17th July

Memory Verse: **In the beginning God created the heaven and the earth**. Genesis 1:1

Something to read about birds[1]

Do you ever watch out for the comings and goings of birds that migrate? Migratory birds leave our country when the summer ends. They fly to warmer places in the world and come back again when it is time to build their nests, lay their eggs and raise their young. Swifts, swallows and martins are the most obvious examples of migratory birds although there are many more; even some insects migrate.

The Arctic Tern has the longest journey of any creature. This bird nests and raises its young up in the Arctic during the summer months. Then it flies all the way to the Antarctic. Of course, when it is winter in the Arctic it is summer in the Antarctic so the Arctic Terns have two summers and no winter every year. What a journey – about 43,500 miles in a round trip every year! But how do they accomplish this amazing journey? Do they fly non-stop? Where do they feed en route? What route do they follow? Until fairly recent times these questions had few clear answers.

In the 1960s scientists put small rings on the legs of some Arctic Terns. This enabled them to discover that on the journey south the terns leaving the Arctic in July and August follow the west coast of Europe and then West Africa arriving in the waters off South Africa in November. Scientists also used radar to "watch" the terns in the Antarctic and this led to the conclusion that they flew round the Antarctic in the early spring before starting back to their Arctic nesting grounds. But so much was still unknown, especially about the journey north from the Antarctic and the exact route these amazing birds take.

Then in 2007 Danish scientist, Carsten Egevang, decided to investigate. Technology had advanced since the 1960s and tiny loggers could be attached to the birds' legs that would not interfere with their flight or hinder their lives. The very best loggers would enable the researcher to monitor the birds' whereabouts as they flew but these were slightly heavier. Dr Egevang decided to use lighter weight loggers although this would mean more work for him. He tested the loggers out first using dummy loggers of the same size and weight to observe how the birds behaved with the loggers attached to their legs. They seemed to get along fine without being hindered. In the picture you can see a tern with a logger on its leg. These lighter loggers recorded and stored ambient light intensity measurements that are used to calculate information on sunrise and sunset. This information is combined with time recordings to give two daily geographical positions allowing migration routes to be mapped. Each logger would have to be collected and then downloaded to get the information back. Dr Egevang would have to catch each bird needed for his study, fit the logger and release it. That was quite easy. The hard part would come the following year when he would have to find and catch those same birds again, remove the loggers and download them on to his computer to read the results.

1 Photos, map and information from Egevang, C. 2010: Migration and breeding biology of Arctic terns in Greenland. PhD thesis. Greenland Institute of Natural Resources, Dep. of Arctic Environment, NERI, Aarhus University & Department of Biology, Center for Macroecology, Evolution and Climate, University of Copenhagen. Greenland Institute of Natural Resources & National Environmental Research Institute, Aarhus University, Denmark. Grateful thanks to Dr Carsten Egevang for allowing the use of this material.

Dr Egevang carried out his work on a barren island called Sand Island on the east coast of Greenland where many Arctic Terns nest. The birds were caught with a little wire cage trap that did not harm them, the loggers were fitted and the birds were freed. Now came the long wait. Would the birds return unharmed and how many of the loggers would he be able to get back? Finding the logged birds among the mass of terns was going to be difficult!

The following spring, Dr Egevang returned to Sand Island. Now came the difficult task. The only way to spot the logged birds was to spend hours gazing up at the flying terns. But the birds could not be caught on the wing so the watcher, when a logged bird was spotted, then had to keep his eye on the particular bird until it landed on the ground. This revealed the nest site of the logged bird and a wire cage trap could then be set as before to catch it.

At first it seemed an impossible task. But then on 16th July 2008 a bird was spotted with a logger on its leg. Following its flight to the ground led to the nest, a trap was set – and the logger was removed. You can see how delighted Dr Egevang was!

Sand Island is remote. It has no electricity supply. Dr Egevang's office was many miles away across the sea in Denmark. He would have to wait until he had collected all the loggers he could before he would know if any of them had worked properly. Did he have the information he needed for his study or not? He would not know until he returned to Denmark.

