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REPORT ON A VISIT TO SOME ORNITHOLOGICAL FIELD STATIONS IN EUROPE SUMMER OF 1956

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A generous private grant through Harvard University made it possible for me and my wife to visit several ornithological field stations in Europe in the summer of 1956, to help us establish the research program of the new Louise Ayer Hatheway School of Conservation Education for the Massachusetts Audubon Society. We also wanted to learn what factors in the teaching of natural history to young people lead some countries into having a high standard of professional and amateur field zoology. This trip, from the first of June to the first of October, allowed visits to England, Holland, Germany and Finland.

Rather than try to visit all the people who are running important zoological research centers in Europe, we concentrated on visiting a few people, and spent rather a long time with each one of these. Because of our own personal interest and the emphasis that we feel should be placed on the research at Drumlin Farm, we were especially interested in visiting those places in Europe where research on the breeding biology of common species is being carried out.

ENGLAND

At the Edward Grey Institute of Field Ornithology, Oxford, we visited David Lack, who has recently finished most of his work on Swifts (*Apus apus*). While we were there he was working in detail on some of the aspects of Swift migration, and continuing studies on the survival and other biological details of the various stages of their breeding cycle. Detailed observations were carried on in the tower of the University Museum in Oxford, using an extensive structure built inside the tower, along which, and around which, observers could walk and look into particular nests. Before Lack started his study of Swifts, they nested in various crannies and uncontrolled places under the slates and in the air vents in this tower, but when the work was started, all unwanted holes were stopped up, and the ventilation outlets modified so that they would be especially suitable for Swifts. In these holes, suitable boxes were built, and in the boxes were placed proper materials for them to use in the foundations of their nests. The boxes had glass sides or tops, permitting a view of the nest without disturbing the birds, and without being seen. Daily checks were made to see exactly what was going on at the different times of the breeding cycle.

Dr. Lack is now in the process of transferring his concentrated research from Swifts, and is looking for another species on which to work. I was very lucky to be able to talk to him about the way in which he is going about selecting a new species. This decision will be an important one in establishing the research program at Drumlin Farm, and it was most helpful to have the ideas of the various other people on the peculiarities of a species that make it desirable for research.

We were able to see something of the work of three other people working with Lack at the Edward Grey Institute; that is, Snow's work on the Blackbird (*Turdus merula*), Davis's work on the Song Thrush (*Turdus ericetorum*) and Dorwood's work on the Jackdaw, (*Corvus monedula*).

David Snow is working in detail for the fifth year on the breeding biology of Blackbirds, in the Botanic Gardens at Oxford. Here, in an area that seems no more than two or three acres, he has been able to study the territories of nine individual pairs at once, including four territories in an area scarcely 75 yards square. By making daily visits at his own convenience, he has become so familiar with their activities that he considers the study of an individual nest not worthwhile, unless he has found the nest while it was being built. He is able to do that, because he knows in detail the behavior of the male Blackbird at the time the female is starting to build. He has color-banded all of the young birds and can follow their movements after they leave their nest. Because these birds have come to know him, and are so used to people visiting the Botanic Gardens, the birds seem extraordinarily tame to anyone from New England. He, like many others studying individual birds, was extremely impressed with the new tool, the Japanese mist net, and agrees that this is a minor revolution in ornithological studies, because it will allow a student to catch any particular individual bird; this has allowed them to catch certain especially elusive female Blackbirds in the Gardens. In addition to the studies in the Botanic Gardens, Snow has studied Blackbirds in the large Wytham estate near Oxford. These latter Blackbirds are very wild, and their territories are nowhere near so closely spaced, but they allow him very good comparative data.

At the same time Peter Davis, who is helping David Lack in the studies of Swifts, is working on the same sort of study of the Song Thrush. I found their work on these two closely related species especially interesting because they illustrate how two populations differ in so many features when they are sympatric (occurring in the same region). The difference in the two birds' personality is quite marked, and it emphasized to me again the great similarity of the Blackbird to our Robin (*Turdus migratorius*).

With Douglas Dorwood, who became interested in the study of detailed biology through analysis of a population of escaped Black-crowned Night Herons (*Nycticorax nycticorax*) near the Edinburgh Zoo, I went to visit the Wytham estate, about a mile long and a mile and a half wide, which belongs to the University of Oxford. Dorwood is in his first year working on Jackdaws, but has inherited the work of a previous student who concentrated on them for two years. This year

he had marked various birds, using a trick called imping, inherited from the old sport of falconry. A feather from a brightly colored bird is cut and glued to a pin; a feather from the wing of the particular Jackdaw is cut; the new feather is then inserted in the shaft, and the whole glued together. The result is at least as strong as the original feather, and allows identification of a bird in flight from a considerable distance. It has most of the advantages of color-banding, except that you have to re-mark your birds every year.

Like many other species being studied intensively in Europe, Jackdaws have the advantage of nesting in boxes. By saturating the area with suitable nesting boxes, Dorwood is able to know exactly where all of his birds are nesting, and is then able to follow their nest stages and band all of the young.

