Books For Banders

"SOMETHING OLD AND SOMETHING NEW"

Edited By Mabel Gillespie

The 27th Annual Biology Colloquium at Oregon University held in May, 1966 resulted in six papers on Animal Orientation and Navigation. In them were considered the migration and homing of salmon, sun-compass orientation of fish, and of amphibians, and migration and orientation in seals and whales.

A paper by William J. Hamilton III presents a new theory of the mechanics of bird orientation. It suggests that social stimuli and interactions between individuals in flocks may help in orientation. Or that two (or many) heads are better than one. Frank C. Bellrose bases his paper "Orientation in Waterfowl Migration" on observations made from an airplane, by radio and radar tracking, and by visual means. In the course of his study the author has captured ducks during migration and then released them hundreds of miles away in territory entirely unfamiliar to them. He concludes that ducks use the sun and stars to guide them under clear skies. He claims that, also, conspicuous landmarks like rivers or lakes may be used as guide lines during migration. The evidence from radar readings indicates that when thick clouds shut out sun, moon or stars, waterfowl may use the wind direction to guide them. Furthermore, the birds seem able to compensate for the wind and thus maintain the correct course.

We have Emil Berger to thank for bringing this publication to our attention. (The six papers may be obtained in book form from Oregon State University Press, Corvallis.) I hope other banders will not only suggest pertinent publications, but submit their own reviews of them.

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Doubleday Anchor Originals include a Science Study Series in inexpensive paperbacks ranging from a study of the forces that mold soap bubbles, to the neutron story. Donald R. Griffin is the author of "Echoes of Bats and Men" and, in 1964, of "Bird Migration". The latter is a fascinating, easily read book of 171 pages.

The first chapter mentions some of the more spectacular results of bird banding with which we are all more or less familiar. Mention is made of animal and insect migration. The second chapter contains a technical but understandable explanation of the use of radar in studying bird migration. Originally technicians were puzzled by radar patterns that they could not explain and referred to them as "angels". The author dryly comments: "The choice of this term, rather than one carrying an implication of diabolical intent to interfere with the radar, may be taken as a touching tribute to the faith of technical people in the fundamental goodness of nature."

Since radar equipment is prohibitively expensive it is only occasionally that its use is available to ornithologists. There are still puzzles yet unsolved from radar data dealing with migration. Yet the study so far "has extended our picture in many ways, most importantly by demonstrating the amazing extent of the mass movements of birds, and the readiness of even the smallest of birds to strike out across stretches of open oceans".

Many birds migrate at very high altitudes. "In good weather many flocks of migrants appear to ignore valleys and climb to altitudes (in the Himalayas) where they can clear all but the very highest peaks. At about 18,000 feet the air contains only half as much oxygen as at sea level. Human mountain climbers, depending on their degree of acclimatization and physical stamina, begin to find heavy exercise difficult between 10,000 and 20,000 feet ... Migrating geese probably take off from the plains of Siberia and fly within a single day to these altitudes and down again to the rivers and lakes of India. This striking biological phenomenon has not been studied enough to provide any hints as to how birds avoid altitude sickness, or how they muster enough muscular energy to fly in air containonly about half of the oxygen obtainable at sea level."

The third chapter deals with seasonal timing and energetics of migration, and mentions experiments of William Rowan, a biologist at the University of Alberta. He started his investigations thirty years ago, and one detail which he investigated was the storing of fat by birds before undertaking migration travels. The term "migration restlessness" is applied to the jittering activities of caged birds at the seasons when they would normally be migrating.

The chapter on bird navigation explores the theories advanced in explanation of a bird's ability to hold the right course on a long migratory flight. In considering the possibility of guidance from polarized light it is mentioned that honeybees guide themselves by the polarized light from the blue sky. In general, human beings cannot distinguish between polarized light and unpolarized light, much less judge the plane of polarization. Yet people with normal vision "can learn to distinguish the plane of polarized light, though only under favorable conditions".

Other possible aids to navigation considered are vision, thermal radiations, terrestrial magnetism, and orientation based on the Earth's rotation. In the case of the latter theory no one has managed yet to devise a workable experiment to test its influence on migration, although the theory is not taken seriously by biologists.

