<u>The Science of Migration</u>:
The Whys and Hows of Birds on the Move

Arctic Terns have been piling up frequent flyer miles since the Ice Age, over 20,000 each year for an individual bird, on their round trip from the high Arctic to the southern tip of South America and as far south as Antarctica. A banding study of sanderlings in Clatsop County found a winter range extending to Chile, Peru and the Galapagos Islands. Some plovers and godwits fly over 2,000 miles nonstop. Other birds migrate at an altitude of 20,000 feet, cruising close to 50 mph. Why? Why not stay in a warm, comfortable spot and avoid the rigors and risks of this annual journey?

The biggest reason is food. Birds need to intake enough calories to produce plenty of internal heat. This becomes difficult for species that feed in water that freezes in wintertime; so too insect consumers find their supply limited. Seasonal migration enables birds to avoid the stress of adverse climates and to exploit food that is available for only a limited time. Our coast's summer upwelling brings cold, nutrient-rich water. Together with the explosion of insect life, this area is an appealing stopover or breeding location, especially compared to an overcrowded and highly competitive tropical forest.

What we think of as "our" birds are more accurately southern tropical species that make a brief foray north to breed. Attracted by a productive ecosystem and the longer periods of daylight found in higher latitudes in which to gather food, seasonal migration probably evolved as a means to ensure optimal reproduction.

While most birds stop regularly to rest and refuel, some shorebirds and waterfowl undertake 80 to 90 hours of continual flying. This has been called the "greatest physiological feat of any vertebrate." To prepare for this journey birds increase body fat, nearly 40 percent of body weight in some songbirds. Fat provides fuel for long flights. It is not uncommon for passerines (perching and songbirds) to lose one-fourth to one-half of their body weight during over water migration.

As birds change their bodies for the trip, their behavior changes as well. Nocturnal migrants, for example, alter their nightly activity rhythms and begin to "preferentially orient" in the direction they'll be traveling. Many species migrate at night to limit their exposure to predators. Short-distance migrants usually fly during the day, spending only a few morning hours in migration.

How does a bird know which direction to fly (orientation), and how do they locate a particular nesting site (navigation)? In some species the juveniles and the adults travel together. Young geese, for example, learn the migratory route from older individuals. By flying in groups they also pick up migratory flying strategies, like the familiar "V" formation. Drawing on basic aerodynamics, the uplift of air from the leader's wings gives an energy-saving boost to everyone else in the group.

In a famous experiment, Manx shearwaters were taken from their burrows at night in Wales, placed in a lightproof box and flown to Massachusetts, 3,200 miles away, and released. In less than two weeks the birds were back in their burrows. How they did it so quickly and with such precision is a mystery.

This is what we do know: birds obtain directional information from four main sources: (1) natural landmarks, (2) the sun and other stars, (3) Earth's magnetic fields,

and (4) odors. Through some revealing experiments, researches have learned how these cues assist transiting birds. Birds placed in a planetarium will orient in the proper migratory direction using the stellar cues projected on the ceiling. Shift the stars and the birds shift accordingly; remove the stars and they orient to magnetic cues.

Some species have tiny crystals of magnetite in their brains. These minute magnetic particles, scientists believe, sensitize a bird to the Earth's weak magnetic fields. An ability to detect minor variations in the fields aids navigation in cloudy conditions.

Most birds have a very poor sense of smell, but some, like Leach's storm petrels, apparently rely on smell to find their burrows. In another experiment, storm petrels whose nostrils were plugged or whose olfactory nerves had been severed were unable to find their way back to their burrows.