In the course of my visit to the Wytham estate, I was shown the various areas where other members of the Edward Grey Institute and the Bureau of Animal Population had made their studies. I saw Dennis Chitty's boxes for Tawny Owls (*Strix aluco*), and John Gibb's boxes for Titmice (three species nest there, and three more occur at other seasons). The convenience of being able to know exactly where all of the population under study is nesting, of course, cannot be overestimated, but the Bureau of Animal Population students have an additional, especially attractive wrinkle, which is a mirror set on the top of the box, which allows you to examine the contents without having to climb the tree.

Certainly one of the most remarkable differences in the various stations we visited this summer was that of the nest-boxes in use; each particular group was quite convinced that its nest-boxes were eminently the most suitable, and they varied about as much as it was possible to vary. Those in the Wytham estate were about as simple as any we saw.

After we got back from our trip to the Continent, we had the chance to talk more fully with some of the other members of the Edward Grey Institute, including Mr. Moreau, the able editor of *The Ibis*, and Dennis Owen. Moreau is doing some extremely interesting work on the independent variation of the various characters in some Central African birds, and Owen has been carrying on detailed studies of the breeding biology of the Heron (*Ardea cinerea*) in the Thames drainage area.

With Owen I was able to visit the Breckland study area in East Anglia, an area where David Lack did some of his important early quantitative work on afforestation and its effects on birds. At the Breckland, John Gibb is just concluding a number of years' study of the relation of Coal Tits (*Parus ater*) to their insect prey. For this work he has a nearly ideal area of many thousands of acres of completely uniform plantations of pines, inhabited largely by the Coal Tits and a very small number of species of insects. John Gibb, one of the most ingenious individuals that I have had the privilege of meeting, is the inventor of a number of mechanical aids which really are amazing. He has developed a convenient spring-balance for use in the field for weighing nestlings; a mechanism, in the form of a cage, by which he can measure the total amount of energy given to a bird, and the total

amount of energy which the bird is unable to use, thus calculating the actual amount of energy in its food the bird uses. Among other gadgets, he has an exceptionally ingenious one, using a baby's nipple and a pair of modified bent scissors, which he has made to mimic exactly the head of a nestling Coal Tit, and which he uses from a blind placed against the back of the nesting-box. When a parent brings an unidentifiable beakful of insects to feed the young, Gibb blocks the nesting entrance and, as the parent sits at the entrance, looking around for the outlet for its feeding drive, he produces this marionette, which gapes to the parent bird, and is immediately fed. In this way Gibb can get a complete sample of what is being fed to a particular young bird at a particular time, without any danger to the nestling such as is inherent in the various neck-ring systems used in the past.

While I was at the Edward Grey Institute, it was also of a great deal of interest and, we hope, of a great deal of value for our future plans, to talk with Dr. Lack about the establishment and progress of the early years of The British Trust for Ornithology, and the Edward Grey Institute. The relation of these two institutions has shifted in the recent past, but they have always been closely allied to each other. The Edward Grey Institute, together with the Bureau of Animal Population, forms Oxford's Department of Zoological Field Studies, and concentrates on original research in field ornithology and acts as a center for the deposit of information on birds. The British Trust for Ornithology has assumed the supervision of the activities of the amateurs, and is supported largely by its members, and in part by a grant from Her Majesty's government through the Nature Conservancy.

The Trust's activities are remarkably varied. Under the general heading of field investigations there are three permanent enquiries (bird-ringing, nest records, and the sample census of heronries), occasional direct enquiries (such as a census of Mute Swans), many trust-aided investigations (such as Dr. Lack's on the seaward movements of Swifts in summer), and requests for information on particular subjects. The Trust has regional representatives in most parts of Great Britain, and holds several public meetings a month at many different places. It serves as a coordinating agency for the different bird observatories, maintains an excellent lending library, publishes a number of pamphlets and forms (in addition to its quarterly journal, *Bird Study*), and makes small grants to individuals for their researches.

We were surprised that the interest in collecting detailed records of bird nests is as great as that in bird-banding. This is in contrast to our own interests in the United States. As an example: David Snow has had turned over to him by the British Trust a stack of individual cards 18" high, on the Blackbird, for the single breeding season of 1955. I doubt that there is as much information as this on any species in the United States for all time, if not for all species put together.

We were much impressed at the high degree of organization of British amateur ornithology in the direction of helping with projects that are of scientific value, and hope that we may be able to profit by their example in New England. For example, one year it became clear that the Black Terns (*Chlidonias niger*) were performing a very interesting

migration, and as a result of the enthusiastic cooperation of the members of The British Trust for Ornithology, a very interesting observation was published, indicating quite clearly a reverse migration.

