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Academic Aspects of Bird Control (2nd Bird Control Seminar 1964)

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THURSDAY AFTERNOON SESSION

MODERATOR JACKSON: One question to be asked at this point is "where to from here?" in regard to recruiting new talent into this area of bird control. I suspect that all of us here have quite literally backed into our present relationship. We may have been trained as coyote hunters but found ourselves in a place where blackbirds and not coyotes were the problem. Or we may have been reputable pest control operators, tending to our business of rats, cockroaches, and termites, when we were challenged by urban pigeon and starling whitewash problems. Or we may have been medical or veterinary people, tending to the usual run of diseases, when diseases we had previously read about only in the text books pushed to the front of the practice. Or we may have been college professors who were interested in basic ornithology and are called on for the applications of basic ecological concepts to specific control problems.

So for those of us that have backed into this professional niche, how do we get the next generation to walk in with intentions clear, eyes open, and a mind armed with good theory and practice? Do we have an "image" problem? Do we have an advertising problem? These are some of the questions that we would like to look at.

I have been assigned the particular task of talking about the undergraduate college program as a recruitment device. At the undergraduate level, we have two principal problem areas. The first of these is that of attitude. We are not interested in the individual who kills for the love of killing. The boy who takes aim with his first BB gun at every bird, can, and glass insulator, and takes this attitude into manhood is not desired.

On the positive side, the individual must have a broad spectrum approach to the world about him: he must view the bird in relationship to the whole environment. He must have an ecological outlook. And yet many universities fail to teach ecology at all, and when it is offered it is a course for seniors and graduate students. This is much too late in the student's career to be introducing for the first time such an important basic philosophy and orientation. Freshman courses traditionally have been compartmentalized so that sections on anatomy, physiology, classification, et cetera, are covered. A chapter on ecology may be included in the syllabus, but usually it is at the end and gets omitted because too many anecdotes were told earlier in the semester.

What we really need is to introduce the ecological approach at the very beginning of the freshman biology course and have these concepts pervade the whole instructional program. Until this is done our, graduates will have compartmentalized thinking and cannot adequately approach the problems at hand.

The second major problem is that of advertising the employment opportunities. Along with this we need academic course work in these specific areas of applied biology. After all, colleges have whole departments of economic entomology and frequently offer courses in applied or medical microbiology, bacteriology, and parasitology. Schools of Public Health usually pass over rather quickly rodent, bird, and general insect control.

Here at Bowling Green, we have been pleased with the results of our attempt to bridge this gap with our Economic Biology Curriculum. This is an under-graduate program designed for students interested in the many aspects of applied biology -- pest control, Fish and Wildlife Service work, food and drug inspection, pharmaceutical sales, public health sanitation, to name a few. Our approach, which is unique in the academic world, is to build a strong ecological foundation, give some insight into the problems encountered in each of these fields, and to leave the learning of the specific tools to on-the-job-training. Through this program we have been able to acquaint students with employment opportunities and challenges in these fields that they otherwise would never have heard about. More of this approach is needed in other institutions of higher learning.

ECONOMIC BIOLOGY
BACHELOR OF SCIENCE (BS)
(Biology Major)
BOWLING GREEN STATE UNIVERSITY

Freshman Year

English 101 (composition)	3	English 102 (composition)	3
Biology 110 (principles)	3	Biology 111 (zoology)	3
Chemistry 101 or 111 (general)*	3-4	Chemistry 102 or 111 (genera[1])*	3-4
Mathematics 121 or 122 (elements)**	3	Mathematics 122 or 123 (elements)**	3
Foreign Language***	3	Foreign Language***	3
HPE 101	1	HPE 102	1
	16-17		16-17

Sophomore Year

Biology 212 (field zoology)	3	Biology 272 (ornithology)	3
Speech 102 (principles)	3	Biology 112 (botany)	3
Psychology 201 (general)	3	Sociology 201 (principles)	3
Physics 100 (introduction)****	3	Psychology 204 (developmental)	3
Elective in minor	3-4	English——(literature)	3
HPE 201	1	HPE 202	1
	16-17		16

Junior Year

Biology 211 (microbiology)	3	Biology 322 (economic biology)	3
Biology 321 (economic biology)	3	Elective in minor	3-4
Political Science (st.& loc. govt)	3	Humanities elective	3
Humanities elective	3	Electives	6
Possible. Error. By [ED.]	15-16		15-16

Senior Year

Biology 308 (vert. physiology)	4	Biology 422 (ecology)	4
Elective in minor	3-4	Biology 335 (entomology)	4
Humanities elective	3	Electives	6-9
Electives	6		
	16-17		14-17

Suggested Major Electives

201 - field botany
306 - invertebrate zoology
311 - bacteriology
403 - mycology
405 - parasitology
472 - ichthyology
490 - seminar

Related Electives

Accounting 121 - 122 (elementary)
Bus. Adm. 102 (introduction)
Bus. Adm. 303 (bus. writing)
Bus. Law 315 (introduction)
Economics 201 (principles)
Geography 442 (conservation)
Geology 100 or 101 (intro.)
Philosophy 203 (logic)
Psychology 270 (quant.metho)
Sociology 311 (community)

*Chemistry 101-102 should be used for a minor in chemistry. If another minor field is selected, chem 111-112 (general) and chem 203 (organic) are desireable.
**Completion of math 123 is required. If proficiency is indicated on placement test, the student may be exempted from one or more semesters of this requirement.
***If less than 4 years of the same high school language, additional course work is required.
****If graduate work in public health is contemplated, physics 110-203-204 (10 hrs) should be taken.

We will move on from here, to some additional topics. Dr. Mel Dyer from the Ontario Agricultural College, who has played a very important part in the red-winged blackbird research program that you heard about earlier today, is going to approach the area of graduate teaching, graduate research.

