during the 2022 breeding season.

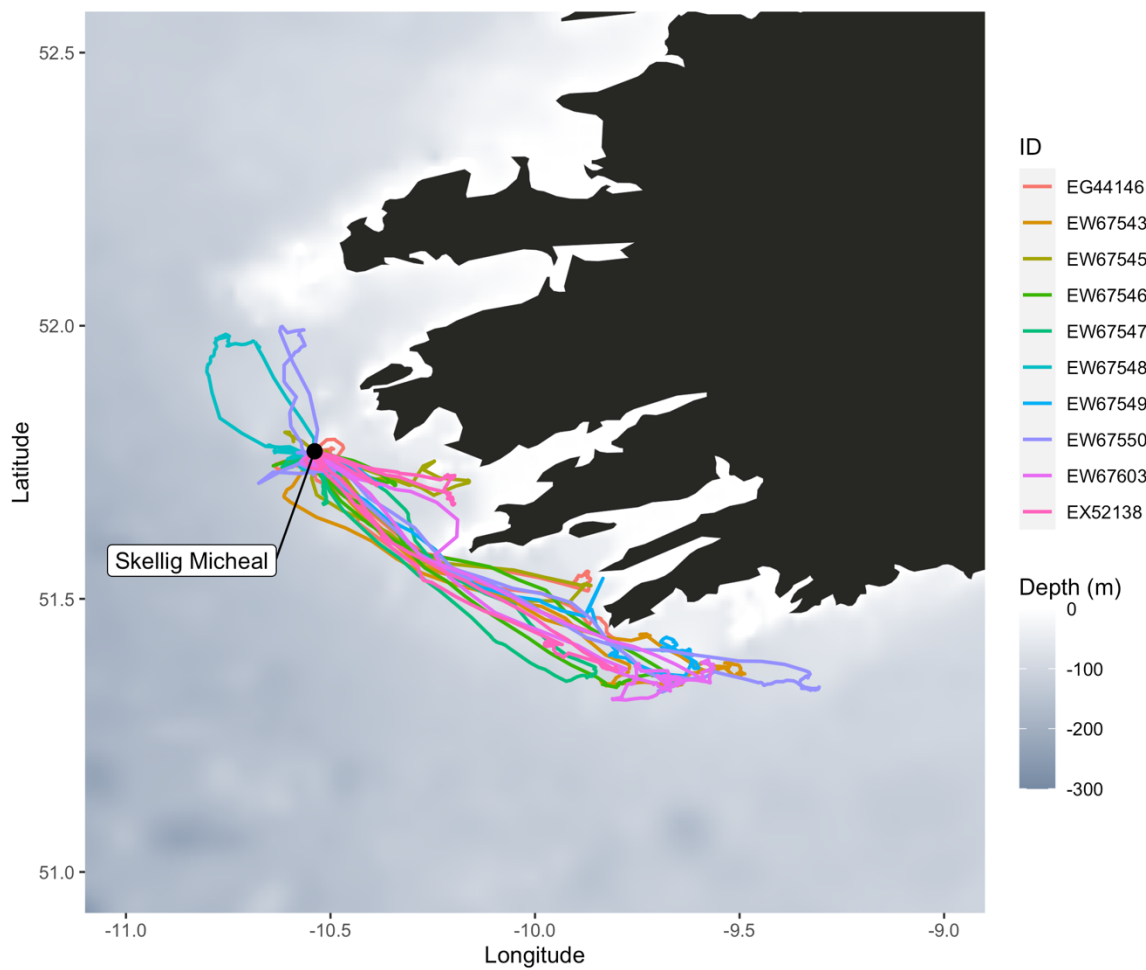
All bird capture, handling, ringing and tagging was approved by the UCC Animal Ethics Committee and conducted under licences issued by the British Trust for Ornithology and the Irish National Parks and Wildlife Service, with permission from the Office of Public Works who have responsibility for managing the site.



Puffin with a geolocator attached to a darvic leg ring.

