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FROM NATURAL HISTORY TO AVIAN BIOLOGY: CANADIAN ORNITHOLOGY 1860-1950

By

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A thesis submitted to the
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From Natural History to Avian Biology

ABSTRACT

This thesis is the first full-scale historical treatment of Canadian ornithology from 1860 to 1950. Ornithology is one of the most important branches of modern biology, and ornithologists were pioneer researchers in the areas of evolution, systematics, animal behaviour, zoogeography, migration, population biology and ecology. The institutional development of ornithology in Canada was much retarded by the prevailing utilitarian attitude towards science with its lack of funding for fundamental research. It was not until the second decade of the twentieth century that ornithology became part of the scientific establishment of the Canadian government. Despite this, Canadian ornithologists, in face of considerable difficulties stemming from the lack of encouragement and financial support, pursued pioneering studies in migration, behaviour and population biology of birds. Their research contributions were instrumental in taking ornithology from nineteenth century natural history to twentieth century avian biology.

SOMMAIRE

Dans cette thèse nous voulons esquisser le développement historique de l'ornithologie canadienne de 1860 à 1950. La science de l'ornithologie se trouve parmi les branches importantes de la biologie moderne, et les ornithologues ont été parmi les chercheurs pionniers de l'évolution, de la taxonomie, de la migration, et des études du comportement, des populations, et de l'écologie. Au Canada, le développement institutionnel de l'ornithologie a été retardé par l'orientation utilitaire de la science canadienne, qui était caractérisée par l'absence de subvention pour la recherche fondamentale. A cause de cette orientation prédominante, l'ornithologie au Canada n'est pas deveue une partie de létablissement scientifique du gouvernement fédéral jusqu'à la deuxième décennie du vingtième siècle. Malgré l'absence de l'aide institutionnelle, les ornithologue canadiens ont poursuivi des études de la migration, du comportement, et des populations des oiseaux. Leurs contributions ont a aidé à la transformation de l'ornithologie de l'historie naturelle à la biologie avienne.

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PREFACE

Ornithology has always been one of the most popular branches of natural history and has become an important part of modern science. There are many reasons for this. Birds are conspicuous, may occur in great numbers, and are mostly diurnal, therefore they are relatively easy to observe and study. They are the best studied among all animals and provide material for research in evolution, systematics, zoogeography, animal behaviour, migration, population biology and ecology. Ornithologists were pioneer researchers in these fields. Since World War Two birds have been discovered to be excellent environmental indicators, and ornithologists, always leaders in conservation, have taken on the subjects of wildlife toxicology and environmental physiology.

This thesis grew out of my interest and previous research into the history of North American ornithology, and of my more recent interest in the history of science in Canada. Both are relatively unexplored research fields. Historians of biology since the middle of the century have concentrated on areas of reductionist biology, forgetting the contributions of naturalists and "whole animal" zoologists, such as mammalogists and ornithologists.

The history of ornithology has been largely written by scientists. The only comprehensive work on the early history

of North American ornithology, Elsa G. Allen's "The History of American Ornithology before Audubon" (1951), limits itself to the ornithological work of early explorers and naturalists. Articles by J.L. Baillie, G. Williams, and C.S. Houston have dealt with the work of naturalists on Hudson Bay, Upper Canada, and the Prairie Provinces. Erwin Stresemann's Ornithology, from Aristotle to the Present (1975) is an "internal" history of the science, and follows the development of its various branches, without considering the broader external factors that influenced them. Paul L. Farber's recent work, The Emergence of Ornithology as a Scientific Discipline, 1760-1850 (1982) is a discussion of European ornithology and provides a useful background for the understanding of collection-based natural history-ornithology. My previous research has considered the institutionalization and professionalization of North American ornithology in the last century, the contribution of the amateur to North American ornithology, and the careers of several Canadian ornithologists. This thesis is the first full-scale historical treatment of Canadian ornithology during a period that was important both for twentieth century ornithology and for Canadian science.

The study of Canadian science has long lagged behind that of Canadian history in general. During the past decade the subject has begun to come into its own, and the

intellectual, institutional, and social aspects of Canadian science have been investigated by Trevor H. Levere, Richard A. Jarrell, Vittorio de Vecchi, W.A. Waiser, Michael Bliss, Peter Bowler, Susan Sheets-Pyenson, Yves Gingras, Raymond Duchene, and Carl Berger, who have studied topics such as scientific associations, scientific education, scientific discovery, and the relationship between science and government. Research was also done on the development of paleontology, botany, and physics in Canada, and on French Canadian naturalists.

Questions concerning colonial science have been raised by various researchers. Current research on colonial science often uses a loose, three-phase framework for the "Spread of Western Science" proposed by George Basalla in 1967. Basalla's model follows the 'Spread' of science from European centres into non-scientific nations or societies. In the initial phase 'new' areas provide source material for European science. In the second phase a dependent, colonial science develops; educational and professional affiliations with Europe are strong, and colonial scientists receive their ideas, problems for study, and recognition of colleagues from Europe. From this phase a transition period leads to the final one, characterized by the establishment of an independent scientific tradition. In studying the development of natural history-ornithology in Canada, Basalla's model is a useful framework within which various stages in the emergence of Canadian ornithology can be considered. "Canada" and

"Canadian ornithology" throughout the thesis are used to denote the area of present day Canada, and the study of birds undertaken within its present boundaries. "Natural history-ornithology" and "naturalists" are used for the periods when ornithology was still part of natural history. Indeed, well into the twentieth century many ornithologists defied the modern trend towards specialization and maintained their interest in other aspects of natural history. Since living birds cannot be studied in isolation from their environment, retaining a broader interest in nature was advantageous for the study of ornithology.

In exploring the history of Canadian ornithology I consulted many sources. Among the printed material, biographical sources in the Dictionary of Canadian Biography, The Canadian Field Naturalist, and The Auk were most useful. Other standard reference works, such as the Canadian Who's Who, Dictionary of Scientific Biography, and American Men and Women of Science were also consulted. Government records, including Sessional Papers, reports of provincial departments of agriculture, the Geological Survey of Canada and the National Museum of Canada were also used.

Archival collections helped reconstruct the biographies of a number of outstanding Canadian ornithologists and illuminate their role in shaping the transformation of various areas of ornithology. It was also useful in tracing

the emergence of ornithology within the Canadian public service, and the simultaneous lack of development within Canadian universities.

Many people assisted my research. I am grateful to my adviser, Dr. M.J. Dunbar for his continuous interest and support of the project; to Dr. William Shea, Dr. Rodger Titman for their help and encouragement; to Dr. John H. Thompson for his invaluable help and advice, not only on Canadian intellectual and social history, but in many other ways. The staff of the Blacker-Wood Library of Zoology went beyond the call of duty to extend help and courtesy. Dr. W. Earl Godfrey, Dr. Henri Ouellet, and Michel Gosselin of the National Museum of Natural Sciences, Iola Price of the Canadian Wildlife Service, and Bill Russon of the Saskatchewan Natural History Museum provided invaluable source material, discussion and encouragment, Dr. C.S. Houston and Jack Cranmer-Byng offered challenging discussions and insights, Stewart Holohan long-term encouragement. I am very grateful to Louise de Kiriline Lawrence and to Doris and Murray Speirs, and Josephine Rowan Traugott for putting invaluable private material at my disposal. They, together with Dr. Michael J. Brodhead of the University of Nevada, Mary E. Baldwin of Concordia University and Jane Nelson gave me long-term intellectual and moral support.

I am also grateful to the Province of Quebec Society for the Protection of Birds for supporting my research into

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My final thanks and appreciation must go to my husband David. Without his encouragement and manifold assistance I could never have completed this thesis.

CHAPTER 1

ORNITHOLOGY IN NOUVELLE FRANCE, RUPERT'S LAND AND BRITISH NORTH AMERICA, 1534-1860

I

From Jacques Cartier's first voyage to Canada in 1534 to the middle of the nineteenth century, European navigators, explorers and colonizers observed, described and collected botanical, zoological and geological specimens in the large geographic area of present day Canada. Most of the observers before the eighteenth century were untrained in science, and their scientific activities, such as they were, occurred as by-products of the geographic exploration and/or colonizing activities of western European nations. The information provided by the letters and journals of sixteenth and seventeenth century English and French travellers and missionaries in Canada were most useful for the emerging science of botany in Europe. Birds and mammals were frequently mentioned but their value ranked higher as a source of food, or objects of curiosity, than subjects for scientific study.

