



Tawny Owls (*Strix aluco*) and the sunken forests of the North Sea

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Abstract

During the Mesolithic period, Britain was part of Europe through the existence of a substantial land bridge, which we know as Doggerland. This may explain the wide array of Tawny Owl plumage colourations and physical differences we have found in the museums whose counties border the North Sea i.e. Norfolk, Suffolk and Essex. In this paper we anticipate that the genetic composition of Tawny Owls in Britain is more complicated than is presently known. Further phylogenetic and vocalisation research is required on this subject.

Key words: distribution history; sub-species; *Strigiformes*; *Strix aluco*

Introduction

It was during the course of the last ice age, that many plants and animals of central and northern Europe, sought refuge in the south. Eventually the glaciation reached its peak, and the climate began to warm, and as it did so, then those species gradually moved north to colonize or recolonize the landscape.

At present it is believed that when Tawny Owls returned, they reached Britain by migrating across an ice sheet which extended from Denmark to Britain, and that further migrations probably took place on the south coast of England. Here we examine those proposals, and throw further light on this subject.

A brief description of the Tawny Owl

The Tawny Owl *Strix aluco* is a common and widespread species across much of Europe (Hagemeijer and Blair, 1997) with eight recognised sub-species (König et al., 2008). It is a polymorphic species with varying morphs of brown, grey and rufous individuals, as well as varying intermediates throughout its range.

Building on previous works, Voous (1988) was of the opinion that the Tawny Owl was going through a process of sub-species creation in Europe, and we have previously supported that view by suggesting that some of Britain's Tawny Owls may be in the process of forming a new sub-species (Martin and Mikkola, 2014).

At present, the nominate sub-species *S. a. aluco* resides east of a guideline from Norway through to the Mediterranean and the Balkans, while the sub-species *sylvaticus* lives in Britain, western Europe and down on through the Iberian Peninsula. Individuals of *sylvaticus* tend to be more boldly patterned than *aluco* with the trend more towards a rufous or brown colouration. Working on the knowledge that was available at that time, Mikkola (1983) was of the view that grey, light birds were notably the least common in Britain. However, our recent research into this subject has shown that birds of this colouration are more common than what was previously known. However, it is also clear that in Britain, at least, this is not the case everywhere (Martin and Mikkola in prep.).

In various locations across Europe, such as Bulgaria, Italy and Spain, there are different colour forms of grey and brown, living in various locations within the range of each sub-species. The colours may vary from light grey through to dark grey, then light brown to dark brown. According to (Galeotti and Cesaris, 1996) grey individuals live in the north of Italy and are considered to be of the race *S.a.aluco*, while rufous tawnies live in the south. In Spain, rufous coloured Tawny Owls are found in the north but around 60% of the Tawny Owls studied in the south of the country are grey phased individuals (Iñigo Zuerogoitia in litt.). A rare and very dark form, the so called 'Black Tawny Owl' (Nyagolov and Ignatov, 2003) occurs in parts of the Balkans, such as in the North Caucasus.

Tawny owls are above all else, owls of woods and forests. They will use a variety of nest sites but tree holes are favoured for breeding. It is recognised as one of the least mobile bird species in Britain and Europe (Wernham et al., 2002 and Hagemeijer and Blair, 1997) and there are no ring recoveries between the European mainland and Britain, with most recoveries in Britain being less than 20km from the place of ringing (Balmer et al., 2013). They also have one of the highest wing loadings of all European owls (Mikkola, 2013) as a consequence of which, the effort required to fly long distances, and especially across large expanses of water, where there are no rising air pockets, would leave them vulnerable.

After the ice

It was during the last ice age that many plant and animal species sought refuge in the southern parts of Italy, the Balkans and the Iberian Peninsula. During that time nearly all biological life was eradicated from central and northern Europe, including Scandinavia as well as the land mass that was to eventually become Britain. The Tawny Owl was not exempt from the effects of glaciation, and it too sought refuge in the aforementioned southern parts of Europe, waiting for the climate to warm, and the ice to recede. This it did do around 20-18,000 years bp (before present), and this had an interesting effect on a somewhat barren, though not infertile, landscape

In tracking the progress of Tawny Owls after the last ice age, Britto (2005) presented a complex and diverse trail of genetic interchange which suggested that those in Britain have their origins with the Balkans ice age refugia, with additional influence from Italy (Fig. 1).