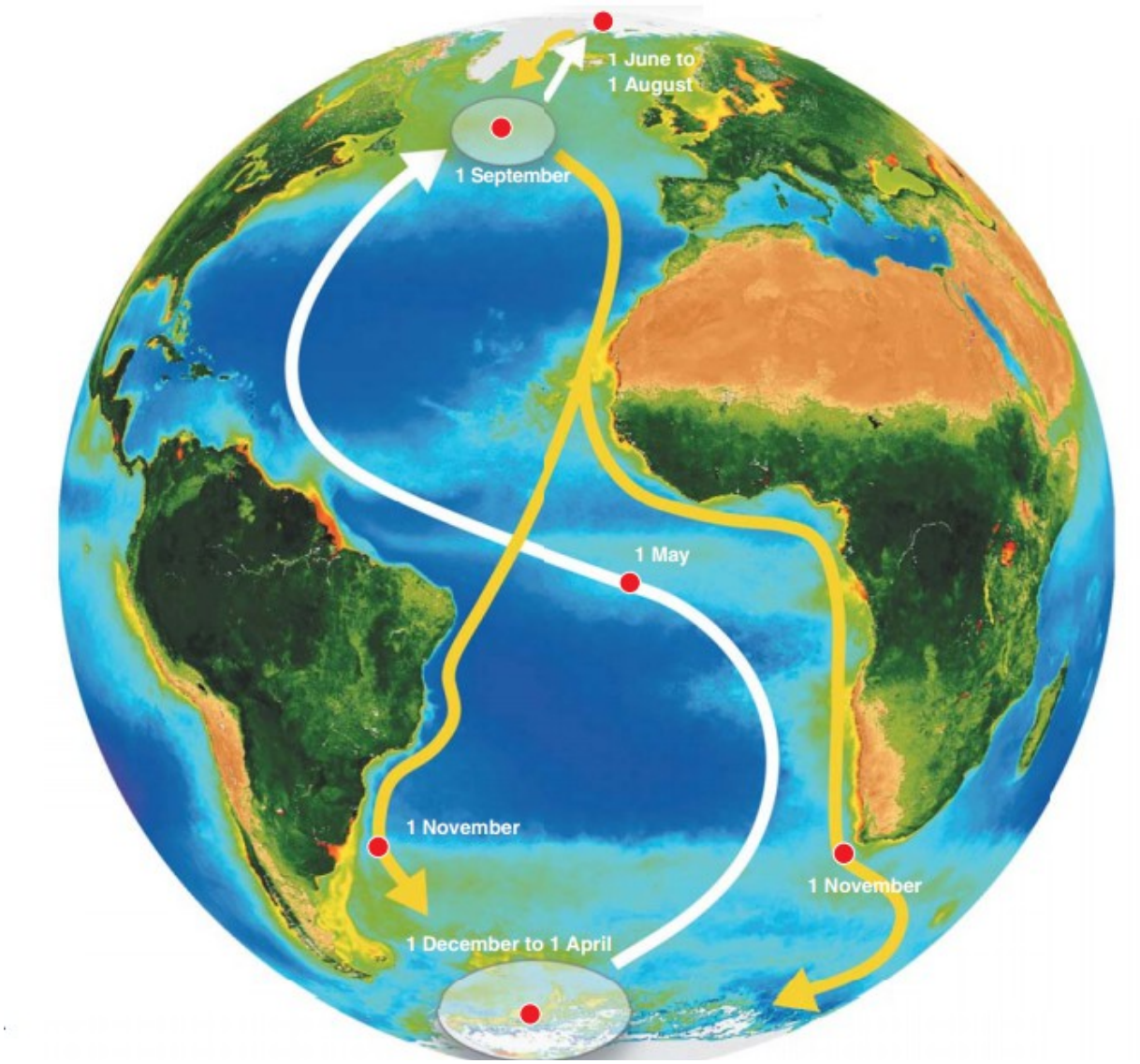
In the end eleven loggers were recovered. At the end of the summer, back in his office, Dr Egevang plugged the first one into the computer. The list of locations began to scroll down his screen; it had worked! Every day of the tern's flight had two geographical locations listed; one at sunrise and one at sun set. His experiment was going to work!

