Atlantic Puffin tagging report 2020, Skellig Michael

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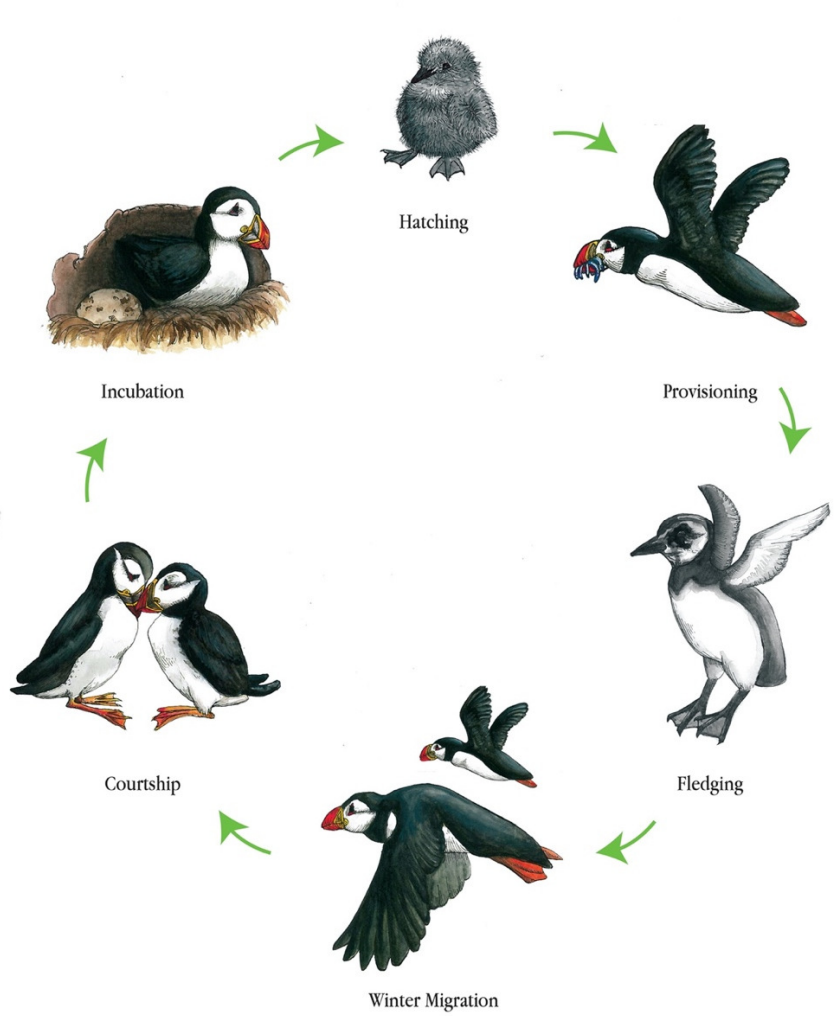
Context

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, rapid 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 population of breeding puffins in addition to populations of Manx shearwaters, European storm petrels, northern fulmars, kittiwakes 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.

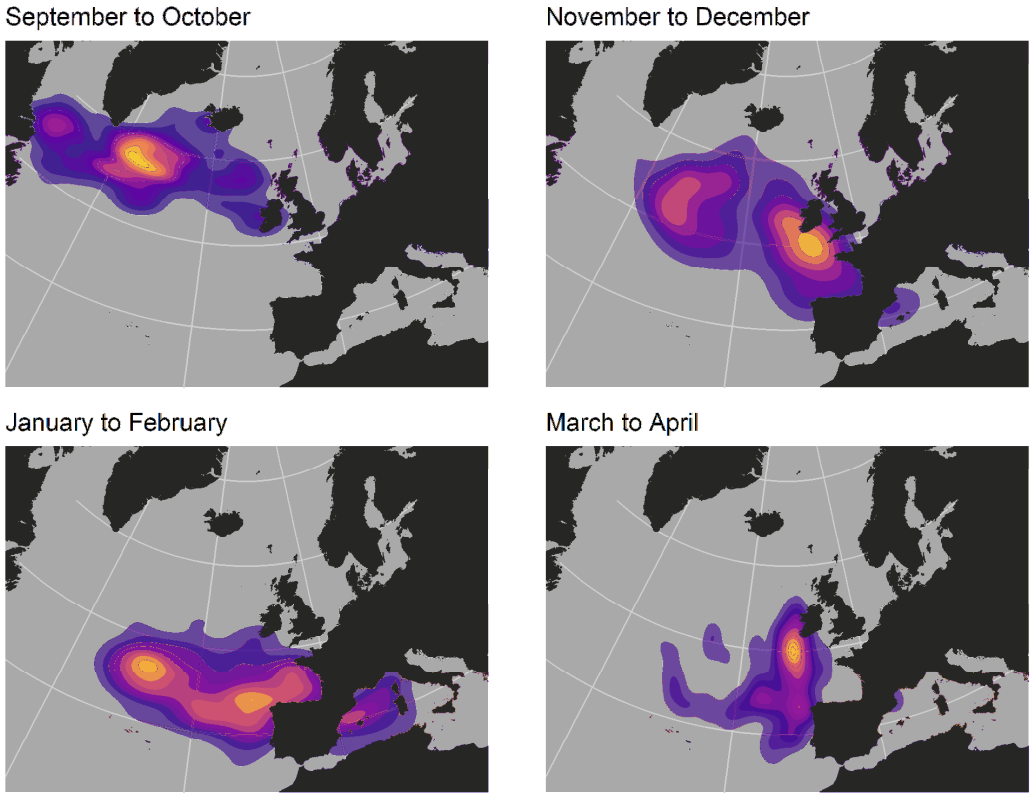
The Skellig Action Plan proposes how this site is managed, and is currently being reviewed, including proposals on systematic monitoring of seabird populations. Puffins are a burrow-nesting seabird making obtaining accurate estimates of population size difficult. No systematic census of puffins has been conducted on Skellig Michael, and previous estimates of population size are highly unreliable for monitoring purposes. A more rigorous approach for counting burrow-nesting seabirds has been recently developed by the Seabird Research Group in UCC (Arneill et al. 2019). Consistent monitoring of the Skellig Michael breeding puffin population would be hugely informative for the management of the site. However, puffins are also susceptible to increased mortality during the non-breeding season, making it important to understand the migration patterns of this species.