And then Walter Howard, since he insisted on coming last so that he could talk, will wander around among various topics. So, Mel, we will let you take over.

DR. DYER: I want to amplify, initially, the comments made by Dr. Jackson; that is amplify these comments from an undergraduate level on into graduate training and then give what I think are a couple of approaches to further training of individuals working in the biological field and in control.

Certainly by the time that an undergraduate student, a good undergraduate student, reaches matriculation at the graduate level, he is a selected individual; and, if he has had the training that Dr. Jackson has indicated, he should be an independent thinker by this time. In addition, he will have a broad background. This is the type of individual we are looking for. A survey of biology departments in many graduate schools today will show students with a wide range of training and indeed the department will not look at all like a stereotyped biology department, because we are not looking expressly for "bird-watchers" or persons with limited interests. The individual that enjoys and understands the "out-of-doors'" can contribute must more if interest passes beyond this superficial point. This contribution can be made most valuable by providing means of communication with other biologists and the "new-comers" to biology.

The apparent "new-comers" have as specific backgrounds engineering, mathematics, chemistry, bio-physics, and many other so called "core-subjects," They comprise a group that we considered a few years ago to be completely non-essential to field biology. These disciplines that I have mentioned need not be confined to the laboratory and these students whom are conversant with biologists and workers in the physical and mathematical sciences are greatly needed. From these individuals new ideas about ecology and new applications of old ideas can be expected to arise. There are few individuals who can converse expertly in all fields necessary for understanding ecological problems of today, but fortunately these people do exist, however, an interdisciplinary approach, i.e., the concept of a team of workers going into the field each individual contributing ideas from his own particular field toward the solving of an ecological problem is proving to be a most productive and useful approach. Graduate students projects are broadly based and anything that contributes to the basic understanding of the reactions of a species to its environment is certainly worthwhile working on, whether the project involves building mathematical models, or studying behavior with binoculars. While it has only been intimated during this conference, the phenomenon of human expansion will tend to amplify present problems in the realm of human population - bird control problems. Thus, there will be room for many disciplines in such a program and these are the students that are being looked at for graduate work.

As far as projects are concerned, each student coming in with his own ideas, whether he is an engineer, a medical trainee, or a veterinarian, provides the potential for extending the scope of research into new lines. Let me pose an example with bird control research and bird populations. Much is known about the biology of the breeding season of birds, but it strikes me that there is a serious lack of information of most bird species for the post-breeding season. Studies on post-breeding flock behavior, response of flocks to environmental stimuli, and their population stimuli, and their population structure are lacking badly and here are subjects in which we should have more endeavor for periods other than the breeding season. Such work is complex and this is one reason why there have not been biologists working in this field previously. But, let us say a mathematician comes along with a new idea based on a model system. We cannot deprive him of working on this system, and, while such a study can become divorced from the basic facts of the field situation, certainly the past has shown us that stimulating insight has been introduced into population biology from just such individuals and I am certain that basic information will be forthcoming in the future.

A second subject, one which has not been mentioned in this conference and one that I would like to comment on, regards productivity of a species. We have been concerned with the environment of an animal as a primary factor, and in the ecological environment of course the two most important things for an animal or an animal species is a place to live and something to eat. But, what has not been touched and what is a very basic problem, is the innate ability of an animal species to reproduce. Admittedly, population numbers cannot be calculated in a laboratory closed environment with any great degree of success, yet despite this inadequacy or lack of insight in the simple laboratory situation, there is no reason why we as workers in the field associated with avian control should not attempt to carry the basic laboratory principles into the field. If we do not work on this aspect, we are certainly not going to get anything done. In this respect, intensive work must be continued in order *to* determine this basic factor for our problem species.

A third aspect involves the basic behavior of an animal species. We as biologists realize that the problems of control of a natural existing animal population are prodigious. Behavioral considerations populations have become more important and they have been mentioned in passing many times during this conference. Dr. Herman mentioned them this morning, several of us had a discussion on them last evening, and all of you people that have been concerned with applying measures to birds, by and large, have had to deal with a particular phase of species behavior whether the control has been directed toward individuals or toward massive populations. Control measures directed toward an individual, if the measures are extreme, certainly produce a state of finality. However, control directed toward large numbers of individuals or a large number of individuals contained within the entity of the flock mass is a completely different matter.

I recall the comments of my freshman chemistry professor during the study of half-life of radio-active elements which are apropos at this point. He posed the model of a boy and his girl-friend on opposite sides of the street;

and he proposed that if the fellow, being interested in crossing over to visit, approaches her half the remaining distance every ten seconds he would never reach her position, but, he might be close enough for all practical considerations. I would like to suggest that we are being very foolish, both from the standpoint of being dangerously ignorant for effort and monetary expenditure, in making full scale attempts to control free-living animal species, but what we may be doing instead is "coming close enough for all practical purposes," What we have not decided is exactly where this point is for most, if any, animal species.

One person or the efforts by any on" group of individuals cannot determine fully this procedure, therefore, the task is going to be best attacked by an inter-disciplinary system and the best place to look for this immediate help is going to be from our present, undergraduate and graduate students, all of whom carry enough basic background to the site of the biological problem to systematically add necessary impetus and know-how to the situation at hand.

MODERATOR JACKSON: Thank you, Mel. I think we will hold questions until after Walter has had his say, and perhaps this will integrate some of your thinking.

