1. Introduction

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The present volume is a synthesis of the studies and researches of the Working Group on Granivorous Birds, organized within the Section on Terrestrial Productivity (PT) of the IBP. The studies of the Working Group have centered on weed seed and grain-eating species because of their abundance and importance in both natural and man-made ecosystems, the ease with which they may be worked in both the field and the laboratory and their importance to man.

Development of the project

The idea for such a Working Group originated as part of the program in secondary productivity of terrestrial ecosystems at the Institute of Ecology of the Polish Academy of Science under the directorship of Dr K. Petrusewicz. An international conference covering the general program and including several papers dealing with birds was held in Jabłonna, near Warsaw, Poland, from 31 August to 6 September 1966.

Dr Jan Pinowski, principal ornithologist of the Polish Institute of Ecology, has headed the Working Group throughout the period of its activities. In the autumn of 1965 he sent letters to over 100 ornithologists around the world proposing the organization of the Group and on 31 May 1966, obtained its official approval as a project of the IBP. There was considerable interest expressed in the proposal, and a central steering committee was organized at the Fourteenth International Ornithological Congress, 27 July 1966, in Oxford, England. Besides Dr Pinowski as chairman, this committee included Dr D. Summers-Smith of England, Dr F. J. Turček of Czechoslovakia, and Drs R. F. Johnston and S. C. Kendeigh of USA.

Close cooperation between Drs Pinowski and Kendeigh in the planning and execution of the program on granivorous birds began in 1966 when the latter was on a Cultural Exchange Fellowship arranged between the USA and USSR Academies of Science. *En route* to the Soviet Union he spent several days at the Institute of Ecology, Polish Academy of Science, and later worked for two and a half weeks with Dr Victor Dol'nik in Leningrad. Dr Dol'nik is a co-author of Chapter 5.

In order to develop and encourage the work of the Group and to serve as a medium for the exchange of ideas and reports, Dr Pinowski began issuing a periodical from the Polish Institute of Ecology in 1967 entitled, 'International Studies on Sparrows'. Twenty-two numbers in nine volumes had appeared by 1976. The third number in 1967 listed the names

of 79 co-investigators in 25 different countries. Since that time, new participants have been added while others have become inactive. Later numbers contained an extensive bibliography of the genus *Passer*.

Interest in the program has also been maintained by a number of national and international conferences. On 3 September 1969, Dr Kendeigh chaired a half-day symposium at the meeting of the American Ornithologists' Union (AOU) at Fayetteville, Arkansas. Fourteen papers or abstracts from this session were published as Ornithological Monographs No. 14 by the AOU under the title: 'A symposium of the house sparrow *Passer domesticus* (L.) and European tree sparrow *P. montanus* (L.) in North America'.

The first general session of the Working Group was held on 6–8 September 1970, at the Hague and at Arnhem in the Netherlands. This meeting was under the sponsorship of Dr J. A. L. Mertens and Dr J. H. van Balen of the Netherlands Institute of Ecological Research, Research Institute for Nature Management. The proceedings were published in book form by the Polish Institute of Ecology, under the editorship of Dr Kendeigh and Dr Pinowski and the title: 'Productivity, population dynamics and systematics of granivorous birds'. Thirty-one papers are included in this volume. There were 52 participants from 17 countries attending the meeting.

A second general meeting of the Working Group was held at the Polish Institute of Ecology at Dziekanów Leśny, near Warsaw, on 3–7 September 1973, sponsored by Dr Pinowski. Twenty-two persons, representing 11 different countries, gave reports. The purpose of the session was to organize and begin work on this synthesis volume covering the research findings of the Working Group over the seven-year span in which the IBP had been active. Preliminary outlines of chapters were prepared, chapter editors selected and chapter contents discussed. Following these meetings, a delightful trip by train, bus and boat through north-central Poland to the Baltic Sea and back allowed further informal discussions until the sessions adjourned on 10 September.

Dr John A. Wiens organized the next working session at Oregon State University, Corvallis, Oregon, USA, on 10–12 July 1974. This meeting was intended to consolidate and integrate the thinking of North American collaborators and was participated in by nine persons from the USA and Canada. Considerable progress was made toward finalizing the arrangement, authorship and contents of the chapters.