Jacques Cartier (1491-1557) was a French navigator, who was sent to North America by Francis I of France to discover new routes to China and to explore new lands to add to the possessions of France. Cartier, in his Voyage de découvertes

au Canada entre les années 1534 et 1542 described large numbers of seabirds seen on various islands and rocks off the coast of Newfoundland, which provided his ships with a plentiful food supply. On 21 May 1534, for instance, despite having been enclosed by a bank of ice, Cartier's sailors landed on some of these islands. He wrote,

> ...mais nonobstant cette glace nos barques ne laissérent d'y aller pour avoir des oiseaux, desquels il y a si grand nombre que c'est chose incroyable à qui ne le voit...desquels les uns sont grands comme Pies, noirs et blancs, ayant le bec de Corbeau: ils sont toujours en mer, et ne peuvent voler haut, d'autant que leurs ailes sont petites, point plus grandes que la moitié de la main....Ils sont excessivement gras....En outre, il y a une autre espèce d'oiseaux qui volent haut dans l'air...lesquels sont plus petits que les autres et sont appelés Godets. Ils s'assemblent ordinairement en cette Ile, et se cachent sous les ailes des grands. Il y a en a aussi d'une autre sorte...sont très difficile à prendre, parce qu'ils mordent comme chiens, et les appeloient Margaux.[1]

During the following year, on his second voyage, Cartier wrote of the sailors' attempts to replenish their larders with seabirds,

> ...nous arrivasmes à la dite Terre-Neuve et prismes terre à L'Isle ès Oiseaulx...laquelle Isle est si très-pleine d'Oiseaux, que tous les Navires de France y pourroient focilement charger sans qu'on s'apperceut qu'on n'en n'eut tiré; et là en prismes deux barquées pour parties de nos victuailles.[2]

The seventeenth century French explorer, Samuel de Champlain (1567?-1635) also observed and described birds seen on his various voyages. In Les Voyages du Sieur de Champlain, published in Paris in 1613, the explorer, like Cartier before

him, expressed his amazement at the large number of seabirds present:

> Delà nous fusmes en l'isle au Cormorans...ainsi appelee à cause du nombre infini qu'il y a de ces oyseaux, où nous primes plein une barrique de leurs oeufs...il y a une telle abondace d'oiseaux de differentes especes, qu'on ne pourroit se l'imaginer si l'on ne l'auoit veu, comme Cormorans, Canards de trois sortes, Oyees, Marmettes, Outardes, Perroquets de mer, Beccacines, Vaultour, et autres Oyseaux de proye:...et autres sortes que ie ne cognois point, lesquels y font leur'nyds....[3]

In spite of his obvious interest in the birds seen, we have no evidence that Champlain ever attempted to send birds or bird specimens to France. Considering the primitive state of taxidermy in the early seventeenth century, this is perhaps not surprising. Dampness, mildew, and insects soon wrought havoc with once-beautiful bird skins.[4] Plants were generally much easier to study, to preserve and to transport. They were also coveted by European botanists.

Botany as a science began to develop in sixteenth century Europe. This was partly due to the discovery of new plants by Swedish, English, Dutch and German naturalists, and partly to the increased interest in the medicinal properties of plants. These naturalists exchanged not only information on new plants, but also seeds and specimens. They also wrote illustrated works on botany, the celebrated Herbals, whose appearance was facilitated by newly improved printing techniques and developments in the reproduction in illustrations.

In the early seventeenth century Champlain was responsible for a two-way traffic in plants. He imported European plants, including garden plants and cereals, in addition to fruit trees, which he attempted to grow in Quebec around 1610. He also shipped to France great numbers of seeds, of plants, trees and shrubs from the St. Lawrence Valley which the French botanists Jean and Vespasien Robin attempted to grow in the Paris botanical garden in 1620. These plants were included in the works of European botanists, such as Caspar Bauhin (1560-1624) in his Pinax theatri botanici (1623), and Jacques Cornuti (1606?-1651) in his Canadensium plantarum (1635).[5]

The incorporation of Canadian plants into European scientific works antedated that of birds of the same area by nearly a hundred years, chiefly because ornithology in Europe lagged behind the study of botany. With few exceptions, such as John Ray (1627-1705) and Francis Willughby (1635?-1672), who cooperated on Ornithologiae libri tres (1676), birds were rarely studied scientifically in the seventeenth century.[6] Instead, they were used either for food, or as pets. It is hardly surprising therefore, that many of the birds described from exotic lands were considered as victuals, or even delicacies.[7] These included waterfowl, game birds, and even owls. A good example of this approach is found in the writing of Nicholas Denys (1598-1688), an early governor of Acadia. Denys in his Descriptions géographiques et historiques des

costes de l'Amerique Septentrionale, avec l'Histoire naturelle du Païs (1672) described the food potential of many birds. "Les happefoyes sont des oyseaux fort gourmands, ils s'appellent ainsi, parce qu'ils vivent de foye de moluë,"[8] wrote Denys, and further on in his descriptions he said, "Les Canars sont tous comme en France, pour le plumage et la bonté: ceux qui ont l'aisle bleue et le pied rouge sont les meilleurs...."[9] More surprising to the modern reader is his assessment of the Great Horned Owl (Bubo virginianus):

> ... Le Chat-huant est de plumage et grosseur de celuy de France, a une petite fraise blanche; son cry n'est pas semblable, mais il y a peu de difference, tous les oyseaux luy font la guerre, il est meilleur et plus délicat à manger que la poule; il est toujours gras....[10]

Only in describing the Ruby-throated Hummingbird, (Archilocus colibris), obviously too small to eat, did Denys deviate from gastronomic considerations:

> ... L'Oiseau Mouche est un petit oyseau qui n'est pas plus gros qu'un hanneton, la femelle a le plumage d'un vert doré, le mâle de mesme excepté la gorge, qu'il a d'un rouge brun, quand on le void d'un certain jour, il jette un feu plus vif que le ruby: ils ne vivent que de miel qu'ils amassent sur des fleurs, leur bec est long et gros comme une petite épingle, leur langue passe un peu le bec et est fort déliée, leur vol est preste et fait un grand bruit en volant; ils font leurs nids dans des arbres de la grandeur d'une piece de quinze sols....[11]

Denys' obvious fascination with the Hummingbird reflected that of many other naturalists, explorers and missionaries in the Americas; the above passage is also proof of his powers of

observation. In contrast, the description of the Hummingbird by Paul LeJeune (1592-1664), one of the missionaries sent to Nouvelle France by the French Jesuit order in the seventeenth century, is more literary than scientific:

> [Il] se nomme de nos François l'oiseau mouche, pource qu'a peine est il plus gros qu'une abeille, d'autre l'appellent l'oiseau fleur, pource qu'ils se nourrit sur les fleurs, c'est à mon iugement l'une des grades raretez de ce païs cy, et un petit prodige de la nature...il bruit en volans comme une abeille; ie l'ay veu quelquefois se soustenit en l'air, becquetant une fleur, son bec est longuet, son plumage me sembloit d'un verd paré; ceux qui l'appellent l'oiseau fleur diroient mieux en mon iugement, le nomment la fleur des oiseaux...[12]

LeJeune was typical of the French missionaries, who observed and even enjoyed the natural history of Canada, as time permitted, but wrote about them only sporadically in a literary rather than scientific vein.[13]

By the middle of the sixteenth century, Europeans were introduced to some exotic birds, such as the Wild Turkey, and some South American parrots. Most of the colourful birds brought back to Europe by the early navigators were never seen by either the public or serious naturalists, because they were kept in menageries by royalty, such as King Philip II of Spain and the Emperor Rudolf II of Austria. They were also kept by rich noblemen, such as the Italian princes, who emulated royalty. The contents of these ménageries can now be appreciated from the paintings of exotic birds done by the court painters of the sixteenth and seventeenth centuries. Most strange new birds which were shipped to Europe during

this period disappeared without a trace. Nevertheless, a few naturalists had access to some specimens. The French anatomists G.J. Duvernay and Claude Perrault were known to have "dissected exotic birds that have died in the Jardin du Roi."[14] Some of these may have come from Nouvelle France. The only mention of a "Canadian" bird in the 17th century is to a "Black-cheeked Eagle" in the ménagerie of Louis XIV.[15]