Also at Oxford University, I was able to visit with Niko Tinbergen, co-founder with Konrad Lorenz of the modern study of ethology, animal behavior. He is supervising the research of various students who are working on fish, insects and birds. Some of his students are working on the general behavior repertory of a particular species, such as the work that has been done on the Black-headed Gull (*Larus ridibundus*), and is now being done on Arctic Terns (*Sterna paradisaea*), Shag (*Phalacrocorax aristotelis*) and Kittiwake (*Rissa tridactyla*). Others are working on the function of a particular structure, such as that of eyespots on butterfly or moth wings. He has a number of people working on especially detailed studies of the Stickleback, a small fish, and in addition has students working on detailed studies of a particular part of the behavior pattern of an individual species, such as the mating of *Drosophila*, the egg-laying rhythm in Black-headed Gulls, and parental feeding in the weaver finches (*Ploceidae*). The work Tinbergen is doing now, like that of some of the other students of animal behavior, especially those in Holland, is centered around a detailed analysis of the elements of stimuli to which an animal is actually able to respond. Some of these studies are broadening older, simpler ideas, such as the releaser; others are showing that an animal's behavior may be limited by exclusion in the sense organs, rather than in the central nervous system. He was interested in our ideas for the operation of the new station at Drumlin Farm, and pointed to the advantages of long-range controlled field experiments in bird territories, and the function of food and nesting requirements. He was especially interested in the possibility of correlating studies in the field and in the laboratory; of course he is one of the most outstanding advocates of this technique.

One of the features which makes Tinbergen stand out, and one which we value greatly, and intend to try to live up to, is his insistence that the supervision of research of the students around him is not an interruption of his own program of research, but a great contribution to it as well as an especially rewarding personal experience.

We were also able to visit the Madingly Field Station of the University of Cambridge. In many ways the Madingly Station is a matured example of what we hope will be one of the aspects of the program at Drumlin Farm. Robert Hinde, the curator, has several assistants to care for the various excellent examples of a number of native species, as well as many exotic, closely-related species, living in individual aviaries. Under these conditions, detailed studies can be carried on and comparisons made in behavior differences indicating evolutionary changes in behavior in closely related species. In addition to the small outdoor cages, there is a new building in the process of construction, to keep birds in small cages, to make especially detailed, quantitative studies of specific aspects of behavior. At Madingly the importance of comparing aviary studies with field studies was emphasized, and it was interesting that in Hinde's experiences with Chaffinches (*Fringilla coelebs*), he could find no detectable differences. He wondered why

more people were not undertaking to study New World Cardueline and Emberizine finches in this way, and pointed out that with all the extensive knowledge of physiology and migration of *Zonotrichia*, almost nothing is known of the behavior of these species.

Hinde, working on nest-building behavior, has found that canaries are suitable for this study because of the tameness that has been bred through the years. Any modification due to inbreeding does not seem to be at all significant for his studies. Another aspect of his studies is the breeding of hybrids of wild species, and watching the modification or shifts in behavior that are produced by such crosses. In other words, at this station they are analyzing the genetics of elements of behavior in the same way that elements of anatomy and physiology have been studied in the past.

Another area that I was lucky enough to be able to visit was that of the waterfowl pens of Peter Scott at the Wildfowl Trust. We can only admire Peter Scott's ability to organize and promote this tremendous program. He has a wonderful collection of representative waterfowl from the far corners of the world, and is expanding his program of scientific research.

THE NETHERLANDS

The second country we visited was Holland, also noted for the excellence of its field biological research. We concentrated on just two individuals, Baerends and Kluyver, whose work was particularly pertinent to our plans for Drumlin Farm.

I visited Baerends first at Haren, at the new zoological laboratory of the University of Groningen. For us the items of especial interest at Haren were the aviaries for observing behavior in a nearly pure wild stock of domestic fowl, the exhibitions prepared by Luuk Tinbergen on ecological aspects of birds, and Baerends' fabulous aquaria.

In the nearby Botanic Gardens are examples of Dutch habitats, in which the plant species typical of each habitat appear under their own dispersal mechanisms. The success of this method of representing their local flora is based on the uniformity of the Dutch vegetation and habitats.

In the aviaries Mr. J. P. Kruijt is working on the basis of pheasant behavior, and for his baseline has chosen the domestic fowl, obtaining from Indo-China examples as close as possible to their wild form. By keeping them entirely in isolation while they mature, he has insured that their behavior derives from inheritance only; for example, courtship display by solitary birds.

In the attractive dunes at the northern end of the island of Terschelling in the West Friesian Islands, Baerends and his students live in what was built as a canteen for a German anti-aircraft battery of the Western Wall, and from it they walk several kilometers to the Herring Gull (*Larus argentatus*) colony every morning to study behavior related to eggs. Any object remotely resembling an egg will be rolled back into the nest by the Herring Gull if the object has been in the nest, and is placed beside it, but Baerends is especially interested in the relative

importance of size, the kind of speckling on the egg, the form of the egg, and the color of the egg, in releasing the egg-rolling instinct. To analyze this, due weight must be given to the relative position of the two items between which the bird must choose, and their position relative to the sitting gull in the choice of which the bird will roll back in first.

In making these tests, the students are cooperating with the Dutch Government, which is trying to arrest the growth of the Herring Gull population by collecting the eggs. To keep the gulls from merely laying another clutch, they insert in each nest a set of wooden eggs. For their studies, they set up a blind near one nest and start by removing the wooden eggs and placing the test objects close by the edge of the nest. Using these wooden eggs, they can extend the period of the incubation drive of the parent gull to about six weeks, and of course as the end of this period approaches and the incubation urge gets lower and lower, more critical experiments can be made.