The above meeting was followed by one arranged by Dr M. I. Dyer at Colorado State University, Fort Collins, Colorado, USA, on 7–12 October 1974, participated in by 13 collaborators from Yugoslavia, the Netherlands, German Federal Republic (GFR), Poland, Nigeria, Canada and the USA.

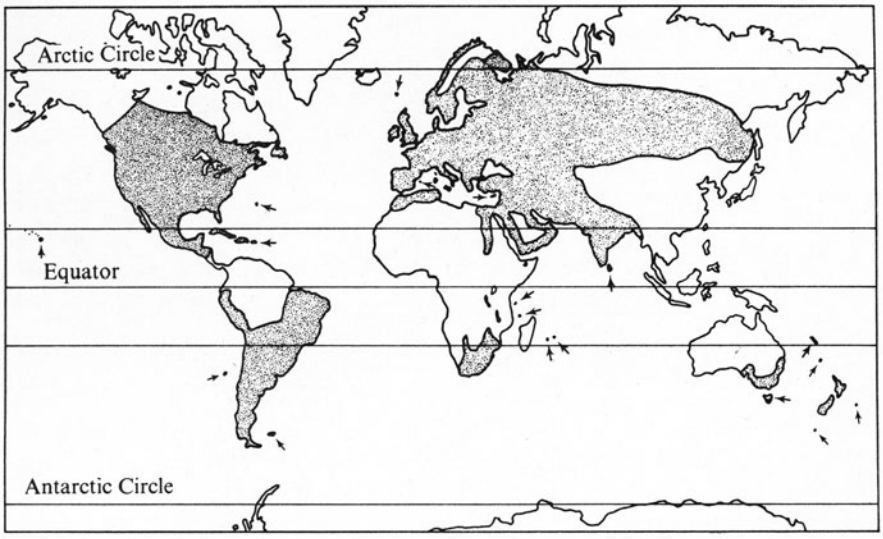

Fig. 1.1. Distribution of the house sparrow, primarily a resident species Map prepared with the help of Richard F. Johnston.

The last meeting of chapter authors to prepare and coordinate the book manuscript was held at Szymbark, Poland, on 17–21 March 1975. Consultants from the Netherlands, Czechoslovakia and Poland also attended.

In addition to the organized conferences, Dr Wiens consulted with a number of collaborators on a special trip to Europe in the summer of 1974 and Dr Dyer did likewise both in the winter of 1974–1975 and in January 1976. Dr Pinowski made two trips to the USA in 1975 for work with Drs Dyer, Wiens, Kendeigh and others. Dr Peter Ward, a co-author of Chapter 7, also came to the USA in October 1975 to work with Drs Dyer and Wiens.

Scope and approach

The IBP and this series of volumes are concerned with productivity and human welfare, with the structure and function of ecosystems, with the analysis of natural resources and how they may be utilized on a sustained yield basis, and with the health and happiness of mankind as he seeks to occupy and utilize the various parts of the world. The agricultural, industrial and cultural ecosystems which man occupies are inherently unstable and would quickly revert to Nature were man to lose his dominance over them. Man is beginning to learn that there are limits to his capacity to exert such dominance which are set in part by the attributes of natural systems and in part by man's ignorance of how to manipulate

