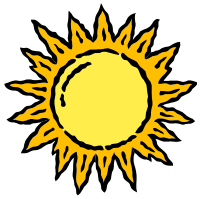
ScienceWatch – Look For The Setting Sun Before You Go



The ability of birds to fly hundreds even thousands of miles during migration and unerringly find their way is astonishing. Reports abound of the same bird returning to nest in the same tree year after year. So how do they do it? Many investigators have tried to figure out what cues are used by birds as they migrate. By manipulating possible navigational signals, experimenters have provided various answers. These studies have by necessity been done in the laboratory on captive birds. For example, after exposure to an altered magnetic field or plane of polarized light* a bird is placed in a cone-shaped enclosure with ink at the bottom so the bird's feet make a record of the direction of each attempted takeoff. These laboratory results show that birds may use a compass system based on the sun, stars, the earth's magnetic field or they may use landscape cues to guide them. But the relative importance of each cue during actual flight has remained unresolved. Now in a groundbreaking study done in the field three scientists have shown what night flying thrushes actually use to navigate in the wild.

William Cochran from the Illinois Natural History Survey, Henrik Mouritsen at the University of Oldenburg in Germany and Martin Wikelski at Princeton University teamed up to chase dozens of night flying birds across the U.S. Midwest and have published the results of their nighttime escapades in the April 16, 2004 issue of the journal *Science*. They used radio tracking to follow naturally migrating Swainson's (*Catharus ustulaus*) and gray-cheeked thrushes (*C. minimus*) during spring migration. On clear evenings birds that stopped over in the Illinois woods were netted, fitted with tiny transmitters, placed in outdoor cages and subjected to an artificial magnetic field rotated $70^{o} - 90^{o}$eastward (clockwise) from magnetic north. Treatments were done after sunset when the sun was below the horizon and could no longer serve as a cue. Control birds were also fitted with transmitters but not exposed to an artificial magnetic field. All birds were released the same evening they were captured and untreated birds continued their northerly migration into Wisconsin.

Thirteen of the gray-cheeked thrushes were exposed to the clockwise change in magnetic field. Five flew off and stayed in nearby woods, while eight continued their migration the same night. However, instead of continuing on their normal northerly flight they flew in a **westerly** (counterclockwise shift) direction the entire night that was the mirror image of their exposure. If the stars dominate their flight, they should have continued on their normal course. If the magnetic compass dominates, they should have turned easterly based on the treatment. The fact that their flight was deflected westerly can only mean they use a magnetic compass that is calibrated by the setting sun. In other words, they select a flight direction using the setting sun and then fly by a magnetic compass in the dark. The birds that didn't fly the first night, but continued their migration on the next evening after treatment support this hypothesis. They flew in the normal northerly direction because they saw a sunset after their exposure, which allowed them to recalibrate their compass.

Similar results obtained with Swainson's thrushes make it apparent that the birds calibrate their magnetic compass at each sunset. All five Swainson's thrushes exposed to the altered magnetic field after sunset continued migrating that night, and their flight path was similarly deflected in a westerly (counterclockwise shift) direction. However, on the second night following treatment they all corrected their course and headed in the normal northerly direction because now they could recalibrate their compass at sunset.

These results would also explain why birds do not become disoriented when crossing the equator. If a bird only depended on the inclination of the magnetic field lines, which become steeper at both poles, it could easily reverse direction when near the equator and not know it. But daily calibrations at sunset would keep it on the right track. So as you watch your favorite migrant raising its young consider the remarkable global positioning system it has developed in order to return to you each year.

Saul Scheinbach

*Unpolarized light waves hit your eye in every possible plane of 360^{o} like the spokes of a wheel. Polarized light consists of light waves all oriented in one plane like removing all the spokes but one. Animals that can detect the plane of polarization of light always know the sun's position, even on cloudy days.