Next will be Dr. Walter Howard, a Vertebrate Ecologist from the Department of Animal Physiology, University of California at Davis, dealing with some general remarks regarding bird control. That is about as general a title as you can get,

DR. HOWARD: Thank you, Mr. Chairman, and ladies and gentlemen. Mr. Moderator, I am extremely pleased at having been invited to attend this seminar. I have found it most stimulating. One disadvantage of being at the tail-end of the program is that I must avoid repeating what has already been said. My comments are not all going to be new to this conference because most of the list of items I had have already been well covered. Unfortunately, I have no specific message to give. I wish 1 did. I would like to try to drive home some special point; but as general as my title is, "General Remarks," I have no special message, hence I will ramble.

I wish to concur with my two previous panel speakers. I agree very much with what they have said. Now is certainly the time for more subtle and more sophisticated research on bird control. I sometimes wonder if we shouldn't also start worrying about what is going to be the undesirable consequence of living in a civilization surrounded by an antiseptic environ-ment, for it also is going to create problems although they won't occur immediately.

Major breakthroughs in the development of new principles and theories of bird control are likely to result, I believe, by investigating simultaneously the specific and complex behavioral, physiological and ecological processes. By working within such a broad framework, animal control policies can then be derived from a clearer insight of both animal behavior and various sophisticated

ecological principles rather than having the control policies based on the more restrictive research designed just toward animal destruction.

Animal controls in this instance bird control, requires broad knowledge of the population dynamics of the particular species concerned, as was so well presented to you by the previous speakers, because control is the management of population levels, not the destruction of individuals. Effective animal control is the translation of ecology into policy.

Frequently, in a university atmosphere, there is the necessary assemblage of talent available to promote the cross fertilization of ideas dealing in the development of unifying and stimulating research themes on animal control, but only after such programs have been activated. The only way to effectively minimize bird damage in a satisfactory manner is to have a well-staffed and strongly supported — money, money — research program, which has a broad ecological basis upon which to operate.

There is a great need for colleges and universities and for educators at all levels to begin to recognize and to spread forth the philosophy that bird control is not just killing birds. It is managing bird populations. Whenever man modifies the habitats, we must recognize that more problems will probably result. We must strive to have a more realistic education program in this whole field. We must get away from the emotional stigma that has been too frequently associated in academic circles to anything related to the word "control."

We are all aware of these problems, I am sure. It is my opinion, however, that the atmosphere, the general climate in this area, is improving; but it is not improving rapidly enough to suit me ——not necessarily the academic aspect, but the views of the protectionists who are sincere but unfortunately also often misled. Many of these folks who become problems to us are not really at fault, basically, they are merely misinformed. What we need to do — you and I — is to influence thinking, not try to influence thought — we don't have to brainwash these people, only just get them to think through the biological problems we are talking about. Then I think many of our difficulties with them will be overcome.

The importance and significance of achieving adequate communications between ourselves and with the general public are not always fully appreciated. Unfortunately it is easier for someone to take a strong positive stand for or against something the leas he knows about it. You know the old adage: Don't confuse me with facts; my mind is made up. As a result, too often these viewpoints become so strongly entrenched through ignorance that I consider them then as being equivalent to religious convictions. Due to misinterpretations resulting from inadequate communication regarding bird control, all comprehension of facts often evaporates into a state of confusion.

We are aware, of course, that ecological abuses of any unwarranted control program can no longer be tolerated. This has been brought out frequently

at this seminar. I think w all recognize the importance of doing all we can to minimize the unnecessary killing of innocent animals, by developing where possible more effective means and by using repellents, frightening techniques, habitat manipulation and physical exclusion; and we also recognize that in the actual destruction of birds we must be as specific as possible, not only as to the species but even to the target individuals or flocks of individuals that we are concerned with.

There is a growing reaction in this country and all over the world against any unwarranted killing of animals that are not actually creating a problem. The difficulty, then, is who decides whether or not a given situation is actually a problem? The whole thing is relative. What is a pest to one person may not be a pest to someone else. Since time and social values are changing, and pest animals are now assuming recreational significance, these new aesthetic values must be reckoned with and fully appreciated in all control activities. It is paramount that control programs fully recognize the sliding scale of values and that all control be limited to the troublesome species and preferably the specific individuals concerned.

Animal problems, i.e. vertebrate pest control problems, are primarily people problems. If one analyzes this phase of the subject first, he will get much further in his actual control program. They become people problems, largely due to the ignorance among the lay and the scientific public alike as to what the true situations really are. And this is partly our fault.

It should be apparent that pest control operators and the rest of us are not operating under any pest psychosis, pest hysteria, or pest phobia. This left the field long ago.

Another point I would like to mention regarding the improvement of public relations, is that you should always emphasize the need for control measures and go easy on what you say regarding the methods you intend to employ. There is no need to elaborate on how you plan to destroy birds. Instead, put the main emphasis on the need for the control operation in question and you will gain far more support.

Let me cite you one example. A few years ago there was a serious outbreak of meadow mice in sugar beets and alfalfa in California. Conventional methods of control did not work so we had to initiate research with new chemicals. Since we were after direct destruction of the mice — there was no chance of any other type of control measure working — this meant that in our tests with "unknown" chemicals there was a chance of killing a few pheasants or waterfowl. Both groups of game birds were in the area. To avoid getting into difficulties in case a pheasant was unintentionally killed, I informed the public regarding the problem, but said nothing about methods to be used. I spent several days trying to photograph sugar beet that had been hollowed oat by mice and which also had a live mouse in it. I wanted something that would appear as general news, not be restricted just to the agricultural sections of papers. To get a good photograph, I finally had to call in a university photographer. Bust it was worthwhile because the story

became general news. My worries were over. Now I could test the new chemicals without worrying about the consequences should I accidentally destroy a bird or two. Everyone's concern now was "those poor growers and is the price of sugar going to go up?"