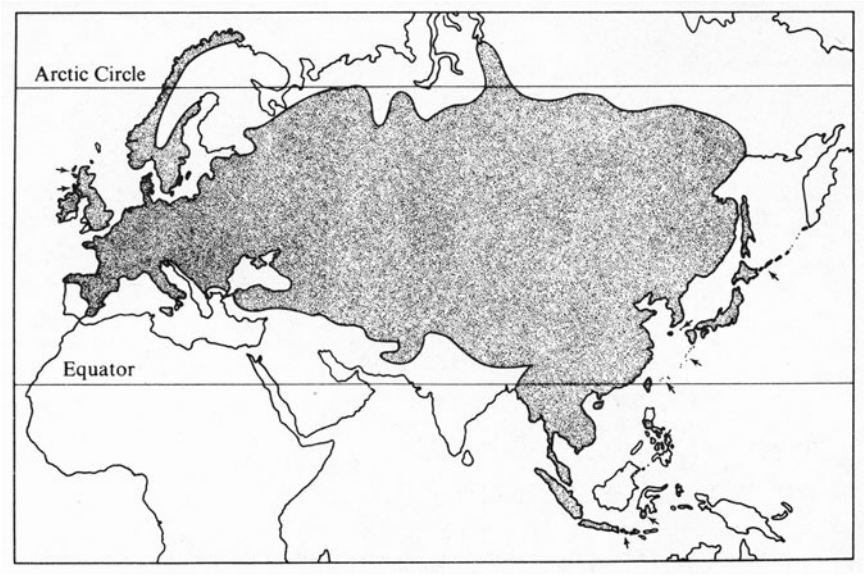

Fig. 1.2. Distribution of the European tree sparrow, primarily a resident species It also occurs in the region around St. Louis, Missouri, USA, and in southeast Australia.

these attributes. Granivorous birds may be direct competitors of man for food and may also harbor zoonotic disease organisms that affect his health. To control man-dominated ecosystems, it is necessary to understand the role played by these species and their relationships with man. This requires not only the direct study of population ecology in the field but also the acquisition of experimental information in the laboratory about how birds are made, how they function and how they behave.

The house sparrow (Fig. 1.1) has been given most attention in this volume because of its wide dispersal and long and close association with man, followed by the European tree sparrow (Fig. 1.2), red-winged blackbird, common grackle, brown-headed cowbird, red-billed quelea, dickcissel and horned lark. All of these species belong to the order Passeriformes, sub-order Oscines. While other granivores, such as columbids, galliforms and some waterfowl have been largely ignored, this concentration on a few well-studied species will hopefully provide insights which may apply to granivores in general.

The house sparrow *Passer domesticus*, European tree sparrow *P. montanus*, Spanish sparrow *P. hispaniolensis* (Temminck) and red-billed quelea (dioch) *Quelea quelea* (L.), are all in the family of weaver finches Ploceidae. The first three are separated into the sub-family Passerinae, the last in the sub-family Ploceinae. The red-winged blackbird *Agelaius phoeniceus* (L.), common grackle *Quiscalus quiscula* (L.), and brown-

Fig. 1.3. Distribution of the breeding range (stippled) and wintering range (cross-hatched) of the red-winged blackbird.

headed cowbird *Molothrus ater* (Boddaert) are in the family Icteridae and sub-family Icterinae. The dickcissel *Spiza americana* (Gmelin), belongs to the family Emberizidae and sub-family Cardinalinae, and the horned lark *Eremophila alpestris* (L.) to the family Alaudidae. Classification and nomenclature throughout this volume follows Peters' *Check-list of birds of the world*, published by the Museum of Comparative Zoology, Cambridge, Massachusetts, USA. Common names will be generally used, but