To study the regulation of the incubation drive according to the temperature of the eggs copper eggs are made. Inside them there is either a resistance wire with a thermostat to raise the temperature of the eggs from within a blind, or a tube through which cold water can be run to chill them. Then the observers can watch the behavior of the gull as the temperature of the egg is raised or lowered beyond the gull's ability to compensate.

The Dutch have found that in spite of this removal of most of the young, the Herring Gull population continues at about the same level, so a recently-undertaken project is to color-band those young gulls that are found at the later end of the breeding season, and which escaped the workers who were taking the eggs from the nests. The persistent low percentage of color-banded birds seen in Holland seems to indicate that much of their population comes from elsewhere. The feeling is that Holland is merely an area for expansion for the excess population from the East Friesian Islands in Germany, and that the population will continue at its high level, in spite of local control.

The second person that I visited in Holland is Dr. H. N. Kluyver, who has a new institute for ecological research outside of Arnhem. He is extending his classic study on population studies of Great Tits (*Parus major*), to work on two aspects which he found unsatisfactory earlier. First, he is following two separated populations, one in especially poor pine woods, and another in an excellent mixed deciduous forest area, hoping to find more about the effects on the population in these exaggeratedly different habitats. Second, in his analysis of population maintenance, he has started to work on a population without emigration or immigration; that is, the population of Great Tits on the island of Vlieland in the West Friesian Islands. There are three large areas of new pine plantations which have been colonized from the mainland, but which now have, for all practical purposes, no interchange whatever of Titmouse populations.

It was here that I learned one of the typical examples of the importance of knowing your species extremely well, because, as Kluyver points out, if you trap the female Great Tit on the nest at certain stages of incubation, she will, almost without exception, abandon the nest;

whereas at other times, you can pick her off the nest, band her, and put her on again, and she will continue to brood the young. He pointed out, also, the importance of putting the bird back on the nest, rather than releasing her after color-banding. This sort of lesson most of us have to learn by painful error.

Kluyver is continuing his work on Starlings by studying nesting boxes in pine woods at varying intervals from the feeding areas in nearby farmland, so as to follow the comparative survival of the nestlings.

Holland is a remarkably well-integrated country, with a high standard of work among the students of nature, probably in part the result of the advanced state of the biological education to which Dutch students are exposed. In my experience, most of the high school graduates had as complete a grounding in general biology as those who have concentrated in a rather superficial way in biology in college in the United States. Another thing that contributes to this high standard of work is that the universities hold field biology in very high esteem, so that some of the best minds in Holland have gone into this work. Correlated with this, the serious-minded amateurs are able to get a great deal of help and advice from very well-qualified supervisors.

GERMANY

Germany has a long and high tradition of interest in the field biology of various animals. This interest is expressed in the government as well as privately, so that a number of institutes, such as the *Vogelwarten* and the Max Planck Institutes have been established to carry on independent research in various aspects of biology. The German bird-banding scheme is centered in two of the *Vogelwarten* (bird observatories), the one formerly at Heligoland and now at Wilhelmshaven, and the one formerly at Rossiten and now at Radolfzell in southern Germany.

The first person whom I visited in Germany was Hans Löhrl at the *Vogelschützswarte* at Ludwigsburg, in Wurtemberg, south of Stuttgart. A *Vogelschützswarte* is a research station for bird protection, and thus of especial interest to the new sanctuary of the Massachusetts Audubon Society.

Löhrl's own work has been concentrated since 1949 on detailed studies of the Collared Flycatcher (*Muscicapa albicollis*). This work is closely related to that work which Lars von Haartman has been doing in Finland, and the work of Bruce Campbell of The British Trust for Ornithology, in England, on the closely related Pied Flycatcher (*Muscicapa hypoleuca*). Löhrl has just completed a study of the Nuthatch (*Sitta europaea*), and for comparison has undertaken a new series of studies on the Corsican Nuthatch (*Sitta canadensis*), an island population now considered the same species as our Red-breasted Nuthatch. In addition, Löhrl was supervising a number of other research projects and caring for a menagerie of foundlings brought to him by the public.

In his studies of the Corsican Nuthatch, Löhrl was able to capture

four as nestlings and keep them free in his living-room in Favoriteschloss at Ludwigsburg. He made use of the experience of zoo-keepers, and kept his room from being soiled by having only one suitable perch available, which was against a window, and under which newspapers were spread. By having these birds almost completely tamed, Löhrl was greatly aided in following the development and maturing of their food-seeking behavior, voice and other behavior patterns.

Dr. Löhrl made plans to come to Drumlin Farm in April of 1957, in order to make studies of our Red-breasted Nuthatch, to compare it with the Corsican Nuthatch, and to form some opinion on the evolutionary position of these widely separated populations. In return we can draw on his broad experience in bird-protection.

Dr. Giselle Üllner has helped Löhrl in two phases of his work with the Collared Flycatcher, the first being their relation to the insect fauna of cherry and apple orchards on the north slope of the Jura Mountains. Miss Üllner, with Dr. Löhrl, is seeking to learn what the parent birds themselves eat, and what they feed their young. By taking samples of the concentrations of insects in the foliage, she compares concentrations in her study area with those in areas where Collared Flycatchers do not nest. These areas can be easily controlled because the Collared Flycatcher is a hole-nesting species, and occupied only the nesting boxes which Löhrl has put out. Correlated with studies in insect pest control, these two workers are able to make important contributions to the understanding of the relation of a bird predator to an insect prey, and over the years are also following the population changes in the Collared Flycatcher.