The foundation of the Académie Royale des Sciences in 1666 had important implications for science in Nouvelle France. While members had to be residents of Paris, the "academiciens" were assigned correspondents both in the French provinces and abroad. Thus from the late seventeenth century members of the Académie requested information on natural history from their correspondents in America and elsewhere. Michel Sarrazin (1659-1735), Médecin du Roi in Quebec, was among the first of these. Sarrazin became a corresponding member of the Académie in 1699. His previous acquaintance with the botanist Joseph Pitton de Tournefort (1656-1708), to whom he was first assigned as correspondent, directed his main interest towards botany. Later Sarrazin also corresponded with other académiciens, including René-Antoine Ferchault de Réaumur (1683-1757), and sent him detailed antomical information on the beaver and the muskrat.[16] There is no evidence, however, that Sarrazin, now best remembered as the discoverer of the Pitcher Plant, which was named Sarracenia

purpurea after him, ever sent bird specimens to France. His successor, Jean-François Gaulthier (1708-1756), correspondent of the Académie since 1745, did. Many of the specimens described by Mathurin-Jacques Brisson (1723-1806) in his book Ornithologie (1760) are accompanied by the note: "On le trouve en Canada, d'où il a été envoyé à M. de Réaumur par M. Gautier (sic)." Brisson was employed by Réaumur as keeper of his extensive Cabinet d'histoire naturelle. He also had access to other famous collections in Paris, such as those of a Mme de Bandeville and the Abbé Aubry.[17] Réaumur also received bird specimens from Quebec from "M. le Comte de la Galissonière." Roland-Michel Barrin de la Galissonière (1693-1756) was acting Governor of Nouvelle France during the 1747-49 period. He was an educated naval officer, who became "associé libre" of the French Académie and remained in touch with his Parisian friends and associates while living in North America. During his short tenure in Quebec he made that city a temporary centre of scientific activity. At Réaumur's request, for instance, Gaulthier prepared a mémoir, distributed to all commanders of French forts in America, providing instructions for collecting information to be sent to Gaulthier. These were then relayed to France, as were the specimens collected in all parts of Nouvelle France.[18]

Thus the first scientific work on ornithology in France (Brisson's book) included Canadian birds. These were later incorporated in the works of other ornithologists-naturalists,

such as Buffon in France, Latham and Pennant in England, and Muller and Gmelin in Germany. After La Galissonière's recall to France and the subsequent political upheavals in Nouvelle France after the English conquest of 1763, scientific communications between the former French colony and France ceased.

II

> Science is indebted to the exertions of the Hudson's Bay Company for almost all that is known of the Ornithology of the American fur countries...under which term we comprehend generally the whole country north of the forty-eight parallel of latitude.[19]

Useful natural history information in the late eighteenth century came increasingly from the northern regions of North America, where from the beginning of the seventeenth century English navigators and explorers included some descriptions of the flora and fauna in their reports and narratives. Accounts on birds are found in the narratives of Henry Hudson (d. 1611), and Captain Luke Fox (1586-1635), who made one of the earliest references of the Whooping Crane (Grus americana).[20] During the late seventeenth and early eighteenth centuries Hudson's Bay employees sent sporadic information on birds and plants from Rupert's Land, the territory granted to the Hudson's Bay Company by Royal Charter in 1670. For nearly one hundred years, however, most of the scientific information reaching England from Rupert's Land concerned the geography of the region. The quest for the

North-West Passage, a direct route to the riches of Asia, encouraged explorers to concentrate on geographic and climatic factors to the detriment of other natural history observations. Thus the letters and reports of not only the explorers but also the fur-traders provided members of the Royal Society of London with much valued information on weather, tides, and variations of the compass. Fauna, flora and information on the natives' way of life were also included.[21]

The Royal Society of London (est. 1662) had a long-standing interest in the Hudson's Bay Company. Members of the Royal Society

> envisioned the advancement of the sciences by enlisting the support of intelligent, practical men upon whose observations scientists could rely. Specimens of flora, fauna, and minerals were eagerly sought, both for the Society's "Repository" and for collections of individual Fellows.[21]

Fellows were always willing to give advice or provide necessary instruments for observations. As early as 1668-69, (that is even before the Charter of the Hudson's Bay Company), Secretary of the Royal Society, Henry Oldenburg addressed twenty-two questions to Zechariah Gillam, a returning sea-captain. These, together with Gillam's answers, were read before the Royal Society in 1670. During the following century "reverberations of the Hudson's Bay Company's findings...echoed again and again in the meetings of the Royal

Society."[23]

At the end of the seventeenth century Hudson's Bay personnel lived under difficult circumstances. From 1686, when d'Iberville's voyageurs began attacking Hudson's Bay forts, until after the treaty of Utrecht in 1713, conditions due to continuous skirmishes were not conducive to more than sporadic natural history observations. During this period only a few specimens reached members of the Royal Society. These included "a white Hudson-bay Partridge [Ptarmigan] whose feet were all overgrown with a thick Down to preserve them from the Cold," presented by Edmond Halley to the Royal Society in 1689-90.[24] He acquired it from a sea-captain.

The era of random observations and sporadic collections in Rupert's Land was drawing to a close. However, trained naturalists did not reach the region until 1768, when William Wales (c1734-1798) arrived to take part in the organized international endeavour of observing the Transit of Venus. During the eighteenth century it became increasingly apparent, however, that the observers sending information from Hudson Bay were the product of a scientific culture, which valued "the systematic exploration of nature."[25]

The earliest naturalist-ornithologist employed by the Hudson's Bay Company was Alexander Light, who had been sent to Rupert's Land in 1741 "on account of his interest in Natural History."[26] Light made the first collection of Canadian birds which, to our knowledge, was incorporated into ornithological

works in Europe. George Edwards (1694-1773) included four of his specimens, a Snowy Owl (Nyctea scandiaca), a Hawk Owl (Surnia ulula), a Gyrfalcon (Falco rusticolus), and female Spruce Grouse (Dendragapus canadensis), in the second volume of Natural History of Uncommon Birds (1747). Two of Light's specimens were later included by P.L.S. Müller (1776) and J.F. Gmelin (1789) into supplements of Linnaeus' Systema Naturae.[27]

James Isham (1716-1761) entered the Company's employ in 1732. He was Chief at York Factory and at Prince of Wales Fort. A manuscript written during the winter of 1742-43 at the Fort included many bird notes. Isham took his notes and specimens of birds to England in 1745. The notes, and the illustrations taken from these specimens, were used by Edwards in Volume three of his Natural History of Uncommon Birds in 1750. During the following decades Andrew Graham (c1730-1815), Humphrey Marten (1729-c1790), and Thomas Hutchins M.D. (d. 1790), observed and collected birds in Rupert's Land. Twenty-eight of the specimens provided by them "were given Latin names by Linnaeus and other early taxonomists."[28]

Andrew Graham's interest in Hudson's Bay wildlife started in the 1760's. His observational diaries began in 1767, but according to Williams "the first book is missing, and may have born an earlier date, but in any event the contents of the surviving volumes...bear the stamp of some years' experience and observations of wildlife."[29] Graham, as

Master at Severn House (1761-74) and Acting Chief at York Factory (1765-66, 1771-72) came into contact with other Hudson's Bay personnel and a large number of Indians who came to trade at the forts. The Indians somehow knew of his interest in ornithology, because each summer they brought skins, "stuffed and dried" from inland.[30] In 1769 Graham went to England on a year's leave of absence. There he obtained a copy of British Zoology (1766) by Thomas Pennant (1726-1798) and he possibly met the ornithologist. Following Graham's visit and the return of William Wales from his observations at Hudson's Bay, the Royal Society, realizing the scientific potential of increased observations and collections from the far north, asked Hudson's Bay officials to instruct their personnel to send natural history observations and specimens to England. Wales spent only thirteen months at Hudson's Bay, but in addition to astronomical observations he also studied wildlife, plants and fossils in the area and took representative specimens to England. Graham, upon his return to the north of America, sent his collection of specimens to the Royal Society. Johann Reinhold Forster (1729-1798) described these and read a paper on them to the Royal Society in 1772.[31]