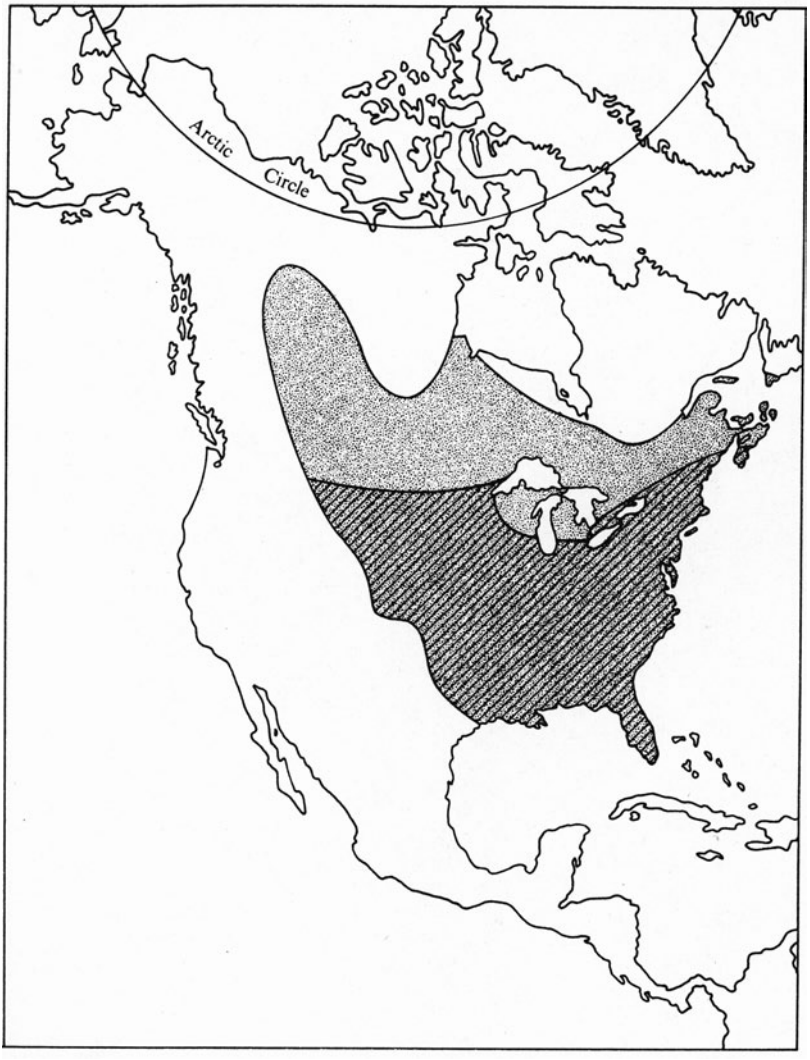

Fig. 1.4. Distribution of the breeding range (stippled) and wintering range (cross-hatched) of the common grackle.

these will be followed by the scientific name the first time that the species is cited in the chapter.

The three species of icterids are largely confined to North America (Figs. 1.3 to 1.5). They are generally resident where they occur, except in the northern portions of their ranges where there is movement southward in the winter. The dickcissel is a grassland species that nests in mid-North America and is highly migratory (Fig. 1.6). The genus *Quelea* occurs south

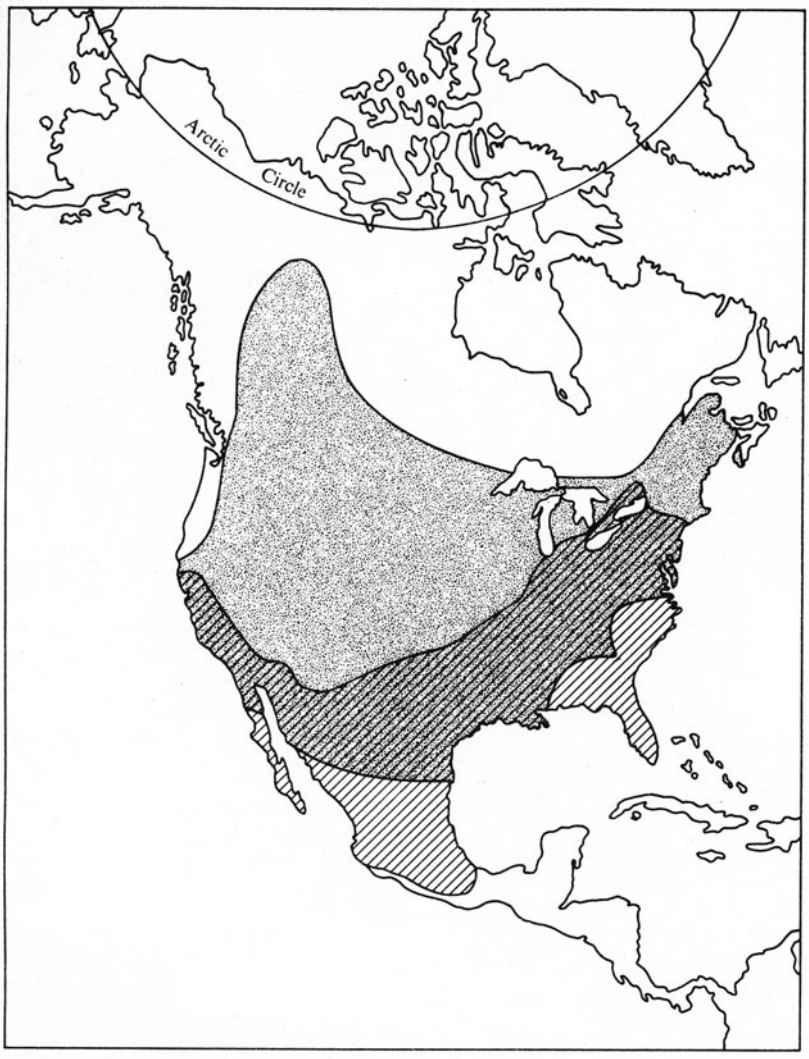

Fig. 1.5. Distribution of the breeding range (stippled) and winter range (cross-hatched) of the brown-headed cowbird.