Map Work

By combining the data from all the recovered loggers, Dr Egevang was able to make a map that you can see on the next page. He could see where the terns had stopped for food on the way and how their return journey differed from the outward route. Study the map carefully. What differences can you spot? What about the length of time taken – is there a difference between the northbound and southbound journeys?

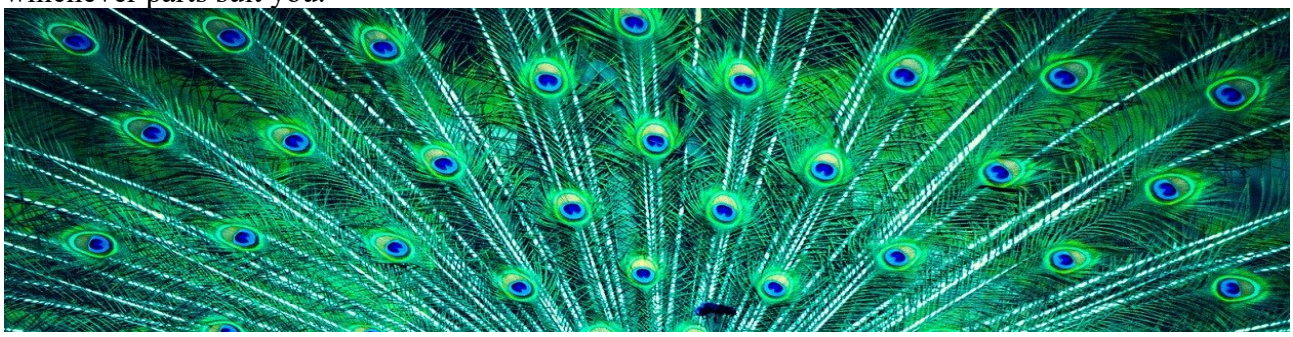
The information from the loggers showed that the birds stop in the centre of the North Atlantic Ocean for about 25 days in September before carrying on southwards. You can see the place marked on the map – all the terns' stopping points are marked with red dots. Dr Egevang looked at information from satellite pictures of the earth which showed where chlorophyll was most abundant in the earth's oceans. Plenty of chlorophyll means there is a lot of biological activity going on in the water, in other words, plenty for the terns to eat. The area where they stopped in September was very high in chlorophyll and areas further south were lower. The terns knew exactly where to stop to fuel up for the rest of their journey! The map has areas of abundant chlorophyll in the sea

coloured turquoise/green/yellow to indicate relative levels of chlorophyll and you can see that the terns' migration routes take these carefully into account.[2]



Something to make

The ability to migrate is only one of the many gifts with which God has endowed birds. Another stunning example is the peacock's tail with its many “eyes” that appear to stand still while the rest of the tail moves when the peacock “rattles” his tail.[3] Today's optional resources files include a craft mini-project on peacocks from the *Mothers' Companion* which is included complete for you to use whichever parts suit you.



2 If you are interested in migration https://www.youtube.com/watch?v=gxUiaLNuhhM is an interesting talk by Prof Andy MacIntosh on the subject.

3 You can read about it here: https://creation.com/peacock-eyes-that-hypnotize.

Something to write about

"The cry of the Arctic tern is for many in Greenland the ultimate sign of the end of a long winter and the onset of summer, the return of the sun and warmer temperatures."[4] Write down some things that mark the change of seasons for you – sounds, sights, smells....

A story to read

Hans Andersen's *Thumbelina* goes well with today's lesson as a migrating swallow is central to the story – and of course, Andersen was from Denmark like Dr Egevang! I have included a version of the story in the optional resources files.

4 Egevang, C. 2010: Migration and breeding biology of Arctic terns in Greenland. PhD thesis. Greenland Institute of Natural Resources, Dep. of Arctic Environment, NERI, Aarhus University & Department of Biology, Center for Macroecology, Evolution and Climate, University of Copenhagen. Greenland Institute of Natural Resources & National Environmental Research Institute, Aarhus University, Denmark. P15.