The chapter on homing experiments deals with the training and performance of pigeons, the incredible homing performances of Manx Shearwaters, and finally the testing of theories of bird migration by means of homing experiments. The chapter which follows tells how the author learned to fly in order to observe directions taken by experimental birds. The

following chapter deals with experimental analysis of homing and migration tendencies. "In the early 1950's two important advances were achieved in the explanation of bird navigation, one by Geoffrey V.T. Matthews at Cambridge University in England, the other by Gustav Kramer at Wilhelmshaven, Germany." Matthews' book is slated for future discussion here. Probably most banders know of Kramer's famous experiments with starlings. These birds were confined in a circular cage, but at the time of fall migration they went to the cage limits in the right direction for normal migration. When the sky was completely overcast the directional tendencies of the caged birds were random. There followed food seeking experiments during which a starling named Heliotrope gained fame, although another starling eventually passed the test successfully in far less time.

Ultimately the results of these experiments indicated strongly that birds "know how to compensate for the apparent movement of the sun across the sky. This type of orientation has come to be called 'sun-compass orientation', meaning simply that the bird or other animal uses the sun's position to determine a particular direction. Essential to sun-compass orientation is the ability to choose an angle of travel relative to the sun's position - an angle that must change continuously through the hours of the day as the sun moves across the sky. At first thought this seemed an astonishing achievement for an animal. Indeed, for a long time biologists refused even to consider it seriously. But in recent years careful observations and experiments have shown that sun-compass orientation is exhibited not only by birds but also by many small invertebrates, such as shrimps, spiders, insects, and also by fish and lizards."

There follows a presentation dealing with the biological clocks - built-in time clocks, they have been called - "which make their presence known through what are called endogenous activity rhythms". These are not affected by temperature nor by darkness. However, it is possible to reset the time clock of a creature so that in New York it operates on the time schedule of the far east.

A further step along this line of inquiry was undertaken by Franz Sauer and his wife at the University of Freiburg. They studied the directional tendencies of birds not only under the natural night sky but in a planetarium. The birds - warblers - headed toward the right migrational direction. These were hand-raised birds without experience in a natural environment. "The implications of the Sauers' experiments are far-reaching, because they apparently show that, built into the organization of the brains of migratory birds, is some mechanism that causes them to react in a specific way to the pattern of stars. Such a mechanism must also include provision for a reversal of this directional choice between fall and spring, presumably dependent upon the bird's internal physiological and endocrine balance... Various species must have genetically determined recognition patterns appropriate for the latitudes and seasons of their migrations."

There are descriptions of further experiments, and the chapter ends as follows: "After the past twenty years of research on bird migration it is clear that migrating birds are quite capable of setting courses by the sun, moon or stars." Modern science requires us to avoid quick conclusions and gullibility and at the same time demands that we believe in incredible hypotheses.

The final chapter tells of next steps. As banders, we should know the results already obtained, the methods of experimentation, and the type of observations we should be making.

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The reader has possibly been led to wonder what kind of brain allows directional accuracy in migration routes. And how can the proverbial emptiness of the scorned bird brain achieve this incredible orientation! Little by little scientific study shatters one after another of our fond beliefs. The ignominy of the epithet "bird brain" has finally been vindicated. The bird brain is small and its cortex is proportionally very small, but birds have a hyperstriatum which human beings have no trace of.

This information is presented in an article entitled "The Brain of Birds" which appeared in the June 1968 issue of Scientific American under the joint authorship of Lawrence J. Stettner and Kenneth Matyniak, both of Wayne State University.

The authors state that the size and physical aspect of the bird brain are deceiving, and that birds are capable of highly intelligent behavior, sometimes surpassing mammals. For this reason they claim that studies of the avian brain could serve as a guide to the sources and evolution of intelligent behavior.

Modern studies have produced considerable evidence of the learning capacities of birds. However, it is difficult to devise experiments which result in clear tests of animal intelligence and flexibility of behavior. The Bryn Mawr psychologist M.E. Bittleman devised a test called "multiple reversal": in this, fishes failed; rats improved; pigeons equated with rats; crows, ravens, magpies, mynas and parrots did better. According to the Harlow test at the University of Wisconsin based on forming learning sets, the performance of lower mammals was poor; chickens and pigeons did better than non-primate mammals. In tests regarding quantities, ravens did better than elephants; in another experiment, rabbits, hens and pigeons did poorly, cats did some better, and only dogs, crows and crow relatives succeeded at once.

The article is illustrated by diagrammed drawings of the bird brain, whose cortex has shrunk in size through the course of evolution and the hyperstriatum, absent in man, has apparently assumed much importance.

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