One of the chemicals I was experimenting with on a research basis, which was not registered, did kill several waterfowl and pheasants. I promptly called the California Department of Fish and Game and requested them to come analyze them. I said, "I was sure this material had killed them." They then conducted an excellent field test with the Bureau of Sport Fisheries and Wildlife. This meant they were new part of the picture. Instead of jumping on me for accidentally killing a couple of game birds, we got together and made a careful study and concluded that this material was too dangerous to use on mice in this situation.

When starling problems were beginning to appear in California, we knew the state legislature was going to give us money. Before we got the money I wrote the National Audubon Society and said, "Gentlemen, we have a starling problem. We are going to be ordered to do something about it. It is not a delightful responsibility to receive. For heaven's sake, help us. Have you any suggestions? We will answer every letter you send to us immediately and also we will keep you fully informed of our progress if you wish it."

I told them the various approaches we were going to use. "This one is going to kill a few robins. This one will kill blackbirds and maybe a few other birds" -- all of the various things that we would have to try. Consequently, they were now part of the starling control program. They have had their opportunity to advise and to object. They have been very good. There have been no complaints so far. We have gotten along beautifully. Honest communications are important.

Referring to what Dr. Dyer mentioned, we do need to investigate all aspects of biology of the species in question before any of us can predict what our control results are going to be. The time has come when it behooves certain academic personnel to become very sophisticated in their approach to bird control problems, since they are in the best position to do this. We need physiological measurements of the environment and of the various pressures on bird populations. We need autopsies; biochemical, histological, pathological tests; examinations; we need to look for inherent weak points in birds which might be exploited.

As Dr. Herman mentioned earlier, there is a dearth of physiologists working in this area. We have been trying to hire one for many months to work with us on certain applied aspects of ecology. They are very difficult to find. We need information or. dispersal, on seasonal and local movements, on the social structures, and on how to analyze banding returns. Many starlings are banded, but it is not easy to analyze the results. More information on photo periods and even the orientation mechanisms are also important.

Some pigeon fanciers I know have found that when they release pigeons close to a nearby radio station, many never return home. We cannot build a high

powered radio station just to confuse starlings so they will get lost, but there are many unknown mechanisms that need to be researched. We don't even know how to age most of our birds as to whether they are two or three-year-old birds. We don't know how to do this, yet it is very important for us to understand the structures of the bird populations we are dealing with to know whether the population levels are going down or up. We have a lost of basic biology about birds that is still needed. We certainly need more information on the reaction of birds to colors, i.e., color as a frightening device and as an attractant to food; the general importance of smell and taste or flavor with birds also is not well understood. We often say that birds do not have a sensitive taste and that their sight is more important; but we need physiologists to help us out in this area. We also need more information on the effect of sound pressures upon birds, i.e.., both sonic and ultrasonic, although I have to concur with some of the previous speakers — so far we have no positive beneficial effects with ultrasonic on either rodents or birds.

We certainly need more information on the physiological effects of various toxicants on the animals we are dealing with. There is often quite a variation between different species. Sometimes the heart or the entire circulatory system is affected in one species by a given chemical, while it is the nervous system that is affected in another species. There is room for a great amount of work here.

Additional sophistication is needed in the area of bait acceptance and baiting techniques. I refer ho such things as size of bait material, the amount of bait to put out depending on population density, and whether or not one should make single baits lethal and then mix them with a much larger percentage of clean baits. This latter method has great potential because then the total amount of toxic chemical that any one bird can consume will be less, and this reduces the hazards of secondary poisoning and the degree of environmental contamination.

I proposed the single-bait-lethal technique in 1957 when I was in New Zealand and Australia on a Fulbright studying rabbit control, I am pleased to find that Western Australia has developed this technique for rabbit control. In this instance, they use oats, of which one kernel out of a hundred is treated with 1080. The 1080 is applied by vacuum. This means that out of every hundred kernels, 99 serve as pre-bait, hence the distribution of pre-bait and toxic bait can be done in one operation. They compared this method with pre-baiting for a number of days before the poison bait was put out. They analyzed the results and the average of all of tests ran somewhere in the neighborhood of 21 percent greater success with what they call the one-shot method, i. e. one kernel toxic to 99 clean. This technique needs a lot of additional study. There would be no hazard whatsoever of secondary poisoning of dogs, cats and other carnivores if field rodents were poisoned in this manner, so that no rodent could consume more than twice the lethal dose of 1080. Secondary hazards from 1080, which is used to control field rodents, results when the prey consumes many times the lethal dose before dying.

This, of course, happens under the conventional method of animal control

because enough bait must be distributed to insure that the casual feeders will still get enough; but, as a result, some of the eager eaters consume many times the lethal dose and then become a hazard to predators and scavengers. More work is needed in evaluating the secondary hazards of different baits. We have some good toxicologists working with us in Davis, but this field needs a great expansion in many localities.

I will not discuss the technique in bird control of lowering the surface tension or, in other words, the use of wetting agents. This was well covered by Ki this morning.

Chemo-sterilization is an area that needs exploring. In vertebrates it only has restricted us, but ultimately it will have a place, if good enough materials can be found. They must be easy to get to the animals so that a high enough percentage of the animals will receive them. And they must last long enough, otherwise the method would merely increase the rate of survival of those not affected, hence not effectively reducing the over-all population level.

I won't get into frightening devices. They have been well covered. Diseases were also nicely covered.

Biological solutions to pest problems are an area in need of sophistication. What potentials are there for ecological control of some of our pests? How can we upset the biological balance so that it will give us relief? You might call this "ecological management to promote a natural balance," or "self-regulatory ecological units," if they can be established.

A Very good example that happened by accident in New Zealand of this situation concerns aerial fertilization of their pastureland. Wherever, they have thirty or more inches of rain, the fertilized pastures produce such a rank growth of grass that it creates habitats unfavorable to rabbits. Even though New Zealand today still has to annually drop by air quite a few thousand tons of 1080 bait for rabbit control, more potential rabbits have probably been controlled with lime and super-phosphate than with the toxic chemicals.