This genetic trail is believed to have come to Britain through Denmark, and was considered to be the result of direct immigration across the North Sea area, with the later suggestion that they made the journey over the North Sea ice (Fig. 2). Additional genetic material, containing some Italian influence, is believed to have arrived in southern England, via France.

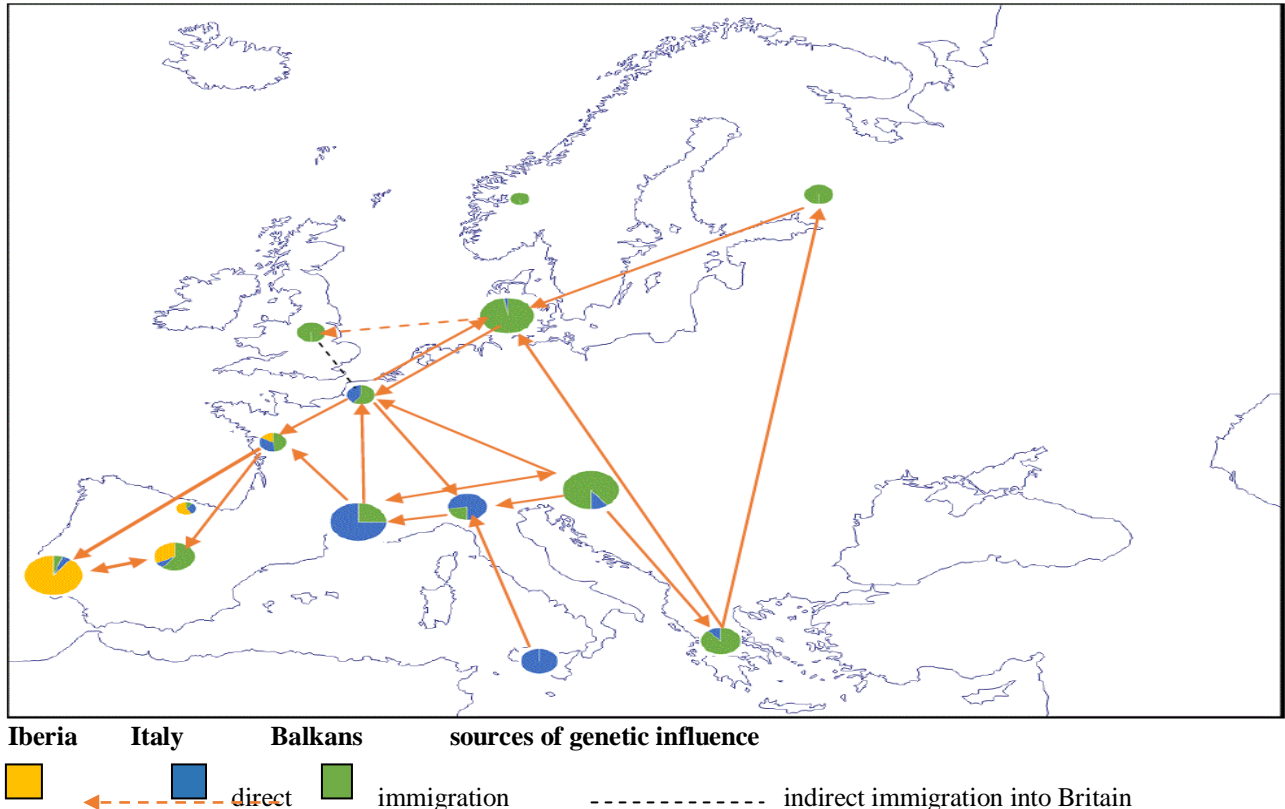


Fig. 1 Phylogenetic and interchange route map of the Tawny Owl across Europe from their ice age refugias. Arrows indicate suggested lines of post glacial integration, while dotted lines indicate direct lines of immigration and probable paths of migration to Britain. Re-drawn after Britto, 2005.

