

Every egg is different

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Female pectoral sandpiper. Image: Wolfgang Forstmeier

Migratory birds have to allocate their resources for reproduction in an efficient way in order to commence breeding shortly after arrival. Researchers from the Max Planck Institute for Ornithology in Seewiesen studied pectoral sandpipers on their breeding grounds in northern Alaska. Using stable isotope mass spectrometry they found that the birds applied different resource allocation strategies for reproduction.

Females arriving early at the breeding grounds utilize resources for egg production that they acquired at stopover sites, whereas later breeding females mostly relied on nutrients from local food sources. Moreover, early arriving females apparently came from wintering sites in northeastern South America and thus traveled shorter distances than their conspecifics from further south (*Journal of Avian Biology*, September 9, 2010)



Migratory birds need a considerable amount of energy to cope with the efforts that are associated with such a long journey. Upon arrival, with the start of the breeding season, they face another strenuous time. The resources females allocate for egg production may either come from body reserves that originate from a period before breeding or from food sources at the breeding grounds. At high latitudes the breeding season is rather short and birds have to get ready quickly. Thus, it was hypothesized that arctic migratory birds build up their energy resources before their arrival at the breeding grounds as food abundance might still be scarce there. A team of scientists from the Max Planck Institute for Ornithology has now shown that female pectoral sandpipers (Calidris melanotos) that breed in northern Alaska apply a mixed strategy to allocate resources to their eggs. They found that early breeding females indeed use resources for egg production that stem from stopover sites along their migratory route, whereas females that started breeding later in the season gathered these resources predominantly at the tundra breeding ground.

By means of an isotope ratio mass spectrometer, the scientists studied different isotopes in the diet and the tissue of the birds to determine the origin of the accumulated resources. Using the distribution of stable carbon and hydrogen isotopes they could reveal when those elements had been incorporated through the diet. First, it was found that the values of the stable carbon isotope C13 in blood plasma of females, but also in feathers and claws, were different from those of their chicks. Moreover, the chick values showed an isotopic signature that was clearly different from the local diet.

From this observation the researchers concluded that the resources for egg formation could not originate from nutrients of the breeding area. Interestingly, isotopic values of female red blood cells matched those of the offspring, suggesting that resources were acquired somewhere along the migratory route. The wintering site as origin could be excluded,



because in this case the red blood cell values should correspond to those of claws and feathers (assuming that birds moult in the wintering site). "The stable isotope analysis allowed us to confirm the hypothesis that body stores of migrating sandpipers are acquired at stopover sites along their migratory routes. This finding emphasizes the importance of these stopover sites for the well-being of the population", explains Bart Kempenaers, director at the Max Planck Institute for Ornithology in Seewiesen.

The data analysis revealed another surprising result. As the breeding season progressed, the isotopic values of females and chicks became more similar to those of the diet. This means, females that started egg laying later in the season mainly used dietary items from the breeding site, such as crane fly larvae and oligochaetes, as resources for egg production. "It suggests that pectoral sandpipers adopt different strategies for resource allocation according to their arrival time and the start of breeding", argues Elizabeth Yohannes, first author of the study. But the question remains why some b

irds arrive earlier than others. Again, this could be answered with the help of stable isotopes. When the researchers analysed the hydrogen isotopic composition from feathers of female pectoral sandpipers, they found that these values corresponded closely to those of precipitation in northeastern South America. Presumably, birds overwinter in different areas (where they also moult their feathers), and those that start off from northern South America migrate shorter distances and therefore, arrive at the breeding ground in Alaska earlier than their conspecifics that start further south. However, details on the routes and timing of migration, and whether the different breeding strategies have an impact on the reproductive success of pectoral sandpipers are still unknown.

More information: Elizabeth Yohannes, et al. Resource use for reproduction depends on spring arrival time and wintering area in an



arctic breeding shorebird *Journal of Avian Biology*, Published on (doi: 10.1111/j.1600-048X.2010.04965.x)

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