of the Sahara in Africa. *Quelea quelea* is a migratory species inhabiting the dry savannah and grasslands (Fig. 1 7). Flocks travel over considerable distances, stop to form breeding colonies whenever and wherever they find conditions favorable, and thus the species may be abundant in an area one year and almost absent the next The horned lark is a grassland and tundra species, widely distributed over the northern hemisphere in both the Old and New Worlds (not mapped) There is a shift of individuals

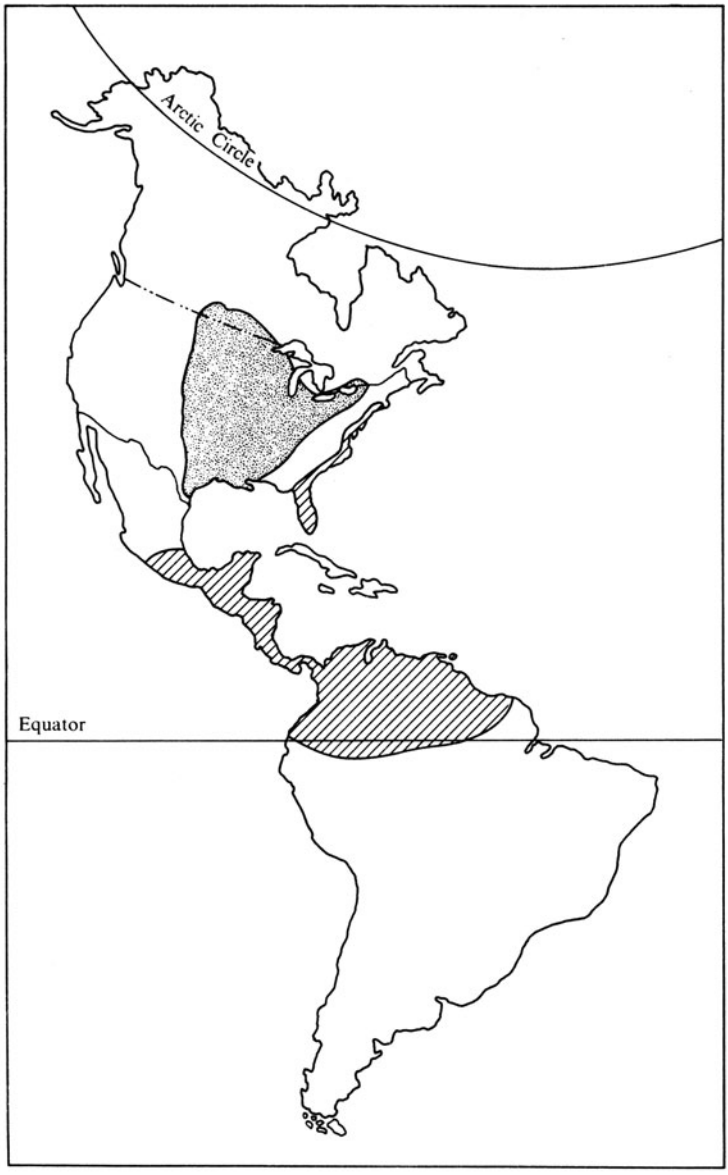

Fig. 1.6. Distribution of the breeding range (stippled) and wintering range (cross-hatched) of the dickcissel. Map prepared by J. W. Tatschl, Kansas State University, USA.