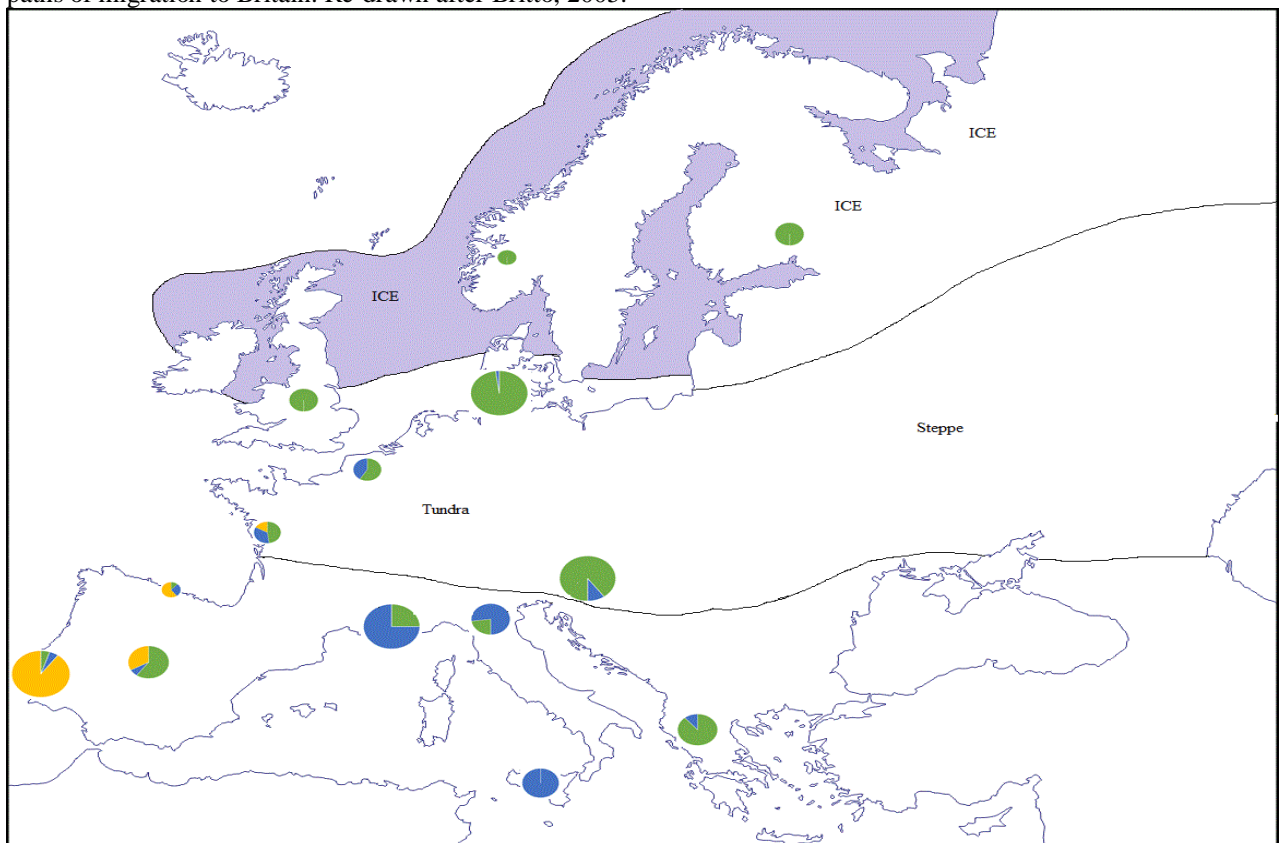


Fig. 2 The landscape of Europe as the ice retreated northwards. While a tundra landscape would have suited Snowy Owls, a countryside devoid of trees would not have suited the Tawny Owl. It is unlikely they would have colonised Britain over the ice pack as suggested. To the north, in Scandinavia, the Tawny Owl is a relatively new arrival, having first been recorded during the early parts of the 19th century. Re-drawn after Britto, 2007.