In addition, Miss Üllner is helping at the Favoriteschloss, where Löhrl was keeping about 90 nestling Collared Flycatchers, which had to be fed many times a day, on ant pupae, meal-worms and silk-worms. When fledged, these birds were to be released in areas beyond the limits of the Collared Flycatcher's normal range. In the past Löhrl has made several releases, and has learned that such birds do return to the area where they were released, and some wild birds appear with them. Now he is interested in finding out at what stage in the birds' development they are imprinted with the site to which they return to nest. The 90 nestlings that they were raising in the spring of 1956 were to be released before, during and after the first fall molt, to see at what point in this period the learning of the home site occurred. The true difficulties in feeding 90 insectivorous nestlings cannot be appreciated, unless such an undertaking has been experienced. When they can fly, Löhrl releases the nestlings into a large cage and they learn to catch their own prey by a simple device. Flies are allowed to collect in the cage, near a screen, under which cheese and bad meat is kept; and the birds very soon learn to be expert at catching them, at which point they are ready for release in the wild.

Löhrl had a large menagerie of various abandoned nestlings and injured birds brought to him by the public to be cared for. While I was there he had nestling Wrynecks (*Jynx torquilla*), a woodpecker-like bird which has a bad reputation for pushing other hole-nesting birds out. The male occupies many suitable holes, only one of which

the female uses for her nest. Löhrl was also feeding a nestling Swift, and a very precious founding, a Golden Oriole (*Oriolus oriolus*, not a relative of our New World orioles). A common orphan in this part of Germany is the young of White Storks (*Ciconia ciconia*), whose parents are being killed in serious numbers by flying into high-tension wires. In other parts of Germany their decrease seems to be dependent on draining wet meadows for agriculture. As with many such problems, each interested individual had his own explanation for the reason White Storks are disappearing. The only place we saw them in any numbers was in Schleswig-Holstein and Denmark.

Löhrl's work area is in a public park, which of course is much more open to the public than the privately owned Audubon Sanctuaries. Yet the German public is very orderly and, through the simple device of instructing visitors to stay on the paths in the study area, there is negligible disturbance to their studies.

With Löhrl, as with other people visited, it is impossible even to mention all of his various undertakings, but two more should be noted. Löhrl was supervising the work of Mr. Böhringer, who has been studying House Martins (*Delichon urbica*). These birds nest in mud nests under the eaves of buildings, and Löhrl has been able to get a local factory, which has specialized in making bird houses, to prepare uniform nests of cement and sawdust, which mimic the House Martins' nests. By attaching these nests to the eaves of buildings, an artificially controlled colony of House Martins can be established as has been done in several places in Europe. The tops of these nests are roofed over with glass, so that observations of the activities inside the nests can be made from the attic without disturbing the birds. In the early part of the season feverish territorial fighting goes on in these nests, and at this time, with the birds busily occupied, Mr. Böhringer has been able to paint the white rump-patches with various color-combinations so that he has been able to identify his birds in flight, in the field. Of course color-bands on birds of the swallow group are almost useless. Mr. Böhringer has been studying (with considerable success) the process by which the Martins recognize their own particular nest, and entirely uniform artificial nests are suitable for this sort of experimentation.

Another associate of Dr. Löhrl's is Mr. Thielke, who is working in the Schwartzwald, on a problem similar to that of Dr. Üllner's: the effect of an abundant bird predator on the insect pests. In these fir forests the titmice are most effective. He is also carrying on detailed studies of the breeding biology of several species, especially the holarctic species we call Winter Wren (*Troglodytes troglodytes*) and Brown Creeper (*Certhia familiaris*). Mr. Thielke had been able to find all of the nests of wrens on an area of 100 hectares (approximately 250 acres). He had been able to entice them to nest in clumps of pine branches in chicken wire, and in addition to these captive audiences had found several naturally placed nests. Thielke is one of those individuals who impresses an American student because of his remarkable ability to find birds' nests. This is an art, of course, which can be developed by an individual who is sincerely interested in following the activity of the species in detail.

Dr. Löhrl and people working with him form a very good illustration of the sort of work that should be very much expanded and emphasized in the New World. By such work we will eventually learn to understand the details of the breeding biology of various species, and certainly it is a truism that to conserve our native species we must first understand them thoroughly. We can just hope our enlightened organizations will begin to appreciate this fact and emphasize more studies of the nature of population changes and breeding biology, so that the material learned from them can be applied to the management of all kinds of animals.