The instructions to Hudson's Bay factors to send "Sundry Species" to England resulted in an increase in natural history observations and specimens after 1770. From an ornithological point of view the chief contributors were

ornithological point of view the chief contributors were Graham, his collaborator Thomas Hutchins, and Humphrey Marten. These observers laboured under considerable difficulties. Material to ensure the efficient collection and preservation of specimens was not always available. Marten, Ontario's first ornithologist, in his notes which accompanied the specimens to England wrote that in some cases he had to rely on "the best Indian intelligence I could get"[32] instead of making personal observations. Moreover, he wished that,

> ...when I received orders from my masters to make a collection of birds, etc., that the Naturalists' Journal, as also British Zoology, had been sent to me, for which I should have paid with thanks; fine seed bird shot, birdlime, glass bottles with ingredients for making preparing liquor, would have enabled me to have given more satisfaction to the gentlemen concerned as well as myself than it is possible for me now to do.[33]

Marten, at the time Governor at Fort Albany, admitted to "my Ignorance in Zoology."[34] In spite of this and other initial difficulties, Marten turned into a fine naturalist. He began his ornithological work by building nesting boxes for swallows around the fort and by studying their life histories. In the early 1770s Marten received some of Pennant's publications from Graham, one of which was possibly his 1773 The Genera of Birds, which gave "practical aid to laymen."[35] Following this, Marten provided the Royal Society with many specimens, and Pennant with much information, which the British zoologist incorporated into his Arctic Zoology, 1784-85. By the mid-1770s Marten sent several hundreds of animal

and plant specimens to England. His unpublished manuscript on birds is still in the possession of the Royal Society.

Marten was less well-known in scientific circles than either Graham or Hutchins. Thomas Hutchins, a surgeon with the Hudson's Bay Company since 1776, became Secretary of the Company upon his return to England in 1782. He knew Graham at York Factory, and in 1771 the two began to keep notes on their meteorological observations. They also collaborated in ornithology. These two naturalists sent seventy-two bird-skins to England during 1772 and while Graham kept a notebook on his observations, it was Hutchins' one hundred and four page manuscript which accompanied the collection. In his notes Hutchins described not only the specimens they sent, but also other birds which they were unable to collect. According to Williams the "Hutchins manuscript...reveals a conscious sense of scientific research, of an advancement of knowledge.[36]

Marten, Graham and Hutchins observed birds at a time of increased scientific activity in ornithology in Europe. During the eighteenth century private bird collections increased both in England and on the continent. Bird books proliferated. The public clamoured for large, illustrated folio volumes, and naturalists obliged them. They also produced serious taxonomic treatises.[37] Linnaeus, Pennant and Latham incorporated the observations and descriptions of Hudson's Bay birds in their works. Specimens sent to England

were depicted and described in such works as Pennant's Arctic Zoology and John Latham (1740-1837) A General Synopsis of Birds (1785) in which the one hundred and six plates were done by the author. A later publication by Latham, A General History of Birds (1821-28) contained one hundred and ninety-three of the author's colour plates.

Other boreal observers, were Samuel Hearne (1745-1792) explorer in Rupert's Land, and Captain George Cartwright (1739-1819) in Newfoundland and Labrador. William W. Ellis, bird artist with Captain James Cook's third voyage must also be mentioned. Hearne was familiar with the observations of Marten, Graham and Hutchins, and contributed valuable observations on distribution, economic importance (i.e. food value), and on the moult of birds.

Hearne in his journal described fifty-three kinds of birds. Particularly note-worthy were his observations on bird behaviour, and his detailed notes on the plumage changes of ptarmigans (Lagopus sp.). His journals, published posthumously in 1795, were widely read. His ornithological observations were known to Pennant and other contemporary ornithologists, and also to later naturalists, including Sir John Richardson, who accompanied the two Franklin overland expeditions to the Polar Sea during the 1820s.[38]

Cartwright's journals of his six voyages to Newfoundland and Labrador include many bird observations and

provide evidence of a scientific turn of mind. He weighed the eggs of some species of birds, and also studied the moult of the ptarmigans. Ellis's drawings of west-coast birds were never published. According to Stresemann, Pennant and Latham had access to birds collected during Captain Cook's voyages, which were in Sir Joseph Banks' and Sir Ashton Lever's private collections. These ornithologists quoted in their works from Ellis's history of the expeditions (1782), but to "judge from their quotations...it does not seem to contain much reliable information about ornithological matters."[39] Birds of the Pacific Northwest were also collected by Vitus Bering and George W. Steller, under the aegis of the Russian government. Steller's collection from Bering Island (1741-42) contained five new species of birds, later described by Pallas.[40]

By the beginning of the nineteenth century increased interest in ornithology as a growing field for study, as separated from other aspects of natural history, led to the development of small groups of experts in several European nations. These ornithologists were familiar with each other, quoted each others' books, and visited museums and collections in England and on the continent.[41] Notes and specimens of Canadian birds were among those permanently incorporated by these experts in the ornithological literature. Thus sightings, descriptions and pictures of the birds of Acadia, Nouvelle France, Newfoundland and Labrador, and Rupert's Land contributed to the developing science of ornithology through

the publications of Edwards, Pennant, Latham, Forster and later Vigors, Swainson and Richardson in England. On the Continent scientists using this information included Linnaeus in Sweden, Gmelin and Muller in Germany, and Brisson, Buffon and Cuvier in France.

As we have seen Canadian ornithology in the eighteenth century was a cooperative venture between members of the European scientific culture, who were the actual observers and collectors of birds, and the "absentee landlords of science"[42] who, without first hand experience with North American birds in their natural habitat, utilized information on them in their popular and scientific works. Moreover, late eighteenth century Canadian ornithology was the result of the cooperation of a scientific society, the Royal Society of London, with part-time, self-trained naturalists whose natural history contribution constituted a side-line to their main occupation. These part-time naturalists provided information and specimens from Hudson's Bay.

As Houston has recently pointed out, "Few ornithologists have appreciated that until 1870 the popular term Hudson's Bay...designated an area of nearly 3.6 million km^2 extending west to the Rocky Mountains and draining into the Bay." Hudson's Bay and Canada were vague geographic entities, and some specimens from Hudson's Bay were given the type locality "Canada" by Linnaeus in 1758. Thus he was "112

years ahead of his time" since Hudson's Bay became part of Canada only after 1870.[43]

Such a large area could not be thoroughly surveyed geographically, geologically, and from a natural history point of view. Large-scale exploring and surveying parties were developments of the early nineteenth century, and were typical of nineteenth century organized enterprise. Britain, with its widely scattered colonies, numerous scientifically trained military and naval officers (and many penniless young aristocrats in search of adventure) was in a good position to mount and direct such ventures. American explorations also produced natural history material.

Ornithology in nineteenth century Canada was a by-product of general natural history investigations which were only a side-issue of the large-scale explorations and surveys. According to Richardson, surgeon-naturalist to the first two Franklin expeditions (1819-22, 1825-27), natural history was "only a subordinate object" of the expeditions.[44] The same could be said of other Arctic expeditions of the 1820s to the 1840s, and the Palliser expedition, and other geological and boundary surveys of the 1850s to the 1880s, which were conducted by Britain and Canada. The only exceptions were the Smithsonian Institution's natural history survey to Arctic America in the late 1850s, and the eventual Geological and Natural History Survey of Canada after 1877. Despite this, the large, organized exploring parties contributed

considerably to our knowledge of the flora and fauna of unexplored areas of Canada.