In constructing the phylogenetic route map for Britain's Tawny Owls, eleven samples from two locations in England were drawn upon, one of which was from Stoke-on-Trent (UK01), with a further ten (UK02- UK11) from Huntingdon, Cambridgeshire. In addition to this, König et al. (2008) later described a common ancestry between Tawny Owls (*sylvatica*) in Scotland and *aluco* in Germany, so clearly the subject is wider, and subject to further investigation.

No information was provided in Britto's analysis as to how Tawny Owls reached Norway in the post-Pleistocene era, and the origins of when they first appeared there is not clear. Based upon present knowledge, it would seem that the colonisation of northern Europe, ie Fennoscandia, appears to have taken place during the past few hundred years. In Finland the first record of a Tawny Owl was one that was shot on 14th December 1875 near Helsinki, while the first nest with eggs was discovered on 15th May 1878 near Turku (Collin, 1886), while in 1833, Magnus von Wright painted a Tawny Owl at Mörkö, near Stockholm. He wrote that the Tawny Owl was the most common owl in Sweden (von Wright, 1859), although his comments should, perhaps, be taken in context, as he lived in southern Sweden. However, the telling evidence for the presence of the Tawny Owl in Scandinavia is provided by Carl von Linné, who described the 'Type Specimen' from Sweden in 1758. At present there is no genetic link to Tawny Owls in Sweden.

We now examine ways in which Tawny Owls may have colonised Britain, and to investigate this subject, we have to go back to the end of the last ice age when in 18,5000 bp, the world sea level was 120m lower than what it is today. This meant that many areas of land which are now separated by sea water were once connected, and this included the British Isles and Europe.

In doing so, we point out that these genetic traces are not in question. However, we do feel that the effects of climate change, the subsequent Mesolithic landscape and the life-style of the Tawny Owl, when applied to this subject, is worthy of examination.

The making of the 'Wildwood'

At 14,000bp the sea level of the world was 100m less than present (Table 1), and Ireland and Britain were joined to the present land mass of Europe. However, around 11,700bp there was a sudden and dramatic rise in temperature of approximately 8° C, which took place over a period of little more than 50 years. This encouraged plants to grow at a fast rate, and in a period of around 2,000 years, a forest vegetation had emerged (Yalden and Albarella, 2009). This was the 'Wildwood', an extensive forest landscape which stretched out not only across much of Britain, but also across much of Europe. By using fossil remains, Yalden (1999) has shown that by 10,050bp, a fauna existed at Thatcham in Berkshire, England, which is similar to the present day fauna of southern Sweden and Poland.

This forest expanse included broad-leaved tree species such as ash, oak, elm and small-leaved lime, of which the oak and elm were the most important for Tawny Owls. This is because those two tree species have the ability to produce suitable nesting cavities, as a consequence of which, the owls would have tracked the spread of these trees, as they moved northwards.

The spread of oak *Quercus* as a forest tree, is important in this story, and Brewer et al. (2002) in describing the spread of oak from those three ice age refugias, point out that the colonisation process took place in two stages. The first was the inter-glacial period 13 – 11 thousand years ago, where the trees reached the central European mountains, before a stabilising and warmer climate that was favourable to deciduous trees, encouraged the oak to spread into northern Europe. In central and eastern Europe the spread was steady but slow, due to geographical barriers, but in the north-west the spread was rapid.

Using the Białowieża National Park in eastern Poland as an example of the former wildwood that stretched across much of Europe, Yalden and Albarella (2009) calculated that during the Mesolithic period, some 6,000 or more years ago, there may have been as many as 160,000 pairs of Tawny Owls living in Britain. The Białowieża National Park is an ideal habitat for Tawny Owls (Jędrzejewski et al., 1996).