Munster is a city of special value to someone interested in methods. There, at the University, Professor B. Rensch has prepared a remarkable museum of biological principles. His own ideas are especially well presented and it is a delight to visit a museum where each room presents you with a series of ideas, rather than individual specimens arranged in taxonomic sequence. Cases illustrate subjects such as heart size in relation to the bird and its activity; the solution to the problems of flight; various kinds of wings; various kinds of flying; territoriality and the way various animals fight; specialized types of nest-building; variation in individual species from colder to warmer climates or from dryer to wetter; the formation of geographic races; expansion of certain species to occupy new areas; the way animals spend the year; the migrations of fish and birds; animals that are closely associated with man; the way various animals climb; adaptation to darkness; the way animals swim; and so on. Even in the rooms where exhibits presented the species of animals occurring commonly in that part of Germany, each species was treated as an illustration of a particularly interesting aspect of its biology. This sort of exhibit of course requires a considerable amount of information and study as well as imagination, but certainly the end results are worth it.

Konrad Lorenz, author of *King Solomon's Ring* and *Man Meets Dog*, is certainly familiar to all those who have read these popular books on animal behavior which have appeared recently. I was able to visit Lorenz, both near Munster where he worked while he was building up his now impressive international reputation, and in the new Institute for Comparative Zoological Studies being prepared for him and Erich von Holst at Seewiesen just north of Munich. The older Institute is a monument to human ingenuity in terms of what brilliant studies can be developed while keeping animals under conditions originally designed for anything but keeping animals. In contrast, the new Institute will have all of the most recent and fancy designs for the convenience of the individual worker, for example, a lake which is completely surrounded by a fox-proof fence, where Lorenz' geese and ducks are free to wander at all times. Lorenz spends much of his time simply living with these geese, watching their personal contacts, and the social structure within the species and between the species, to study all the details of their behavior. He is known to be especially interested in geese, and his present collection of geese is there to allow him to expand his behavior studies from the Grey Lag Goose (*Anser anser*) which remains his favorite, to other closely or distantly related species. It is a very mov-

ing experience to spend a day with Lorenz with his own animals, realizing how completely sympathetic he is with their activities, and yet how he realizes their mental limitations.

When I was there the various buildings were not completed, but it is quite clear that their facilities will be superlative: a completely sound-proof room; temperature-controlled rooms; an aquarium in which it will be possible to make observations of the schooling of fish through a column inside the aquarium; and extensive pens for the keeping of geese and ducks in individual compartments, and in large compartments, each designed without blind corners so that the dominant bird of a pen will not be able to tyrannize any particularly unaggressive individual.

The last place in Germany that I visited was the Max Planck Institute at Wilhelmshaven, where Gustav Kramer has been working since the war on the problem of orientation in birds. We are nearly all familiar with his epoch-making discovery of 1948, that Starlings were able to orient themselves to the sun, and able to compensate for its direction according to the time of day. In other words, they have an internal clock by which they can follow the movement of the sun through the day, and find, from the position of the sun on the horizontal plane, what direction they wish. Kramer recently has been working on orientation in homing pigeons. His recent work has been to analyze why pigeons do not return so well in winter as in summer, and why they return better from the west and north than they do from the east and south, and why pigeons are able to return well from within 20 miles and from beyond 40 or 50 miles, but have trouble in the intermediate area. All of these ideas, and their relationship to general problems of bird orientation, have appeared in a paper that Kramer was preparing for *The Ibis*.

Kramer, as many readers will recall, is in disagreement with Matthews on theories of bird orientation, and they have been repeating each other's experiments. Kramer has recently been able to come to the New World to work both with his own and United States strains of pigeons, to see whether the same experiments work as well with a seacoast toward the east as with a seacoast toward the west. Among the many fascinating aspects of this work is that of the initial direction, which is not necessarily related to the compass direction of the home loft. It is defined as the spot on the horizon at which the bird disappears, and may be as much as 70 degrees from the actual home vector. If, in a group release, most of the birds disappear very close to the same spot on the horizon, although not necessarily in the actual direction of home, most of them can be expected to return to the home loft. If, however, the birds disappear more or less randomly over the horizon, a very low percentage will get back. It really seems that the more that is known in detail about the homing of pigeons, and the orientation of birds, the more complicated and the more intriguing the problem becomes.

A number of Kramer's students have contributed to our knowledge of clock mechanisms, and activity patterns. One of these is Klaus Hoffman, who actually first published the information on the clock in

Starlings and the way in which experiments can set the clock ahead, or set it back, but not alter its rate. Hoffman is now working on clock mechanisms in newly hatched lizards, because these are cold-blooded organisms, and are of theoretical interest in the effect of temperature on a physiological clock.

At the Vogelwarte Heligoland, now at Wilhelmshaven, where Dr. Goethe and Dr. Drost have their headquarters, there is another good museum. Here they show in remarkable detail the summer ranges, migration routes, and winter ranges of particular populations of certain species, based on facts from banding returns. Of especial interest to me was a long exhibit of the Herring Gull's world, from the nest and eggs through the young plumage and activities and through the adult courtship. Another exhibit shows the food of gulls and where it is found.

These exhibits demonstrate a primary interest in the details of the biology of common species. We can profit by their example in New England, and we hope very much to be able to emphasize this approach at Drumlin Farm, and to see this sort of interest expand around us.

FINLAND

For a visitor Finland has the great advantage that the people doing the most important work are concentrated in the Helsingfors area. Were it not for the exceptional fluency of the Finns in English, we would certainly have been paralyzed, because we found Finnish almost completely beyond us, and had no Swedish.