Considering the vicissitudes of the Franklin expeditions, it is remarkable how much was accumulated in terms of specimens and observations of birds. Richardson wrote that :

> Ornithology did not occupy much of our attention. The want of means of transport for bulky packages in the overland marches and the difficulty of preserving from injury recent specimens of birds...induced us to devote the whole of our spare time during the journey to Botany and Minerals.[45]

Nevertheless, birds were collected in the late fall and spring, before it was impossible to continue the journey. These were shipped directly to England. During the second journey, four to six weeks in 1827 were "devoted almost exclusively to collecting birds"[46] in the spring, and many migrants must have been included. The birds were shot by members of the exploring party, but only Thomas Drummond, assistant naturalist who explored the Rocky Mountain region, and Richardson, as surgeon-naturalist, prepared them. One of the drawbacks of this apprach was that only the most common birds could be obtained. In spite of this, two hundred and forty taxa of birds were included in the second volume of Fauna Boreali Americana (1831). Another twenty-seven were described by Nicholas A. Vigors (1785-1840) and Pennant..

Sir John Richardson (1787-1865) was born in Scotland. He obtained his license from the Royal College of Surgeons in

1807, and served in the Royal Navy for the next seven years. His first journey to Canada was during the 1812-14 period, when he spent several months in Halifax, Montreal and the Richelieu Valley with the Royal Marines. Richardson was a good general naturalist, which contributed to his being hired by Franklin as surgeon-naturalist. According to Houston, he was a "competent geologist, a remarkably good lichenologist and botanist, a good ichthyologist, but only a beginning ornithologist when he left England in 1819. By the second Franklin journey of 1825-27, Richardson was a competent field ornithologist."[47]

In his "Introduction" to Fauna Boreali Americana, Richardson, a modest man, played down his own contributions, and praised William Swainson (1789-1855), the British naturalist-illustrator, who was responsible for "all the remarks on the natural arrangements ...the specific names and synonyms [were given]on his authority."[48] Apparently Swainson was more of a hindrance than help in the publication of the volume. His illustrations were good, but he held up publication by working out a weird system of classification, and it was Richardson who "wrote every work in the book worth looking at today." He was also "too self-effacing and unrealistic in letting Swainson's name stand first."[49]

The Swainson-Richardson volume of birds is an important contribution. The knowledgable and critical Elliott Coues

wrote nearly fifty years later that,

> The influence which this work exerted cannot be well overstated. It occupied in the present century the place previously filled by the works of Edwards, Forster, Pennant, and Latham, so far as the birds of America north of 49° N orth lat itude are concerned; for forty years following its publication, it was the chief source of inspiration of numberless writers upon the same subject, and it continues to be a standard authority.[50]

The specimens collected during the expeditions were given either to the Zoological Society of London, or to the museum of the University of Edinburgh. Swainson received about eighty specimens, and an additional dozen went to the Plymouth Museum.[51]

For the next thirty years no major expedition or survey, resulting in new natural history material, took place in the north or west of Canada. The Geological Survey of Canada had no jurisdiction in these regions, and restricted its activities to parts of present day Ontario and Quebec. It follows that very little was known of the prairie region, or in fact of the whole area west and north of the Great Lakes. The limited amount of available knowledge was due to a "handful of fur-trader-explorers."[52] In 1856 John Palliser (1817-1887) an adventurous Irishman, who travelled in America ten years previously, attempted to persuade the Royal Geographical Society to support him in a survey of a large portion of North America. The R.G.S. suggested the participation of scientists in such a venture and the Colonial Office, after some persuasion (by well-placed friends of

Palliser, the R.G.S., and some interested scientists), contributed £5,000 for two seasons towards the cost of the expedition.

Palliser's exploring party was accompanied by Eugene Bourgeau, a botanical collector recommended by Sir William Hooker of Kew Gardens, James Hector M.D. from the University of Edinburgh as geologist and naturalist, and Lt. Thomas Blakiston (1832-1896) of the Royal Artillery as magnetic observer. It was Blakiston whose observations published in the Zoologist (1859) and the Ibis (1861-63) contributed to our knowledge of Canadian birds. Blakiston not only observed and collected birds, he was also the first oologist of the plains. The eggs and nests collected during his visit to the western plains were sent to the Smithsonian Institution; information on these was included in Charles E. Bendire, Life Histories of North American Birds, published in 1892.[53] His bird specimens were given to the Royal Artillery Institution at Woolwich, "where they can be inspected by an ornithologist.[54] Blakiston, a British officer, was aware of both European and American developments in ornithology. Instead of using British nomenclature of birds, like his predecessors in Arctic America, Blakiston "adopted [the one] that is given by Professor [Spencer Fullerton] Baird's recent Report on the Birds of North America [1859] unless the contrary is stated.[55]

Another Englishman, John Keast Lord (1818-1872),

veterinary surgeon and assistant naturalist to the British-North American Boundary Commission Survey (1858-62) in British Columbia, also published works on the birds of Canada. His 1864 paper on the birds collected during the survey was important "in determining the geographical distribution of birds of North-western North America."[56] His book, The Naturalist on Vancouver Island and British Columbia, published in London in 1866, contained many interesting descriptions on the life history (or as it was then called "habits") of birds.

III

A significant development in the mid-nineteenth century was the involvement of American naturalists in the study of Canadian flora and fauna. American natural history studies had developed considerably by the first half of the nineteenth century. Although interest in natural history was promoted in some early colonial centres, such as Boston, Philadelphia, Charleston and New York, it was only after the American Revolution than an indigenous natural history, and indeed scientific, tradition began to develop in the United States. After 1785 a number of scientific journals began to publish American scientific contributions. Early in the nineteenth century the United Stated Government began to sponsor expeditions to the west, and by the 1840s American naturalists had accompanied exploring parties to the Rocky Mountains,

parts of Texas, New Mexico, Arizona and California. Specimens from these surveys were sent to the Academy of Natural Sciences, Philadelphia, where the birds were studied by Curator John Cassin (1813-1869). Expeditions were also sponsored to areas beyond the boundaries of the U.S. Among these were the Charles Wilkes expedition to the South Seas (1838-42) and the privately financed Grinnell Expedition to the Arctic. Dr. Elisha Kane, assistant surgeon to the Grinnell Expedition also sent his collection to the Philadelphia Academy. In 1852, Cassin emphasized the importance of this collection which contained many birds in their Arctic breeding plumage. They were known until then in only their winter plumage, worn on migration to and from the Arctic.[57] Ornithology for Kane was still a part-time occupation, as it had been for various naturalists accompanying previous expeditions. Robert Kennicott (1835-1866) on the other hand was the first naturalist-ornithologist in the Arctic. He was sent there by the Smithsonian Institution with the sole purpose of conducting a natural history survey of the Hudson Bay area. Kennicott, an enthusiastic ornithologist from his teens, was one of many naturalist-collectors working for Assitant Secretary Spencer Fullerton Baird (1823-1887) of the Smithsonian Institution. Baird was appointed to the Smithsonian in 1850 and from the very beginning of his tenure aimed to increase its collections. He was chief organizer of natural history

surveys in the U.S. and Kennicott's visit to the Arctic (1859-62) was the first time that a member of Baird's network of naturalists penetrated British-Canadian territory. Kennicott also collected Arctic natural history material for the Chicago Academy of Sciences. He was greatly aided by the Hudson's Bay Company and his presence in the north prompted a resurgence of interest in natural history observations by Hudson's Bay personnel.[58]

During the following one hundred years other American ornithologists followed Kennicott into Canada. The American institutions were more numerous, better organized and definitely better funded than Canadian ones. Thus they were able to conduct surveys in Canada while many Canadian ornithologists had to be content with more local and regional activities.

In the 1850-1887 period Baird and the Smithsonian Institution were the centre of natural history studies in North America. They fulfilled the role which the Academie Royale des Sciences and the Royal Society of London held in the late seventeenth and the eighteenth centuries. The first American natural history survey in Canada was an important event, because it was symptomatic of a great change affecting Canadian science in the middle of the nineteenth century. Until that time scientists in Canada had looked to Britain for information, intellectual stimulation, and exchange of

scientific specimens and ideas. They belonged to British scientific organizations, and published papers in British scientific journals. After the mid-nineteenth century there was a noticeable shift of the centre for Canadian science, from Britain to the United States. The focus crossed the Atlantic Ocean, and many Canadian scientists began to look for institutional affiliation and scientific exchanges with the United States.[59] This was true of the natural history fields of geology, paleontology, botany, ornithology and entomology. By the 1860s ornithological material produced by surveys and explorations was sent not only to Britain, but also to American collections and museums. Articles on the ornithology of Canada, formerly published exclusively in Britain, now began to find their way into Canadian and American scientific journals such as The Canadian Journal, and Proceedings of the Essex Institute.