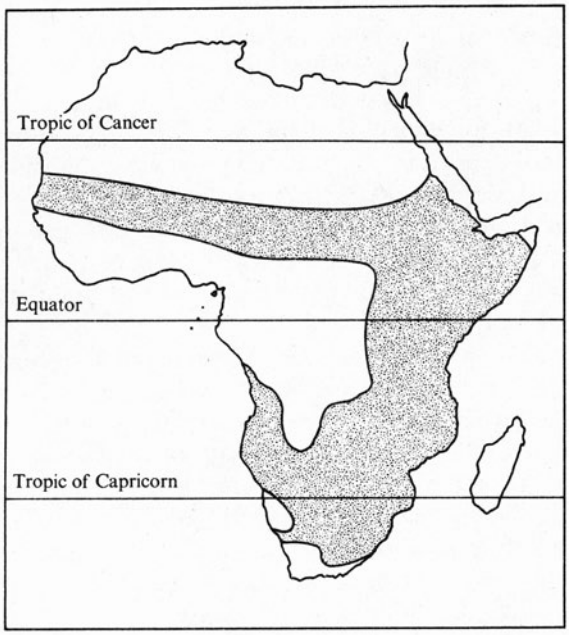

Fig. 1.7. Distribution of the red-billed quelea, a nomadic species. Map prepared with the help of Peter Ward.

southward to overwinter, although in many regions the species is represented throughout the year.

The genus *Passer* probably originated in the savannah biotope of tropical Africa and dispersed northward down the Nile Valley in late Miocene or Pliocene times. From here, beginning in the Pleistocene, it spread widely through northern Africa, Europe and Asia. With the help of man, particularly in the nineteenth century, *P. domesticus* was introduced into North America, Australia, New Zealand, South America, the Hawaiian Islands and South Africa (Fig. 1.1). The spread of the species at known times into widely different localities having different terrain, climates, vegetation and biotic associates provides a unique opportunity for the study of evolutionary adjustments and adaptations. *P. montanus* (Fig. 1.2) was brought to North America in 1870 and became established in the vicinity of St. Louis, Missouri. Its dispersal from this center has been very limited. *P. hispaniolensis* occurs in Spain, Portugal, North Africa, the Mediterranean islands, the Balkan Peninsula and eastward to beyond the Caspian Sea and into Iran and Afghanistan. Populations in the northern part of the species' range migrate south for the winter or disperse as vagrants, but southern populations are largely resident. Chapter 2 deals with dispersal of the house sparrow, how the species came into close association with man, its

morphological variations and adaptations in different geographic areas, and the mechanics of its genetic and evolutionary development.

Once a species invades a new area and finds a favorable environment, it multiplies in numbers and establishes a population. The population grows to the carrying capacity of the area with respect to food, cover, competitors, predators and climate. The population density varies locally and temporally as these environmental factors dictate. At equilibrium, natality balances mortality, but the way these two processes become effective, and whether in fact equilibrium is attained, varies with conditions, with time and with the species. Analysis of population dynamics is the subject of Chapter 3.

Size is commonly measured as weight, and fluctuations in weight among adults in a species are an index of energy balance. Likewise, increase in weight of growing young, together with the increase in number of individuals, give a measure of productivity of the species, as Chapter 4 explains. The impact of a species depends not only on numbers of individuals but also on the size of the individuals. A few large birds may consume as much food, monopolize as much space and exert as much effect as a large number of small birds. Biomass tends to equate numbers and size both in adults and in growing young.

In order to exist and to function, a bird, as all organisms, requires energy. Whether or not a bird can exhibit a specific behavior depends, in large part, on the amount of energy it can mobilize. The occurrence of a species in a region, its population size, its need to migrate and the timing and conditioning of all events in its yearly cycle, therefore, depend on fluctuations in its energy resources. Chapter 5 analyzes the components in the daily energy budget throughout the year and attempts to provide equations of general application.

Current efforts to document and understand the structure and function of ecosystems are founded on population dynamics, on energy flow patterns and rates and on relevant environmental parameters. These factors are put into a computer model which makes possible the quantification of energy demands, food consumption and the potential impact of avian consumers in ecosystems. Chapter 6 thus draws upon and integrates the material of the three preceding chapters.

Chapter 7 is concerned with the practical application of these studies. Emphasis is placed on methods of evaluating the economic impact of birds on cereal grains, conditions under which bird species become destructive, management techniques and control strategies.

Although almost any bird species may at times be destructive to man's interests, the most important bird pests are granivorous. Chapter 8 analyzes why this is so, both because of adaptive strategies in morphology,