Table 1		The timing of climatic induced events after the last ice age
Date		Comment
Before bp		
18,500		World sea level was 120m lower than the present day ¹
14,000		World sea level was 100m lower than the present day ¹
13,000		Ice melt over a 2,000 year period. ¹
11,000		Colder climate and tundra returns ¹
10,200		Glaciation ends ¹
10,050 - 9600	[Thatcham Berkshire. Fauna of temperate forest as found in modern day ¹
9488		Starr Carr, Yorkshire. fauna of Poland and southern Sweden ¹
9500		Land bridge between Ireland and West Wales broken ²
9000		World sea level 37m lower than present. Likely that England cut off from France. ¹
8000		World sea level 10m lower than present level. Xdramatic rise in temperature ³
7200		Land bridgebetween Denmark and Sweden broken ¹
7000		Land bridge between Britain and Europe broken. However, may have been before ¹
"		Britain almost covered in woodland as per Europe ⁴
6000		Woodland dominated by oak and lime ¹
5000		End of Mesolithic. Sea level near to the present ¹
Sources: ¹ Yalden, 1999 ² Cabot, 1999 ³ Proctor, 2013 ⁴ Maroo & Yalden, 2000		

As the ice continued to melt, the sea level continued to rise, so that by around 9,500bp the sea rose sufficiently enough to cut Ireland off from west Wales. Around 500 years later, the sea level was just 37m lower than what it is now, and part of the land bridge that existed between Britain and Europe was flooded and the land was drowned, though it is not clear how quickly this occurred and on what scale. There is a strong suggestion that the land was flooded due to a tsunami that was caused by a massive landslide on the Norwegian coast. However, opinions are divided on this subject and it may be that the land might not have completely drained, as it did after the devastating tsunami of Sumatra, on December 26th, 2004. The Norwegian tsunami was possibly the final act of a situation that had been developing for some while, and which left much, but not all, of the land submerged.

In around 7200bp the land bridge between Denmark and southern Sweden was broken (Yalden, 1999) but whether a temperate forest existed at that time, which was suitable for nesting Tawny Owls, is not clear.

While the case for a wooded land bridge between Britain and the European mainland now seems unequivocal, the existence of one between Ireland and Britain has never been fully resolved (Cabot, 1999), and it may be that it was the absence of such a feature, which prevented Tawny Owls from colonising Ireland (Martin, 2008). It is possible they did reach Ireland, but if so they were not able to establish themselves. Predators in the forms of Wolf *Canis lupus* and Pine Marten *Martes martes*, for example, and perhaps various aerial predators, such as Goshawk *Accipiter gentilis*, all of which were present at that time (Cabot, 1999), meant that ground nesting would have been a precarious business.

The sunken forests of the North Sea

It has long been known that a sunken forest, known as ‘Doggerland’, exists on the bed of the North Sea but until recently, the known expanse of this submerged land was restricted to an area that lies between the Lincolnshire and south Yorkshire coastlines, and Denmark. This was the famous ‘Dogger Bank’ that was once popular with trawler men in the 20th century due to the richness of the fish stocks.

In recent years, extensive research on behalf of the oil industry has been carried out by divers working alongside scientists from the University of St Andrews, in collaboration with others from Aberdeen, Dundee, Birmingham and Wales Trinity St David universities. Their research has revealed that a large land mass once connected Britain to Europe, and that it ran virtually the whole length of the North Sea and down to the English Channel. It started in northern Scotland and was present down to the ‘Channel Islands’, off the coast of north-west France, with the likelihood that this continued down to the northern coast of Spain. This was not just a flimsy land formation, but a substantial landscape, which was comprised of farmed fields and large forests, where many thousands of people once lived.