We visited our host, Lars von Haartman, at his family's home at Lemsjoholm, north of Åbo. At Lemsjoholm the von Haartman family owns all of a peninsula of about 10 square kilometers' area, and have a large 200-year-old home surrounded by farms and forests. Here von Haartman has carried on his extensive studies of the Pied Flycatcher for the last 16 years, in great detail at first, but recently his duties at the Universities of Helsingfors and of Åbo have taken a substantial part of his time. We were very much impressed to see the paths that he personally had worn all over this area in making his rounds of nesting boxes. In the course of his studies he has made very detailed recordings and taken moving-pictures of the territorial behavior at the nesting boxes, and the changes in habitat and in location of individual bird's boxes. He has been very much interested in the return of individuals to the territory of their birth or their previous nesting (*Ortstreu*).

Von Haartman's population and behavior studies of the Pied Flycatcher are of a stature to rank with the best done in any country, and it is indeed a shame that the American education system has so de-emphasized the study of the German language that these studies and many others like them are not readily available to our educated public.

In addition, von Haartman has carried on extensive studies of nesting waterbirds and shorebirds at the University of Helsingfors Zoological Station at Tverminne (on the very tip of the long southern peninsula of Finland towards Estonia), including detailed annual censuses of these breeding birds over the last 10 years. The changes in popula-

tion which they show can be correlated with shifts of the main population of the species, and with specific weather phenomena.

It is interesting to us from a part of the Atlantic coast where we have a marked tide, and a strong difference between the salinity of the seawater and that of the fresh-water rivers, to see here an area where there is probably no tide at all, and to our uneducated taste, almost no sea quality to the sea water. Despite the importance of these points in the ecology of marine species, there is still a very sharp line which separates the "fresh water" flora and fauna from that of the "marine" types in this area.

It was on this peninsula of southern Finland that the Russians established a beach head in their attempts to conquer Finland during the 1940's, and the marks of the heroic struggle by the Finnish people are still evident. Professor Palmgren was at that time a captain in the Finnish infantry, which stopped the Russian forces during the terrible winter of fighting.

Professor Palmgren's work is some of the most important of this century. His early papers contributed to an understanding of the quantitative importance of bird population studies, analyses of the basis of geographical distribution, studies on the balance mechanisms in animals, studies on the daily and annual rhythms of birds, population problems in evolution, and comparative biological studies of ecologically or systematically closely related species. He has recently turned to work on spiders.

Among his most important contributions are the effects he has had on the students and teachers around him. Through his influence and that of such men as A. J. Cajander and Palmgren, the university community of biologists in Finland has grown to one of international importance. Among some of the recent work that Palmgren has inspired is the paper by Henrik Wallgren, which compares the metabolic activities of two closely related species of bunting, one of which winters in northern Europe, and the other migrates farther south. These show clearly the difference in temperature tolerance whereby the southern species is able to tolerate higher temperatures and the northern species able to tolerate lower temperatures without serious metabolic disturbances. Another is the paper by Alpi Pynnönen on the comparative biology of Finnish woodpeckers which examines the biological basis of avoiding competition in sympatric species. Palmgren's interests extend to all areas of biology, and when I asked him why he thought Finland had concentrated on doing such extraordinary work on field biology, and had to date not concentrated so much on laboratory biochemical studies, he answered simply, "lack of financial support."

At the University Zoological Station at Tverminne, and at a much larger field station inland in Finland, all zoological students of the University of Helsingfors spend some time in field work under the direction of the various professors of the university. In this way all students get a real exposure to field biology, as well as laboratory biology. In addition a group of highly selected primary and secondary school students come and camp near this station, and associate with these advanced students. As a result the group of young people in-

terested and trained in biological studies grows in Finland, and we can expect their high standard of academic contribution to continue.

We went from the Zoological Station at Tverminne to Helsingfors, which is more than the capital, it is really the heart of Finland. There we visited various members of the university staff, especially Olavi Kalela and Gjöran Bergman.

Kalela has worked in the past years on extension in ranges of southern birds and mammals into Finland, correlated with shifts in vegetation, in turn a response to the recent warming of climate in northern Europe. Much of his work has been done by correlating the information supplied by amateur cooperators, and for this study they have enlisted cooperators in an ingenious way: they play bird-song records over the radio as part of a competition, and those who send in answers are screened. Those who had a high percentage of correct answers were then circularized to find whether they would be willing to make annual reports of abundance and distribution of berry crops and certain species of birds. Using these broad data over a number of years, they have made a clear picture of population changes or variations together with indications of the food plants available.

Kalela has recently been studying the effects of the periodic wanderings of lemmings, at the end of their irregular cycle, and the correlations of these wanderings with the establishment of new colonies and the increase of population during the next cycle. While we know much more than previously about lemming cycles and wanderings, they remain nevertheless just as extraordinary phenomena, and of tremendous interest to an ecologist and a student of population control. Here in northern Europe there is a strong interest in populations, probably because there is a rather simple structure of population inter-relationships, as there are fewer species and larger numbers of individuals than in most southern areas. With fewer controlling factors the changes in population are greater, leading in the north towards the extreme example in the lemmings.