A new approach is required to fill a scientific void which exists in most applied vertebrate-ecology investigations. Even though there is a great volume of data accumulated on control, the area is under-developed with respect to basic principles and theories. These must be developed, challenged and modified. We need a clearer insight into the mechanics related to the complex ecological processes that are involved.

Peat control problems of managing population levels are much more complicated than the relatively straight-forward problem of managing game animals (Fish and game), which primarily consists of attempting to increase populations. This is quite a different situation.

I want to make one comment about predator-prey relationships. I believe that the upper levels of populations of birds and animals, wild vertebrates, are

largely the consequence of self-limitation —. intraspecific stresses. The density which one sees is primarily determined by the suitability of the habitat and self-limitation. Members of each species of vertebrate usually control their own maximum density levels. This implies that vertebrate predators, under natural conditions, are not important in suppressing the density of their prey. In fact, I contend that on the average -- there are exceptions, of course — that natural selection has brought about a situation where the greatest density of prey can exist only in the presence of predators. This reproductive stimulus resulting from predation is necessary to produce maximum numbers. When a predator kills an individual animal, that animal is dead, of course, but the population, on the other hand, may be stimulated to increase even more.

Following this meeting I am to discuss this subject on a TV program in California. California has an archaic buck law regulating deer hunting. My mission will be to point out to the audience in southern California the need to shoot does so that then there will be many more buck to shoot. If you want more fish in a pond, you fish it. And, may I say that whenever you control birds or rodents in a city by individual premises or buildings rather than by doing area-wide or a community control, the rats and the pigeons have never had it so good as a population. You may kill individuals, but such sporatic control probably works like predators and stimulates the remaining populations more than it suppresses them.

I am way short of completing all I wanted to say, but my time is about up. You have been very patient. Since you have had two days of this, I am sure our moderator is ready to bring this meeting to a close.

MODERATOR JACKSON: WELL, I think what you have said, Walt, brings us to a rather fitting closest to the more or less formal aspect of the program. We have a little time for questions, and then a couple more items before we adjourn for the year. Any of you have questions on any of these presentations?

DELEGATE: Well, on this fertilizer, did this kill the rabbits or did this just repel them?

DR. HOWARD: I fell quite certain that the effects of the fertilizer were not directly toxic. It merely produced an unfavorable habitat. The only guess we have so far as to how the unfavorable habitat (of dense grass) reduced the rabbit population is that it may have caused pneumonia or some such complication in the young, due to the high amount of dew and year-around rain-fall in Mew Zealand. But it may be due to something else. It is not really-known just why some animals like one type of habitat and not another, but it is an axiom that animals do not do well unless they are in a suitable habitat. The species of birds which you are concerned with are difficult to control because they are quite flexible and can adjust to modified environments. There is a great deal of flexibility with some species of birds and this is why they become a problem.

DELEGATE: On your very last point, you mentioned that you stimulate

the population rather than suppress it on individual control. Would you elaborate on that?

DR. HOWARD: I think it is a basic law of nature. When war is declared, we don't stop and think, "some of us are going to be killed, let's reproduce," but there is always an increase in babies when wars are declared. When you interfere or harvest populations, whether it is livestock or wild animals, you give them a stimulus to reproduce more. We don't know how it works or how the self-limitation and undesirable stress factors operate to check this increase. There are undoubtedly interacting forces operating. In certain situations, one factor may be more important than the other. These stresses may be psychological, territorially, competition for mates or food, disease, weather, or other vicissitudes of life. We don't really know what they are, but they ultimately put a check on the density of the species. This is the reason why population levels do not go beyond certain levels, regardless of whether or not predators are present. If loggers go into a pristine forest, yet do not overlog it, two things result: there is an increase in the number of trees per unit area, and an increase in the amount of cellulose being produced per unit area, as long as too many trees are not removed.

There is a good correlation in the western United States indicating that as the number of deer hunters increased and the take of deer also increased, then problems of over-populations of deer occurred. The Kaibab Forest story, which implies that after mountain lions and other predators were destroyed that the deer numbers then increased way beyond the carrying capacity of the area, is not well substantiated from a cause-and-effect point of view. This mistaken view point got into the literature and now it will probably be perpetuated for along time. Game people acquainted with the situation believe that the boom and bust of the deer population was mostly the consequence of habitat modifications - fire, logging and changes in grazing practices - not the result of predator control.

The New Zealand government is trying to control deer because they are a pest in some of their forests. They have had teams of hunters for the last 34 years — sometimes a hundred or 120 men employed full time to kill deer. Initially they directed the hunters to go where the greatest number of animals occurred, and then once the deer populations were reduced they moved the hunters to some other area. As a consequence of leaving the deer herds alone for a number of years, after they had been reduced, new population irruptions resulted. Most people are now convinced that these early control procedures resulted in additional deer irruptions with the level of deer populations exceeding what would have occurred if the herds had been left alone. Sporadic control stimulated them to overproduce.

Populations of caged mice can also be stimulated to over-produce. If, after a normal level of density has been established, they are transferred into smaller or larger cages, or if individuals are taken out or added to the cage, the density will increase. Inadequate control of field or forest rodents can create a higher density of rodents than would be present otherwise. This

has been demonstrated many times. Even though 1 have never done this in urban areas, 1 am sure that rat and mouse populations also are stimulated when only partially controlled.

DELEGATE: How do you reconcile this when you said we should be working toward the more specific --- maybe to even go to the individual birds, or something like that. Wouldn't that, in essence, be defeating what you are talking about now?