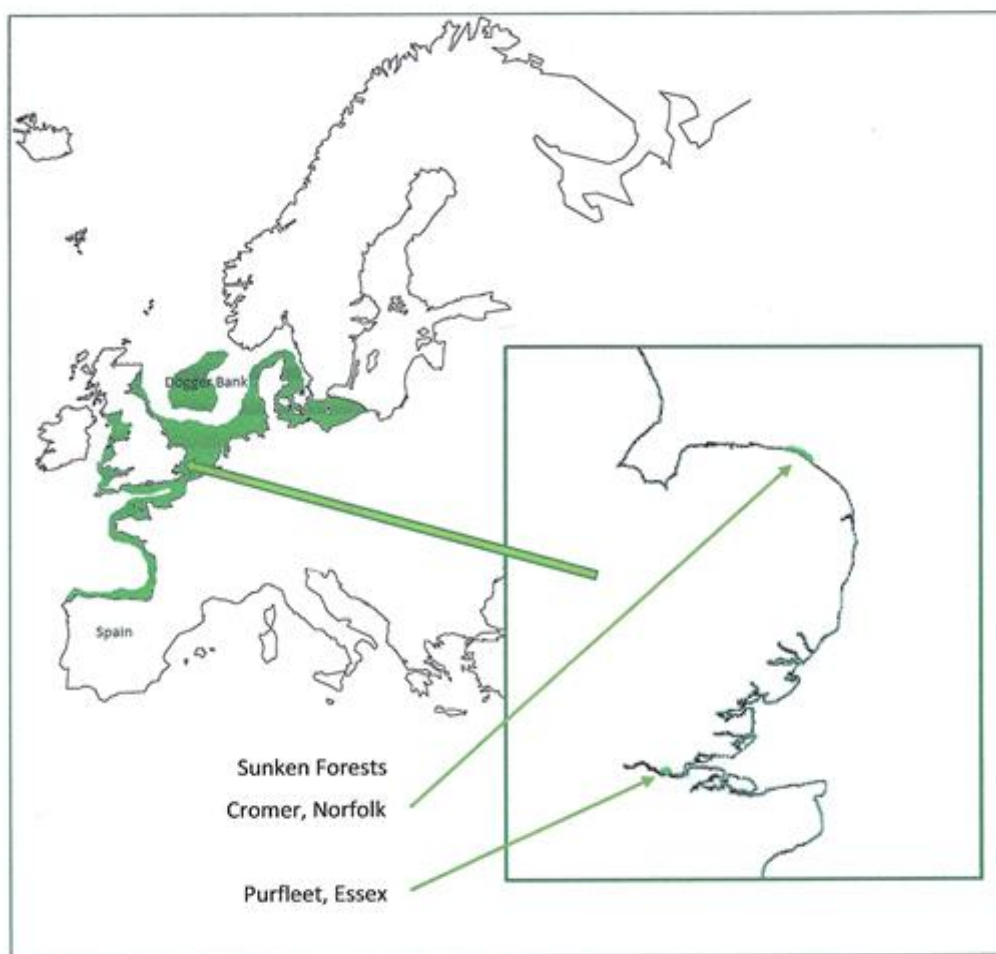


Fig. 3 A guide to the Doggerland of the North Sea around 9000 years BP, with the verified locations of two post Pleistocene submerged forests in the wider East Anglia. Around 10,000 bp Doggerland stretched out beyond the area shown in green, so that it was possible to walk from Britain, to Denmark, via ‘The Dogger Bank’. Some 18,000 years bp, the land stretched out west, beyond Ireland, and north nearly to Norway. Re-drawn from the December 2012 *National Geographic*.

More specific evidence that a sunken forest exists further south of the Dogger Bank emerged in 2014 (Fig. 3) when two divers came across some very large tree trunks lying at the bottom of the sea, 200 to 300 metres off the North Norfolk coast. These were revealed after the seabed was disturbed during the winter storm surges that took place earlier in that year. Provisional estimates suggest that these trunks are around 10,000 years old and are probably of oak. Film footage of the discovery revealed that some of the trunks have large holes, and the comment was made that they may have been suitable as nesting and roosting sites for medium sized birds.

To the south of Norfolk, at Purfleet, in Essex, there is evidence of a submerged forest dating back to the Holocene, some 6,000 years ago, which can be seen when the spring tides are very low (George, 2014). Further evidence of submerged landscapes exist in the Solent, off the south coast of England, at Hampshire and the Isle of Wight (Momber, 2000).