An intriguing sidelight of the suburban Helsingfors population is a group who live in the almost infinite number of small islands to the south of the city, and commute by outboard motor from their small island to the main road where they catch a bus. Such suburban living has allowed Bergman to carry on around his home studies of the Turnstone (*Arenaria interpres*) and Caspian Tern (*Hydroprogne caspia*). He also has been very much interested in changes in population of the island birds such as Tufted Ducks (*Aythya fuligula*), Eiders (*Somateria mollissima*), Caspian Terns, Black Guillemot (*Uria grylle*), Lesser Black-backed Gulls (*Larus fuscus*), Herring Gulls and Arctic Terns. In the course of his studies, instead of wearing a path through upland vegetation, Bergman has operated a daily circuit of the islands he studies, by small outboard motorboat. We arrived too late to see the population of Caspian Terns on their nesting islands, but he had two nestlings that he was raising himself on the rocks in front of his home. These came to him when he called, and would answer his mimicking of their parents' calls. Unfortunately we were unable to meet Eric Fabricius, the third of the classmates, Bergman, Fabricius and von

Haartman, who have made such important contributions to ornithology from Finland.

FINAL COMMENTS

In Finland, as in the various other European countries we visited, we were impressed by the fact that advanced students with a considerable interest in recent advances and the academic side of biology are going into teaching in the primary and secondary schools. As an example, the most eminent world authority on bumble-bees is a high school teacher. We have few people like that in the New World where the great majority of high school teachers are so weighed down by day-to-day responsibilities, public relations, and supervising "activities," that they are unable to keep up with any but the most generalized and publicized recent studies. We wonder at the wisdom of this emphasis of keeping the schedule full. In Europe, while the teaching loads are too heavy, the emphasis is upon a fuller knowledge of what is being taught which makes teaching more attractive for those who are interested in research. Further, in the training program of the places we went, the emphasis is not on methods of teaching but on the subject matter, with the feeling that the ideas and the facts of nature are the really interesting things, and that the methods of presenting them are details that can be learned in a very short time. It may be that there was too much emphasis on this sort of approach, or because of the greater competition for jobs suitable for university graduates in Europe, it may be possible there, where it would not be in the New World. It may be with the pressure of large classes and small faculty groups that such personal teaching is not possible here, but we wonder whether the end results are worth the emphasis on methodology and mass production which we see around us. Frequently we heard comments on the constant hurry which the Europeans find in the American, and the emphasis on materials and facilities rather than on teachers. Often we hear of fund-raising drives for new buildings, laboratories or sports arenas, but seldom if ever a drive for money to have more teachers or smaller classes.

The emphasis of this report has been on those stations which we visited that are doing work in research on the biology of natural occurring species. I cannot overemphasize the importance I place on the expansion of such a program of research in the New World. We have many more facilities and many more suitable species than exist in Europe and yet, other than our state- and federal-supported research programs on game species, we have a miserably small number of studies of this sort.

In Europe amateurs are making worthy scientific contributions on a large scale, and they have as high stature as professionals. I am convinced that we should be able to encourage more amateurs here. An amateur performs his work because he likes to; a professional because he is paid to. I am convinced that as anyone looks into new phases of the large study of ornithology he will find various facets of detailed studies of individual species as interesting as the faunistic studies so characteristic of America to date. The reward comes to the

individual because he is finding out new ideas, because he is departing from an old pattern of action, and because he is contributing facts and ideas of great interest to many other people. The men we visited in Europe are working on these aspects of birds and animals because they are interested in them. If they are so much interested in this sort of study, it is only reasonable that many Americans would find these areas equally interesting.

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THE USE OF MIST NETS IN POPULATION STUDIES OF WINTER FRINGILLIDS ON THE AEC SAVANNAH RIVER AREA¹

BY EUGENE P. ODUM AND GORDON L. HIGHT

In this paper data are presented illustrating the key role that Japanese mist nets may play in intensive studies of the population ecology of birds. In this case the net technic was used not because it was novel, or catches birds, but because it efficiently sampled a specific ecological group under investigation on study areas selected with an overall purpose in mind. We feel that in their enthusiasm for a new method banders may be tempted to overuse, if not misuse nets. Certainly, very little of real value can result from the wholesale capture and banding of miscellaneous small birds when the chance of returns is small. Furthermore, the overuse of nets in a specific area can certainly disrupt the very population structure which the bander wishes to study.

Since the establishment of the AEC Savannah River Plant in 1951 and the consequent retirement of a large acreage of land from cultivation a student-faculty team of the University of Georgia has been engaged in studies of ecological changes oriented towards functional analysis of total systems in nature and the effects which radioactive waste disposal may have on such systems. Because of the unusual opportunities provided, the "old-field" ecosystem has been a point of emphasis. Seasonal changes in the major plant and animal populations, as well as net primary and secondary productivity, are being studied over a period of years. On the southeastern Coastal Plain, as on the Piedmont, birds are relatively unimportant components of the early stages of vegetative succession during the summer but become quite abundant and important as "harvesters" of the seed crops in winter (Johnston and Odum, 1956). Fringillids, many migrating from more northern summer ranges, make up a large part of the winter population of

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