DR. HOWARD; Effective control is not measured by what you have killed or by the percentage of the population that has been killed. We are forced to use these express ions, but they are really poor terms. For example, a 68 or less per cent control of deer can be much more effective than a 98 per cent control of some field mice under certain conditions, because of the differential in reproductive potentials. Effective control is best determined or measured by what is left, whether or not the surviving population has the reproductive capability of replacing rapidly enough the individuals taken out of the population. When the objective is just protection, then populations do not have to be reduced so low because it does not matter if the population level builds up again soon thereafter.

Bird control, for the most part, is a continuous thing. It is a pity that so many people think bird controls such as pigeon control, means that all of the birds are going to be eliminated. We know they are not. Our objective with most bird problems is to bring them to an innocuous level locally. This level is often determined by economies. Also, the cost of control programs should be matched by the benefits accrued thereof.

DELEGATE: I wonder if Dr. Howard would elaborate a little more on this approach to disease in the terms modern warfare. We have been calling it ever-killing versus just killing, thus approach in 1080 oats and so on, dilutions, untreated — would you elaborate a little more on your thinking, what it might imply in terms of over all techniques?

DR. HOWARD: I am not sure I understand your question. Do you mean are we achieving sufficient success?

DELEGATE: No, no. Are there implications here other than just reduction of secondary poisoning hazards, for example? Are there other things that you have in mind here? You mentioned prey -----

DR. HOWARD: I would like to see both a more effective and a more selective type of control developed. One of the reasons I often prefer 1080 for California rodents, i.e., with the field rodents, is because then it is not necessary to use as much toxic material. It is a slow-acting poison; hence it is not necessary to have much bait out that all individuals are immediately killed. Using 1080 both the "eager eaters" and the "slow eaters" will have ample opportunity to pick up a lethal amount. As a rule, with 1080 we treat only every third year. When strychnine is used, not only must more be put out, but it may have to be used every year. Also, strychnine is much

more hazardous, as it is used on rodent baits, to many non-target species of birds both directly and as a secondary hazard. This statement requires qualifications, of course, which we do not have time for at the moment.

MODERATOR JACKSON: I think, in essence, what we were getting at right here is that in terms of dollars and cents, 1080 is much less lethal than strychnine.

DELEGATE: We were always instructed it had very bad secondary poisoning.

DR. HOWARD: We kill more dogs in California with strychnine.

DELEGATE: I mean secondary.

DR. HOWARD: In the matter of secondary poisoning of dogs with strychnine, it depends on how long it is before treatment is given. Strychnine is fast-acting. By the time most dogs poisoned with strychnine reach a veterinarian, whether or not they are going to live has already been determined. The veterinary will treat them, if they have survived that long, but chances are good they would have lived anyway. If 1080 was used carelessly, then far more dogs in California would be killed, because 1080 is quite selective for dogs.

There is no known chemical that I have been able to learn about from toxicologists — and I have asked this question many, many times that could be put in meat designed for effective wolf control or coyote control, which would still leave that meat as relatively safe to humans as it is with 1080, I have personally found people who had learned to follow the agricultural crews, who were poisoning rodents with 1080. They would wait until the men had moved off to some other area in the county, then go out with a gunny-sack and pick up the dead and dying ground-squirrels for food. The chances of any of the people being poisoned as a result of eating the squirrels is absolutely out of the question; but, nevertheless, since 1080 is a toxic material, I put the fear of God in them. They dumped the squirrels and left - for good, I am sure. We can't take chances with toxicants, although it would be possible to poison all of the livestock that is to be consumed by humans without any one being poisoned. Strychnine is from three to seven times more toxic to man as is 1080. And much smaller amounts of 1080 are generally used in rodent baits than strychnine or many other rodenticides. The bad image about 1080 is largely false. What is said about 1080 is not in proper perspective to what is said about other toxicants. I don't think we can save 1080, but I think it is unfortunate that such a good material has acquired such a bad name

DELEGATE: Strychnine is mentioned so many times in this conference on bird control. Not, do you have anything to comment on about it as a humane practice of killing?

DR. HOWARD: This whole subject of humaneness is a very difficult

thing, because we lack these physiologists that Dr, Herman spoke of earlier. To begin with, no one knows how these animals are "affected" by pain. With many of the toxic materials, it is not known how they affect the animals. Some may affect the nervous system. It is even possible that dogs which go through distressing displays as a result of 1080 poisoning may not be conscious of what is happening.

One value with strychnine is that it is quick acting. It is rather incongruous that it is considered inhumane to poison these animals, when such a death is so much more humane than the fate all of these individuals must face eventually under natural conditions. It is much more humane, with every yardstick that can be used, except that one is a natural event and the other is artificial. For the same reason society will shoot a horse when it is suffering, but it will not let a human die even when his chance of surviving is hopeless.

MR. BFCK: I would like to add a comment to what Dr. Howard has said. You have many humane organizations that will accept trapping as a standard practice for pigeon control, and yet those of you who have done it know that it is the most inhumane method that you could possibly invent .for this. In the first place, the bird is in the cage a couple of days. It has never been confined before, probably goes without food and water part of this time, beats its wings against the wire. How we gauge pain in birds, I don t know either, but by the time you take it out of the cage and stuff it in a box to humanely gas it, half of them die of shock.

DR, JACKSON: I think it would be desirable if we could settle on the accepted name and all of us attempt, as we deal with these in conversation and writing, to talk about either the Queletox (instead of Entex) or the Avitrol (instead of Phillips 1861), Let's forget about these other things which we have been using from time to time. Let's see if we can't adopt and use the proper names.

We have a couple of loose ends. George Hockenyos, who really should have been on the program as a formal speaker, but who was so useful in so many different directions that we didn't quite know where to put him, is here as a general resource man to keep topping up and throwing in ideas, and he has a couple of additional things to say which I think will be of interest.