The evidence that Tawny Owls arrived in Britain before the separation from mainland Europe, comes from Yalden and Albarella (2009), who used archaeological mammal and bird remains to establish that they were here during the Mesolithic period (10,000 – 7,000 years ago). The colonisation of Britain by the Tawny Owl therefore occurred while Britain was part of mainland Europe, thus suggesting the likelihood of overland immigration through the forests that once existed.

It therefore seems reasonable to assume that there was not just one route for Tawny Owls to enter into the slowly emerging Britain as suggested (Britto, 2005; 2007); there were multiple points of entry with the possibility that immigration may also have come from northern Spain (Spinney, 2012), where there is a strong Iberian influence.



Fig. 4 Covehithe, Suffolk, 1998
Photo: Jeff Martin

It is likely other sunken forests lie at the bottom of the North Sea and the English Channel (www.eaareports) but the evidence for this lies some way out, and beneath the sandy beds. As a consequence of this, obtaining material evidence such as that from north Norfolk. Is a difficult procedure. The sandy coastal cliffs of Suffolk are being eroded at a fast rate. Calculations have suggested that over the past 2,000 years, land in many parts of East Anglia is being lost at the rate of a meter per year.

What is the present status of the Tawny Owl in Britain?

In our review of the Tawny Owl skin collections of Colchester, Ipswich, Norwich and Oxford Museums (Martin and Mikkola, 2014), and more latterly the skins held by the Essex Field Club (originally held in the Passmore Edwards Museum, Stratford, East London), we found a wide variety of colourations, examples of which are shown (Figs. 5 & 6). While a few of the skins were of locations outside of the realms of those museums, all were from southern England, and all were distant from the typical brown, or rufous colouring of *sylvatica*. The only museum where we found such skins, were those of two females in the Saffron Walden Museum, in north-west Essex.

There is such a bewildering mix and variation in the collection of skins that it is impossible to reasonably align them with existing known populations of *aluco* and *sylvaticus*. With the exception of the Saffron Walden specimens, our initial reaction to seeing these museum specimens was that these were more in keeping with grey colouring of the nominate race *Strix aluco aluco*. We assessed these against two typical grey specimens from different localities; Scotland and Finland (Fig. 7) and found little similarity. On photographic evidence, we found the markings of grey birds from Scotland and Finland were remarkably similar in appearance, but not identical (Fig. 7).



Fig. 5 Examples of contrasting colours and physiques at Colchester Museum 2014. Photo: Jeff Martin



Fig. 6 Examples of colour variation in museum skins from East Anglia Top: Colchester Museum: Date range. 1958 – 1979 and bottom: Ipswich Museum: 1915 – 1985. Photos: Jeff Martin



Fig. 7 Top: Brown and grey phase Tawny Owls from Finland and bottom a grey / brown phase Tawny Owl, Argyll, Scotland 2014. Photos: Ari Rantamäki (Finland) and Chris Griffin (Scotland).

In addition, there are indications that atypical coloured Tawny Owls are present elsewhere, such as this striking male (Fig. 8) which was photographed on February 2015, at Stoke on Trent, while the female is also variously coloured though not so distinctly. The male especially, is unlike any other described species of Tawny Owl that we are aware of. The facial disc is considerably different by being smaller and the amount of feathering that bridges the area of the inter-orbital septum, is very much narrower, while the feathers on the facial disc itself, are set out in narrow circular bands of alternating light and brown feathers. The eyes appear to be larger in comparison to the size of the facial disc, when compared to the female. The ends of the retrices would also appear to be atypical and especially those in the male. We found such a tail shape on a 'grey' bird at Colchester Museum (Fig. 9).