Now let us examine what other ornithological developments occurred in Canada during the first half of the nineteenth century. The exploring and surveying parties covered large areas, but their ornithological results, by necessity, were limited and based on observations and collections done during a few seasons. Individual settled ornithologists, could observe the birds of their region much more thoroughly, as was done earlier by the Hudson's Bay Company employees. The number of local and regional observers was very small, however, even in the Hudson's Bay region,

until the middle of the nineteenth century. In fact, for about one hundred years after the temporary efflorescence of natural history studies in Nouvelle France in the 1740s, very few people pursued natural history studies in the settled parts of Canada.

After 1759 "only a handful of educated people with a taste for natural history remained in Lower Canada , most of them being physicians and clerics...they were to maintain the natural history tradition of New France...until the end of the nineteenth century."[60]

At the beginning of the nineteenth century Upper Canada had few educated settlers with sufficient wealth and leisure to pursue natural history. The utilitarian aspects of science (agriculture, geology, mining, industry) were strongly supported by the new Scottish and United Empire Loyalist settlers. In contrast to these practical sciences natural history remained underdeveloped. A good indication of the lack of support for natural history may be found in the unsuccessful attempts of Charles Fothergill (1782-1840) to establish a natural history society and museum in Toronto. Fothergill, a British immigrant, legislator, King's Printer, post-master, publisher, and an accomplished artist and naturalist, was far ahead of his time. His plans "in the interest of literature and science came to nothing for the want of a sufficient body of supporters."[61] A proposal for a

three-year scientific expedition to the Pacific Coast in the 1830s, another for the establishment of a Provincial Museum of Natural History and Civil History (together with an observatory, zoo and botanical gardens) in the 1830, did not materialize. Although Fothergill's petitions to the legislature resulted in the patronage of the Lieutenant Governor, Sir John Colborne, he was unsuccessful in obtaining financial support for the proposed museum. In 1831 Fothergill, together with the surgeon and meteorologist William Rees, and eccentric author William "Tiger" Dunlop founded the short-lived Literary and Philosophical Society of Upper Canada at York. This was the first society in Upper Canada which, among its objectives, aimed at promoting the study of natural history.

Fothergill, who had developed an early interest in natural history, studied birds and mammals in his adopted country during the 1816-1840 period. Indeed he was one of the first individuals to study the natural history of Upper Canada. Fothergill was both a popularizer and a serious artist-naturalist. He published Canada's first nature column in the York Register in 1822. It included items borrowed from British and American papers in addition to his own notes. He also made an extensive collection of birds, which would have formed the nucleus of his proposed natural history museum. The collection, on exhibit in Toronto, 1835-40, was seen by many people. Fothergill published several books in England,

but his manuscripts on the natural history of Upper Canada and the British Empire never went to print. It is difficult to assess Fothergill's influence on ornithology in Canada, because although, as member of the Toronto intelligentsia, he was well-known to his contemporaries, he never published anything on Canadian birds.

Another wealthy British settler, who lived in the Long Point region (Lake Erie) was William Pope (1811-1902). Like many Englishmen a keen sportsman-naturalist, Pope was also an excellent bird artist, who observed and painted birds in the 1830s and 1840s. He was familiar with the works of Alexander Wilson and Charles Lucien Bonaparte on American ornithology, and kept a journal on his own observations. His water-colour paintings of birds depict them not only in natural attitudes, but also in their appropriate habitat. This is particularly important because so many plants have disappeared from the shores of Lake Erie since the middle of the nineteenth century.

Pope painted during the time of John James Audubon, but his affluence meant that he never needed to sell his paintings. While his immediate neighbours and friends were familiar with his works, he had no impact on ornithological developments in Ontario. The well known twentieth century Canadian bird artist, J. Fenwick Lansdown said:

> William Pope's paintings are not large and neither was his ambition regarding them....While Audubon envisaged

> and brought into being a monumental tribute to the birds of North America... Pope looked upon his paintings as a favourite relaxations.[62]

Pope's work, nevertheless, provides us with "the first comprehensive well executed pictorial record of Canadian birds."[63]

A third British born naturalist-ornithologist in Canada during the first half of the nineteenth century was Philip Henry Gosse (1810-1888), now best remembered for his studies in marine zoology. Gosse spent seven years in Newfoundland and in the 1830s tried farming in the Eastern Townships of Lower Canada. His Canadian Naturalist, published in London in 1840, was the only account of the birds of the Eastern Townships until the early twentieth century when Lewis McIver Terrill, and William Henry Mousley studied the ornithology of the region.

The efforts of Thomas McCulloch (1776-1843) and Andrew Downs (1811-1892) in Nova Scotia were also important. McCulloch was born and educated in Scotland. He became the first principal of the Pictou Academy, N.S. in 1817, and after 1838 was principal of Dalhousie College, Halifax. While in Pictou, McCulloch amassed a considerable collection of birds, the extent and excellence of which impressed John James Audubon in 1833.[64] Downs was born in the United States and came to Halifax in 1825. His interest in nature and in taxidermy became so great, that in time, Downs, who had a thriving plumbing business, became a full time naturalist. In

1847, in Halifax, Downs established the first zoological garden on the North American continent. As a taxidermist he supplied European sovereigns, including King Victor Emmanuel of Italy, with many bird and other animal specimens. He also contributed to the collections of European and American museums of natural history. McCulloch the educator, and Downs the popularizer, both encouraged young people to study nature. Downs presented and published papers on birds, the first of which dealt with the land-birds of Nova Scotia (1865) and incorporated his observations over a forty year period.

Dr. Archibald Hall (1812-1868), a Montreal-born physician, educator and editor, studied birds in the 1830s in the Montreal region. A paper "On the Mammals and Birds of the District of Montreal," was prepared for the Montreal Natural History Society in 1839. It received the Society's silver medal. Hall subsequently sent it to John Cassin, at the Academy of Natural Sciences in Philadelphia, who was to use it "in the preparation of a work of his."[65] and kept it for twenty years. It was eventually published in 1861 and 1862 in the Canadian Naturalist and Geologist the organ of the Montreal Natural History Society. Elliott Coues praised it as the "most important Canadian contribution to ornithology extant."[66]

By the time Hall's manuscript went into print other ornithologists had started observing, describing and

collecting birds in Montreal, Quebec, Kingston, Toronto, Hamilton, Halifax and other areas. Natural history became an accepted pursuit in these large centres. Other observers were isolated in small communities. Local natural history societies, while still mainly concerned with geology and meteorology, as was the case with the early European scientific societies, were important for all aspiring naturalists and scientists. They provided an opportunity to meet other naturalists, discuss interesting findings, and read and publish papers. Most of the societies had natural history collections which had educational value for local natural history aficionados, young and old. The societies' membership was mainly of the educated middle class, although they were democratic enough to accept anyone with an interest in natural history. According to Berger, since "the natural history societies were the earliest organizations of intellectual activity in Canada , they attracted individuals who made their mark in fields other than science."[67] Moreover, the "scientific purpose of the societies was to encourage the accumulation of information relating to natural history and above all, to bring it to the attention of the scientific community through publication."[68]

Notes

1. Jacques Cartier, Voyages de découvertes au Canada entre les années 1534 et 1542 (Québec: Société littéraire et historique de Québec, 1843), pp. 1-2.

2. Ibid., p. 27.

3. Samuel de Champlain, Les voyages du Sieur de Champlain (Paris: Iean Bergeron, 1613), pp. 11-12.

4. At the time methods of taxidermy were very primitive. Bird skins were stuffed with some soft material, then put into casks of brandy or other spirits for transportation. They also embalmed birds by filling the body cavity with aromatic spices, or drying agents (lime, alum). Satisfactory methods were only developed in the eighteenth century. These included removing all fatty tissue, and the development of a, for a while secret, formula of arsenic soap. For a detailed discussion see, P.L. Farber, "The Development of Taxidermy and the History of Ornithology," Isis 68 (1977): 550-566.