MR, HOCKENYOS: Since we are at the end of the formal program, I think it would be appropriate for somebody to remark that this has been a most remarkably good conference, and the accommodations we have had here, I have no idea who is responsible for the fine service and consideration of our welfare and comfort, but if we ever find out who is responsible I think we owe him a vote of thanks.

DELEGATE: Bill Jackson,

MR. HOCKENYOS: Just a couple of observations — I guess I am kind of one of the pioneers of the pest control industry and bird control and that is I note that although we keep getting new tools, we never seem to drop any of the old

ones. One of the first tools we used in our commercial pest control were the sticky repellents, and I would venture to guess that Mr. Fink is still selling about as much sticky repellent as he ever did, and maybe more.

This morning I couldn't help but note that some remarks were made about using the shell crackers, and we did at one tine. It is rather interesting, too, that so many of the tools we use in urban pest control are also used in agricultural pest control. We didn't like the shell crackers. They cost twenty cents apiece; and twenty per cent of them are duds, plus once in a while one exploded in the shotgun shell, and you hope that the barrel will stand another such explosion. Also it has one definite range. For those of you who are not familiar with the red-covered report of the first Vertebrate Pest Control Conference, you will find that we cooked up quite a number of projecting devices that we like much better and are much cheaper to operate than the shell crackers; and when you look at some of these devices, you will know why the ghost of Rube Goldberg haunts me in my dreams. I think that will be over pretty soon, as soon as Rube Goldberg's ghost hears about how they drive starlings through a lighted Niagara Falls of water, he will leave me and go after the Fish and Wildlife boys.

Of course, one should never talk about his pet project until you are pretty sure it is going to work, but the pet project I had when I left home is to use one of these Sure Shot electrically operated acetylene guns, so that it can be fired through a micro-switch, which could be stretched along a ledge, an inch or so above, or stretched along the ground, in the case of ground rodents and squirrels, and therefore time the explosions to the time when you need it.

MODERATOR JACKSON: You heard, just a little while ago, from Mel Dyer, He was talking on an assigned topic, but I have heard about some of the things that he has been doing in terms of his research with blackbird populations, and I have asked if he couldn't take ten or fifteen minutes and rather informally share with you some of his activities in terms of almost basic research that he has been working on.

DR. DYER: During the course of development of my graduate program the question of utilizing radar, a relatively new tool to biologists, for surveillance of a natural bird population arose. It has been shown many times that it is possible to track birds over long distances, and several English reports indicated that they were able to track Starling movements, which to ground observer seemed to be scattered randomly, and show that the birds, both migratory and local, had very definite patterns of movement.

In the fall of 1961, Dr. Dwain Warner of the Minnesota Museum of Natural History, Robert Schwab who is with Dr. Howard at the University of California at Davis, Dennis Raveling now at Southern Illinois University, Al Sargent now with the U. S. Fish and Wildlife Predator Control Group, and I visited Sand Lake, South Dakota. We were interested in collecting birds and in surveying the problem situation. A research team from the Avian Contra-center of the Denver Fish and Wildlife Service Laboratory had been carrying

on a blackbird research program for three years at that time. It occurred to us, while watching the populations at the refuge,, that there were many different populations present in the refuge at any one time and I decided later to pursue this thought.

It is known that prior to the time when radar proved useful there was no way to survey adequately and understand the patterns of movement of a massive population of birds, one in which there are estimated millions. At any one time only a segment of the population can be seen, therefore the patterns of dispersal and of local activity are simply overwhelming. Such was the case in South Dakota. With a lot of frustration and planning, and aid from numerous individuals 1 was able to get the radar set up at Sand Lake in August 1962, Bill Cochran, an electronics expert from the Minnesota Museum of Natural History at the time} aided tremendously. I am sorry I do not have slides or film to show you at the moment, but I will try to summarize what some of the results were.

It is my impression from this work that successive waves of blackbirds, which were not known to have been traveling through Sand Lake in the pattern that I later showed, were indeed present on successive days throughout late summer and autumn. The behavior, shown by the radar data, indicated to me that the activities of these many different populations were very specific, indeed as specific as behavior described for any passerine or any other bird at its home breeding ground„ Now here, to my knowledge, is the first time that we have been able to obtain quantitative data on phases of redwing post-breeding behavior by utilizing massive numbers of a free-living population,, Literature reports on flocking behavior, for instance, are very sparse for any species.

Another fact we obtained from, these radar data is the fact that various populations during migration are on very specific diurnal rhythms and these diurnal rhythms are dictated to them at their point of departure in the fall on their migration - this is supposition based on rather insufficient supporting data at the moment. I think that this information, provides insight to an extremely important point, and this is that we must know, in the case of redwings, starlings, waterfowl and so on, where these, birds are stemming from in their migration. Further work on this point looks promising and is being planned. At the moment, in the program we at the University of Guelph are starting in the Lake St. Clair marshes, we do not know the populations present during the fall at a problem site in. Ontario, To get some of the answers to this problem I plan to get a radar set operating in this locality this coming year,, I hope to verify some of my previous conclusions, but I am not certain what the situation will be in Ontario. I do think, with the aid of a good many people of course, we can come up with information on the rhythms, behavior and insight into problems associated with naturally occurring redwing populations that will prove to be valuable toward a control program.

I have come up with a couple of pet ideas, but this does not mean I have the last answer. Several functions I was certain that existed concerning the biology of the redwing have been adequately countered by John Beck, so this

conference has been an instructional period for me. I just assumed that perhaps Red-wing Blackbirds were operating the same manner over a large portion in North America, then 1 happened to recall a section in recent book by Dr. Ernst Mayr in which he discusses the problem of micro-geographic variability and I quote from one of his sections "Every population of a species differs from all others genetically and, if sufficient sensitive tests are employed, also biometrically and in other ways."