♂ Male



♀ Female

Fig. 8 A pair of Tawny Owls photographed in Stoke-on-Trent, England February 2015. The rufous female is more typical of the sub-species *sylvatica* but the male is not only very pale, the overall appearance is not conducive to that typical of the species. Photos: David Nixon



Fig. 9 Contrasting tail shapes, colours and patterns of Tawny Owls, Colchester Museum.
Photo: Jeff Martin

Discussion and Conclusions

The manner in which Tawny Owls are presumed to have colonised Britain from mainland Europe suggests they made the journey across the sea, but that scenario is open for scrutiny. Colonisation occurred before Britain was separated from mainland Europe, and is likely to have taken place due to the woodlands and forests which once existed in the historical Doggerland. This is something that could well have implications for other species in Britain and perhaps Ireland.

An inspection of county avifaunas reveals that very few mention grey Tawny Owls in their localities. In contrast, three major volumes from Norfolk, Suffolk and Essex (Taylor et al., 2001; Payn, 1978 & Wood, 2007) all mention grey forms of Tawny, with the one from Norfolk being the most extensive account to date.

Following the last ice age, the British Isles, including Ireland, formed part of the large European land mass. As the climate warmed a vast forest sprung up throughout much of Europe, so that by the time of the Mesolithic, some 8-9,000bp, much of Europe was a forested landscape. This was the so-called wildwood, an example of which exists in the Białowieża National Park in eastern Poland.

The separation of Ireland from what is now Britain, either took place before Tawny Owls were able to reach there, or through the absence of suitable nest sites. The possibility of ground nesting is an unlikely one, for in the presence of ground predators that would have been a precarious business. There are no archaeological remains of Tawny Owls in Ireland to suggest they once existed there, as there are in Britain.

During the Mesolithic period, Britain was part of Europe through the existence of a substantial land bridge, which we know as Doggerland, and which existed down much of the North Sea from Scotland to southern England. Working on underwater discoveries, experts now believe that a rich land consisting of farms, rivers and forests once existed there. However, at around 8,500 years ago, a rising sea level, and perhaps the result of a tsunami from a land slip on the coast of Norway, meant their eventual separation. Many thousands of people may have died during this event, and the land was covered by water including the forests. The remnants of those are now discovered from time to time, though rarely do they come to the surface. At Purfleet, in Essex, the remains of a forest dating back some 6,000 years ago can be seen when there is an exceptionally low tide.

It would seem therefore, that although Tawny Owls may have colonised the land that is now Britain through a defined route line from Denmark, there were substantial opportunities for additional colonisations through the forested areas of Doggerland from Scotland down to France. Within that, there may have been a variation of genetics which were likely to have been influenced by immigrations from northern Europe, including France, perhaps Belgium and Holland. A genetic link with samples from Germany and Scotland, tend to support that. There may also have been immigration from Spain, along the tree forested margins of Europe, and through to the Doggerland bridge.

Considering the likelihood that Europe's Tawny Owls are going through a period of sub-species formation, there may be isolated pockets of unknown populations within the wider European population that are yet to be discovered.

The wide array of Tawny Owl plumage colourations and physical differences we have found in the museums whose counties border the North Sea i.e. Norfolk, Suffolk and Essex, make assessment of Britain's Tawny Owls a difficult exercise. Bearing in mind that daylight calling by this 'strictly nocturnal' species, is a common phenomenon in some localities (Martin & Mikkola, 2014), then we can reach no other conclusion but to suggest that interesting things are going on with Britain's Tawny Owl population. We reach the conclusion that whilst phylogenetic analysis and route maps may form an interesting and useful outlook on the classification of the Tawny Owl *Strix aluco*, a geographical route map will sometimes reveal a different story, and pose alternative solutions and questions.

In doing so, we ponder the possibility that an unknown species, or sub-species, was lost when Doggerland was flooded. In addition to that, we also wonder what number of Tawny Owls once existed in the former sunken forests. The number that perished during the flooding must have been substantial. Based on the Mesolithic estimate for Britain by Yalden and Arberella, it might not be unrealistic to suppose that upwards of 50,000 pairs once existed in those now submerged forests.

If we accept that Britain has been separated from mainland Europe for at least 7,000 years, the possibility exists that the genetic composition of Tawny Owls in Britain is more complicated than is presently known. Therefore further genetic diversity and vocalisation research is required on this subject.

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