Puffin tracking

In recent years, the advent of biologging technology has allowed us to fill some of the knowledge gaps of puffin ecology. Geolocator devices, weighing 1-2g were first deployed on Irish Atlantic puffins in 2010, when researchers from UCC attached tags to puffins on Skellig Michael. These devices record light levels, and the location of the bird can then be inferred from the timing of sunrise and sunset. The level of error in these location estimates is high, but broad-scale movements can be determined.

Geolocator device on the left leg on a puffin on Skellig Michael

These first tagging efforts revealed that the Skellig puffins were travelling huge distances in the non-breeding season, with many individuals migrating across the Atlantic to the east coast of Canada (Jessopp et al. 2013). Puffins spent considerable time in the vicinity of the Mid-Atlantic Ridge, the Bay of Biscay and southwest of Ireland, with some entering the Mediterranean Sea towards the end of the non-breeding season. This was in stark contrast to the only previous geolocator study of puffins in the UK, which remained resident not far from the colony winter-long.



Distribution of Skellig Michael puffins at four different intervals over the non-breeding period. The purple to yellow gradient represents low to high densities of geolocator positions in an area. The northeast to southwest movement phase over the course of the non-breeding season can be clearly seen.

Data from Skelligs puffins were included in a study spanning puffin colonies across the North Atlantic (Fayet et al. 2017). This study showed that puffins from Skellig Michael travelled larger distances than their northern European and Canadian counterparts, which may compromise their fitness to breed successfully in the following breeding season. Such a long-distance migration is particularly costly for puffins as their wings have been adapted for swimming/diving, leading to a reduced efficiency in flight. As a result, the energetic demand of flight in puffins and closely related species is one of the highest of all aerial birds (Schraft

et al. 2019). Given the high cost of flight, long-term decreases in the availability of energy-rich capelin in the vicinity of the Grand Banks, and increasing frequency and severity of winter storms as a result of global climate change, there may be selection pressure to reduce the extent of overwintering migration.

Current work

In July 2020, UCC's seabird research group were permitted access to Skellig Michael to deploy geolocators on puffins to assess whether the overwintering migration once again. Tagging work was approved by the UCC animal ethics committee and conducted under permit from the National Parks & Wildlife Service and the British Trust for Ornithology. 20 devices were attached to leg rings on puffins. These will be retrieved over the next 2 summers, with a further 10-15 devices planned for deployment in 2021.

Details of puffins tagged with geolocator devices from Skellig Michael in 2020

Date	Time	BTO Ring	Colony	Weight
11/07/2020	09:40	EW67601	Skellig Michael	395
11/07/2020	09:52	EW67602	Skellig Michael	405
11/07/2020	09:58	EW66641	Skellig Michael	355
11/07/2020	10:07	EX52010	Skellig Michael	355
11/07/2020	10:14	EW67603	Skellig Michael	375
11/07/2020	10:15	EX52015	Skellig Michael	365
11/07/2020	10:20	EW67604	Skellig Michael	370
11/07/2020	10:26	EW67605	Skellig Michael	380
11/07/2020	10:35	ES56624	Skellig Michael	345
11/07/2020	10:35	EW67606	Skellig Michael	370
11/07/2020	10:40	EW67607	Skellig Michael	380
11/07/2020	11:30	EW67608	Skellig Michael	405
11/07/2020	11:36	EW67609	Skellig Michael	390
11/07/2020	11:42	EW67610	Skellig Michael	360
11/07/2020	11:53	EW67611	Skellig Michael	385
11/07/2020	12:07	EW67613	Skellig Michael	445
11/07/2020	12:12	ES56627	Skellig Michael	375
11/07/2020	12:30	EW67614	Skellig Michael	435
11/07/2020	12:35	EW67615	Skellig Michael	365
11/07/2020	13:30	EP66436	Skellig Michael	355

By exploring how distributions and broad-scale behaviours have changed between initial tagging efforts in 2010-13 and the present day, we can answer several questions:

1. Are puffins using the same wintering areas as they were a decade earlier?
2. When do puffins moult their flight feathers and are thus more susceptible to winter storms?
3. Are puffins adapting to decadal-scale oceanic changes, or is their range and distribution unchanging and based on intrinsic drivers?

An additional report on results will be provided to the Office of Public Works upon retrieval of tags in 2021-2022 and analysis of the data.

Funding

Geolocator tags have been funded by the Norwegian SEATRACK programme, and support for the fieldwork funded under an Irish Research Council Postgraduate award to Jamie Darby. The data we collect will contribute to a wider study investigating the winter distribution of puffins across the north Atlantic, providing important context for the Skelligs puffin population.

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