5. R.W. Stearns, Science in the British Colonies of America (Urbana: University of Illinois Press, 1970), p. 47.

6. Erwin Stresemann, Ornithology, from Aristotle to the Present (Cambridge: Harvard University Press, 1975), pp. 42-45.

7. P.L. Farber, The Emergence of Ornithology as a Scientific Discipline, 1760-1850 (Boston: D. Reidel Co., 1982), pp. 1-6.

8. Nicholas Denys, Descriptions géographiques et historiques des costes de l'Amérique Septentrional, avec l'Histoire Naturelle du Païs, 2 Vols. (Paris: Claude Barbin, 1672), 2:49.

9. Ibid., p. 303.

10. Ibid., p. 341

11. Ibid., pp. 342-43.

12. Reuben Gold Thwaites, The Jesuit Relations and Allied Documents. Travels and Explorations of the Jesuit Missionaries in New France, 1610-1791. 73 Vols. (Cleveland: The Burrows Brothers, 1896-1901), Quebec 1633-34, 6 (1897): 316.

13. Paul Fournier, Voyages et découvertes scientifiques des missionaires naturalistes Français a travers le monde (Paris: Lechevalier, 1932), Fournier, in a short chapter on "Nouvelle France" stresses that almost all the "relations" had some descriptions of plants and animals,

"relations" had some descriptions of plants and animals, but that these were not scientific descriptions. "Ces anciens professeurs de style noble...recherchent l'effet plus que la précision," p. 25.

14. Stresemann, Ibid., 47.

15. Thomas Pennant, who described and illustrated the bird in Arctic Zoology (1792), wrote that this "seems to be the species engraved by M. Robert, among the birds of the menagerie of Louis XIV," p. 227. Dr. Dean Amadon of the American Museum of Natural History, identified the bird at the request of Ms. Eleanor MacLean of the Blacker-Wood Library of Ornithology, McGill University. According to him it is a Bald Eagle-Golden Eagle hybrid.

16. Arthur Vallée, Un biologiste canadien, Michel Sarrazin 1659-1735 (Quebec: N.P., 1927); also Trevor H. Levere and Richard A. Jarrell, A Curious Field-book. Science and Society in Canadian History (Toronto: Oxford University Press, 1974), p. 4.

17. See Farber's discussion of Brisson's career and publications in Emergence of Ornithology, Chapter 2.

18. Levere and Jarrell, Ibid., p. 5.

19. J. Richardson, "Foreword," in W. Swainson and J. Richardson, Fauna Boreali Americana, Part Second, The Birds (London: John Murrary, 1831), p. ix.

20. Elsa G. Allan, "History of American Ornithology before Audbon," Transactions of the American Philosophical Society, N.S. 41, Part 3 (1951): 511

21. R.P. Stearns, "The Royal Society and the Company." Beaver, June 1945, pp. 8-13.

22. Ibid., p. 9.

23. Ibid., p. 10.

24. Ibid.

25. George Basalla, "The Spread of Western Science," in S.P. Restivo and C.K. Vanderpool, eds., Comparative Studies in Science and Society (Columbus: C.E. Merrill and Co., 1974). p. 361.

26. J.L. Baillie, "Naturalists on Hudson Bay." Beaver, December 1946, p. 38.

27. C.S. Houston, "Birds first described from Hudson Bay." The Canadian Field Naturalist, 97 (1983): 95-98.

28. Ibid., p. 95.

29. G. Williams, "Andrew Graham and Thomas Hutchins - Collaboration and Plagiarism in 18th century Natural History." Beaver, Spring 1978, p. 6.

30. Ibid., p. 7.

31. This was published in the Royal Society's Philosophical Transactions for 1772.

32. Williams, Ibid., p. 8.

33. Ibid., p. 9.

34. Baillie, Ibid., p. 38.

35. Allen, Ibid., p. 492.

36. Williams, Ibid., p. 10.

37. Farber, The Emergence of Ornithology..., Chapter I.

38. Richardson, Ibid.

39. E. Stresemann, "Birds collected in the North Pacific during Captain James Cook's last voyage, 1778-79," Ibis 91 (1949): 247.

40. E. Stresemann, Ornithology... p. 67.

41. Farber, Ibid.

42. A term used by D. Fleming in "Science in Australia, Canada and the United States: Some Comparative Remarks," Proceedings of the 10th International Congress on the History of Science, Ithaca, 1962, pp. 179-196.

43. Houston, Ibid., p. 95.

44. Richardson, Ibid., p. xi.

45. Ibid., p. xiv.

46. Ibid.

47. C.S. Houston, personal communication, 13 December 1983.

48. Richardson, Ibid., p. xvi.

49. C.S. Houston, personal communication, 4 May 1984.

50. Elliot Coues, "Bibliographic appendix," in Birds of the Colorado Valley (Washington: Government Printing Office, 1878), p. 616.

51. Richardson, Ibid.

52. Irene Spry, The Palliser Expedition. An Account of John Palliser's British North American Expedition 1857-60 (Toronto: The Macmillan Co., 1963), p. 6.

53. C.S. Houston and M.J. Bechard, "Oology of the Northern Plains; An Historical Preview," Blue Jay, 40 (1982): 154-57.

54. Thomas Blakiston, "On Birds Collected and Observed in the Interior of British North America," Ibis 3 (1861): 314.

55. Ibid. Blakiston began his encounter with North American birds in the early 1850s, when he was stationed in Nova Scotia with the Royal Artillery. There he met J. Matthew Jones, who later became one of the founders of the Nova Scotia Institute of Science. Blakiston sent Jones descriptions of birds seen on the Prairies, see C.S. Houston, "A Bird-Watcher's Outing in 1858," Saskatchewan History, 29 (1976): 14-25.

56. Coues, Ibid., p. 667.

57. John Cassin, "Remarks on the Birds of the Arctic Region, presented by Dr. E.K. Kane, "Proceedings of the Academy of Natural Sciences, Philadelphia, 6 (1852): 107.

58. H.C. Deignan, "HBC and the Smithsonian," Beaver, June 1947, pp. 3-7; W.A. Deiss, "Spencer F. Baird and his Collectors," Journal of the Society for the Bibliography of Natural History, 9 (1980) 4: 635-45.

59. Susan Sheets-Pyenson, "The Formative Years of Canadian Science. John William Dawson and his Circle, 1865-1886," paper presented to the History of Science Society, New York, 1979; Carl Berger, Science, God and Nature in Victoria Canada (Toronto: University of Toronto Press, 1983), p. 22.

60. Levere and Jarrell, Ibid., p. 6.

61. J.L. Baillie, "Charles Fothergill, 1782-1840," The

Canadian Historical Review, December 1944, p. 386; also see Rachel Grover , Some Canadian Ornithologists, booklet prepared for an exhibition of early Canadian ornithological works, Thomas Fisher Rare Book Library, University of Toronto, March-April 1981, pp. 7-8.

62. H. Barrett, Nineteenth Century Journals and Paintings of William Pope (Toronto: M.E. Fehely Co., 1976), p. 14.

63. Ibid.

64. Berger, Ibid., p. 3.; Harry Piers, "Nova Scotia Naturalists," Proceedings and Transactions of the N.S.I.S. 13 (1910-14): 14.

65. Coues, Ibid., p. 665.

66. Ibid.

67. Berger, Ibid., p. 12.

68. Ibid., p. 13.

CHAPTER 2

THE EMERGENCE OF A CANADIAN ORNITHOLOGICAL COMMUNITY

1860-1900

I.