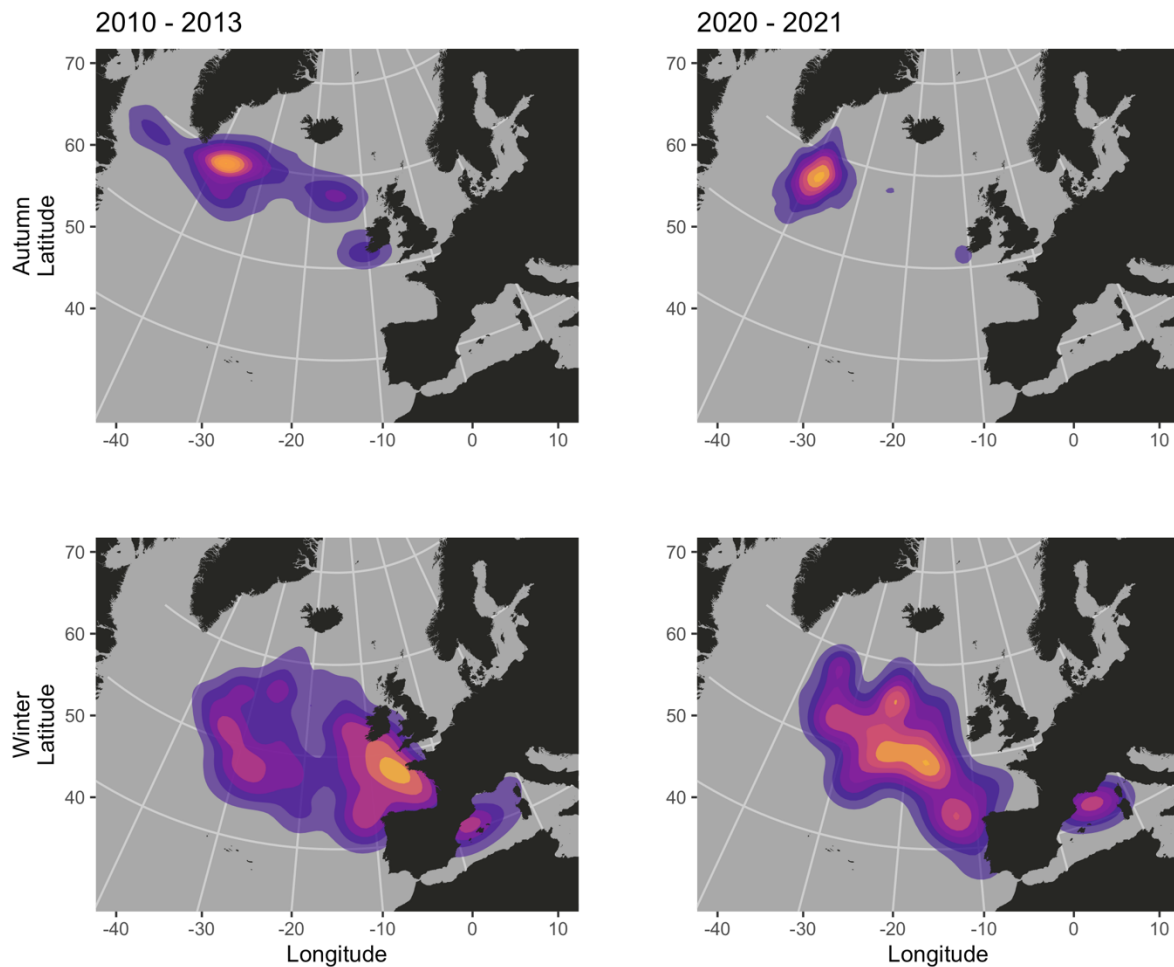
Results

We collected fine-scale data on the movements and dive behaviour of 10 puffins using GPS tags that provide accurate locations ($\pm 10\text{m}$) every 5 minutes. GPS-tagged puffins mostly travelled southeast from Skellig Michael and foraged coastally, including near the Fastnet Rock in Cork. Two individuals travelled northwards and foraged in the deeper waters outside Dingle Bay.



GPS tracks of 10 puffins from Skellig Michael. Their foraging range brings them far beyond the coverage of current Marine Protected Areas.

Geolocator tags are only accurate to ± 200 km, but the year-round data provide broad scale information on migration routes and overwintering distribution. Data from 13 tags successfully downloaded in 2021 show an overwintering distribution across the north Atlantic between September-February, with hotspots southeast of Greenland in the autumn, and more widely in the east Atlantic in winter. The distribution is comparable to tracking data collected from Skelligs in 2010-2013, although there are suggestions the fewer individuals travelled all the way across the Atlantic to the eastern coast of Nth America than previously that warrants further investigation.



The areas used by puffins from Skellig Michael in Autumn (top) and Winter (bottom). The maps on the left show areas used by puffins in 2010-2013, on the right are the areas used in 2020-2021. Though the overall migration pattern has remained similar, there has been a noticeable shift in areas used between the two periods.

Acoustic recorders were deployed to record the frequency range that puffins may perceive and use for social or foraging cues, and how they might be affected by noise introduced by windfarms. Data will be used to investigating potential impacts on seabirds from wind farm development under the EU funded X-Rotor project with analysis scheduled to commence in the winter of 2021.

Future work

There are currently 26 puffins equipped with geolocators due to return to Skellig Michael next spring for the breeding season. We aim to retrieve most of these in summer 2022, and as in previous years, this could be achieved with a small team over a single weekend. We also

successfully collected the first GPS tracking data from puffins breeding on Skellig Michael and gained important insights into the foraging ranges and behaviours during the late chick-rearing stage. Further work is required to collect data from earlier in the breeding season and replicate years to increase sample sizes and enable a robust analysis that can inform the Skellig Management Plan and aid designation of Marine Protected Areas for puffins in sensitive areas. To this end, we would like to explore the possibility of an extended stay on Skellig Michael in summer 2022 for a period of 7-10 days, around mid-June. We understand that we will not be able to use the builders' huts during the working week. An alternative arrangement could be to use the lower lighthouse for accommodation, as was the case for UCC's storm petrel census work in 2018. We understand that it would require more organisation on our part to make this space habitable for up to 10 days, and this is not an issue for us.

Acknowledgements

We would like to sincerely thank Fergus McCormick and the OPW for facilitating access to Skellig Michael and providing accommodation. Geolocator tags were funded by the SEATRACK programme, and support for fieldwork was provided by an Irish Research Council Postgraduate award with support from the Petroleum Infrastructure Programme. GPS tags and microphones were funded by the EU Horizon 2020 X-Rotor project.

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