This is a very complex little statement. It means to me that any problem we attack, whether in Toledo or Cleveland or in the blackbird marshes of Ohio, Ontario or South Dakota, is an entity unto itself and, to carry this thought further, each species, about which we have been considering the control is also an entity unto itself. Therefore, something we have learned about one local condition may or may not apply to conditions elsewhere. I think we have not been altogether too cognizant of this fact in the past and I hope in part of our future work we will be able to treat our problems in avian biology with an awareness of micro-geographic variability in the manner of Mayr's discussion.

If there are any questions on anything I have casually tossed out I will try to amplify them.

DELEGATE: Is there much study going on in the wildlife and college level on the migration, money-wise? Is it really being looked into?

DR. DYER: I think there is a tremendous amount of academic investigation being carried out on bird migration. There are several hundred North American species and of course not all have been investigated adequately, but perhaps studies on waterfowl give us some of the best data because of an intensive banding program and, most importantly, adequate facilities for band returns through hunting.

Radar studies as done by Bellrose, Graber, and Drury in North America and Lack and others in England have provided valuable information for migration studies. European workers are avidly involved with all aspects of bird migration as well as workers in North America such as King and Farner in Washington, Kendeigh at Illinois and Odum at Georgia. I think that in light of the current rate of work that within a few years there is going to be a great amount of information available on navigation, orientation and migration of birds, population structures and other related and pertinent factors concerning avian biology.

MR. BECK: We were talking last night in regards to the social bird, such as the starling and the red-wing, the relationship of the individual to the flock; and ho this fits into studies of basic behavior; and how this might eventually begin to affect some of our bird management procedures. I liked some of the things you said last night, and I hope some of the folks here might hear it again.

DR. DYER: We had a very interesting session last evening, I noted pre-

viously that little time and emphasis has been given to post-breeding behavior of several bird groups and the reason for this fact is that this subject is very difficult to study,

Post»breeding behavior of a gregarious species, such as blackbirds, herons, and the starling, produces some very unusual circumstances. After the territory is absolved or ceases to exist in the breeding season sense in the redwings for instance, a gregariousness develops. There is a totally different association, one bird with another, than has been present during the territorial season. This is very obvious. Now, maybe on a philosophical or theoretical basic, we can regard the birds not as being a group of individuals, but as forming new individuals, i.e., the flock becomes the basic individual.

Further research on this aspect — I am not exactly certain how we can approach this - should be very rewarding. What John has reference to is the study of the coordinating factors within this flock social unit or superorganism, if I may call it that. Any individual, from the amoeba to the highest vertebrate, has some coordinating system, in short the nervous system, which is responsible for co-ordination. If an avian flock assumes an entity as an individual then there must be some system of co-ojdination within the flock. I think evidence from various sources, including some of my work, show that birds of one flock likely have come from a very closely related area. Now, if there is some common denominator or method of communication within the flock, this cohesiveness which is acting to keep the flock together can perhaps be disrupted. If this is so I think we can expect a lot of manipulative considerations to arise from such a line of investigation. I hope I am able to work on this aspect and I hope other people are able to get to it too because there is certainly more than one way of investigating this social behavioral phenomenon.

DELEGATE; Did you say the birds are to the flock like the bees are to the swarm, in other words, they are led, so to speak?

DR. DYER: At the moment I am totally unprepared to make any analysis of this sort. There is a very striking resemblance of course, anybody that has watched shorebirds or redwings, when the leader suddenly elevates its flight over some imaginary obstacle and the rest of the flock do likewise, must be impressed with this sense of co-ordination manifested by these following movements. There seems to be something occurring this instance that we have not defined and that ought to have logical grounds, and perhaps if the definition of this function is forthcoming we may well have further insight into control practices. So certainly we must look to other models and maybe we can use the best ideas of these models on social systems in avian biology - I would prefer looking at most other social systems except the social system of man, mainly because acceptance of rules for man runs the danger of clouding up analyses of animal systems through anthropomorphism.

DR. JACKSON: I have one last person to call on,, and he is not expecting

to be called on, so I think his comments will be brief. Jim Whitson, whom many of you know, works at the Milan Correctional Institution in Michigan, has produced a small manual on bird control. I have seen a few of them around here, Jim. Would you perhaps comment just briefly on how these may be obtained if others would like them?

MR. WHITSON: Well, I have given out about fifty of these. If someone else wants them, they can just write to me, Safety Officer, Federal Correctional Institution at Milan, Michigan. Most of the stuff in there I picked up at the last conference. I guess you will recognize that. And there is a report of some of the experiments that I have conducted since then.

DR, JACKSON: I think Jim has devised some rather interesting techniques for use in his particular situation and has brought together a lot of this rather diverse information, so if you are interested in more details and haven't yet gotten a hold of the manual, talk to Jim or send for it,

MR. STECKEL: Before you close, Bill, as one of the local boys here, I would like to echo George's comments, and you kind of got your accolades here a minute ago, and, think it is only fair that we recognize John for the work that he did it helping together this program, in helping to hold it together during that time that you were in the South Pacific enjoying the sea breezes. John had a good bit of work on his hands at that time, and yet this is one of the things that he gave special attention to, and those of us who are attending certainly appreciate your efforts; and I think we would be remiss if we didn't express to John the efforts that he gave were appreciated also.

DR.JACKSON: I would like to thank all of those who so graciously consented to come and participate, as speakers on the program. It has made the planning of this whole operation much simpler and much easier because you were all so gracious in your acceptance.

We will try to keep you informed during the course of the next year or two as to new developments in this bird control field. I think this is all I have to say. Adios until we meet again.

. . . The conference adjourned at 2:55 p.m. . . .