The first learned society in Canada was the creation of Lord Dalhousie, Governor-General of British North America. Dalhousie, who was interested in the early history of Lower Canada and in the languages of the various Indian tribes, approached several prominent Quebec figures in 1823 and suggested the formation of an historical society. After much discussion the Literary and Historical Society of Quebec (LHSQ) was founded in January 1824. Although the new society maintained collections of botany, mineralogy and entomology, and soon built up a good library containing up-to-date scientific works, literary scholarship remained more important than scientific activity.[1]

The Montreal Natural History Society (MNHS) was the first scientific society in Canada. It was founded by prominent Montreal physicians and clergymen in 1827. Among its aims was the establishment of a museum, or at least a natural history cabinet. This contained four sections, botany, zoology, mineralogy and miscellany; donations for the cabinet came from field excursions of local naturalists and from personnel of the Hudson's Bay Company.[2]

Other natural history societies followed several

decades later. The Canadian Institute was established in Toronto in 1849, the Hamilton Association for the Cultivation of Literature, Science and Art in 1857, the New Brunswick Natural History Society in 1862, and the Nova Scotia Institute of Natural Science in 1863. In addition to these generalized natural history societies, other specialized societies were also founded, e.g., the Botanical Society of Canada, established in Kingston in 1860, and the Entomological Society of Canada, founded in Toronto in 1863. Western settlers established natural history societies remarkably early. The Manitoba Historical and Scientific Society was founded in 1879 and the Natural History Society of Victoria in 1890.

The publications of the natural history societies, such as the Canadian Journal of Toronto (1852) and the Canadian Naturalist and Geologist of Montreal (1857),[3] enabled naturalists to publish papers on a variety of natural history subjects beyond the strictly local confines of their particular societies. French Canadian naturalists reversed this trend, by establishing a natural history journal before having a natural history society. Abbe Léon Provencher (1820-2892), best known for his work in entomology, wrote and published Le Naturaliste Canadien beginning in 1868. Two years later he was instrumental in organising La Société d'Histoire Naturelle de Québec.

While natural history societies and their journals

provided forums for both general and specialized naturalists, certain fields dominated the publications. Geology, paleontology, archeology, and meteorology outnumbered articles on botany and zoology. In spite of this, a number of articles appeared, albeit sporadically, on Canadian birds. Their numbers increased through the 1870s and the 1880s, by which time the new Transactions of the Ottawa Field Naturalists' Club (est. 1879) and the short-lived Canadian Sportsman and Naturalist (1881-83), edited by William Couper in Montreal, published ornithological papers on a regular basis. Some British military officers, studying natural history while stationed in Canada, continued to publish their works in Britain, as books or as articles in the journals The Zoologist and The Ibis. Papers on Canadian ornithology began to appear, however, in the Annual Reports of the Smithsonian Institution, American Naturalist, Forest and Stream, Ornithologist and Oologist, and in the publications of various American natural history societies.

It is hard to assess how much encouragement prospective ornithologists received from local societies. We know that Archibald Hall's essay on Montreal birds and mammals was awarded the MNHS' silver medal in 1839 and that, at that time, the society invited contributions on natural history subjects. It is likely that naturalists-ornithologists in Montreal and elsewhere began on their own without prompting from a scientific society. Even though Hall was active in Montreal

from 1835 there is no evidence of other notable ornithological work there until the mid-1850s. The young British naturalist, W.S.M. D'Urban (b. 1836) acted as temporary curator of the MNHS collection in 1857. He was employed by the society to arrange, according to scientific "principles", the collections of the museum in preparation for the impending visit of the American Association for the Advancement of Science (AAAS).[4] During his short sojourn in Montreal D'Urban published several papers in the Canadian Naturalist. Later he was employed by the Geological Survey of Canada.

Henry George Vennor (1840-1884) began his bird collection and his note-books in 1853. By the time he graduated with honours from McGill University's School of Engineering and Surveying in 1860 he had a considerable collection and had published papers on birds in the Canadian Naturalist. His notebooks testify to his friendship with members of the MNHS, particularly with its taxidermist (and janitor) William Hunter.[5] Vennor later became a member of the Geological Survey and continued to study birds during his field excursions. In 1876 he published Our Birds of Prey, illustrated with photographs by William Notman, a well-known Montreal photographer.

In Quebec, despite the absence of a natural history society, there were some naturalists who studied birds, and read the occasional paper to the Literary and Historical

Society of Quebec. The barrister and historian James McPherson Lemoine (1825-1912), the surveyor John Neilson (1821-1895), and the printer and naturalist William Couper (d.c1890) kept bird notes and built up private collections after 1850 as did some of the clergy and Quebec government officials. These naturalists also contributed specimens to the small collection of the Laval university museum.

At about the same period, in Halifax, N.S., J. Bernard Gilpin (1810-1892) and J. Matthew Jones (1828-1888) published on a variety of natural history subjects, including birds, in the Transactions of the NSINS. Their studies were also carried out on their own initiative. In other areas of the Maritimes Francis Bain (1842-1894), a Prince Edward Island farmer-naturalist, began observing nature and keeping journals in the mid-1860s. He later contributed both popular and scientific articles to a variety of publications, and was one of the founders of the PEI Natural History Society.[6] In New Brunswick, during the late 1860s, Dr. A. Leith Adams (d.1882) a British army surgeon and keen naturalist investigated the province's natural history. After 1870 New Brunswick ornithology was studied by Montague Chamberlain (1844-1924), George Boardman (1818-1901) who lived in the State of Maine, Harold Gilbert, and James Banks, a St. John blacksmith. From 1880 they were the moving force behind the ornithology section of the New Brunswick Natural History Society.

In the late 1870s a number of educated civil servants

in Ottawa resuscitated the short-lived Natural History Society of Ottawa (est. in 1863) and formed the Ottawa Field Naturalists' Club. The Transactions of the society under the title Canadian Field Naturalist developed into the most important natural history publication in twentieth century Canada. The OFNC had its local ornithology experts, in William L. Scott, and George R. White (1856-1927), and later John Macoun (1831-1920) naturalist with the Geological Survey.

In Hamilton, Thomas McIlwraith (1824-1903) began his observations on the birds of Canada West soon after his arrival in 1853. In 1857 he was one of the founders of the Hamilton Association. During the following decades he became one of Canada's best known ornithologists. While the Hamilton Association did not support his studies it encouraged him to publish his observations in the 1860s and persuaded him to publish a book on the birds of Ontario in the 1880s.[7] Ornithological observations in other western and northern regions were pursued by Hudson's Bay personnel, like George Barnston (1800-1883) and Alexander MacArthur (1842-1882), and other observers. These were Charles Nash (1848-1926) who in the 1870s lectured on the economic importance of birds for the Ontario Department of Agriculture, the dentist-naturalist William Brodie Sr. (d.1909), the young Ernest Evan Thompson [later Seton] (1860-1946) of Toronto and Manitoba, and the prospector John Fannin (1839-1904) of British Columbia, who

later became the first curator of the Provincial Museum of British Columbia.

In the London, Ontario region three naturalists observed and collected birds beginning in the mid 1870s. Henry P. Attwater (1854-1931) was an English born naturalist who came to Canada in 1873. He collected birds and mammals for American museums, and other public and private collections. In 1889 he moved to Texas where he became an important conservationist. John A. Morden (1859-1937) and William Edwin Saunders (1861-1943) were born in the London district and remained there all their lives. Morden, a farmer, carpenter and well-known amateur naturalist cooperated with Saunders in London and collected with Attwater in Texas in 1883-84. Morden published jointly with Saunders on the birds of Western Ontario and had several of his own papers in the Canadian Sportsman and Naturalist and The Auk in the 1880s. In the following decades he always kept notes but did not publish them, though later they were incorporated into the works of other naturalists. Saunders, a pharmacist, remained an active ornithologist all his life and published many papers.

It is evident that between 1860 and 1890 there was a considerable increase in the number of ornithologists throughout Canada. The importance of the numerical growth of these enthusiastic observers cannot be overemphasized. It was only by repeated and systematic observations in a great

variety of habitats across the country that a relatively accurate picture of the abundance, migration, and nesting of the birds of Canada could emerge. The need for this type of study was understood in the United States, where the expeditions of the Smithsonian Institution and various other museums explored the natural history of birds, among other animals, in many different geographic regions. Topics for ornitholgical research in North America were determined by Spencer F. Baird, Assistant Secretary of the Smithsonian Institution in the 1850s. In the 1880s the American Ornithologists' Union took over this task.

II

In order to learn about the geographic variation of birds, study collections were necessary. In Canada, in the absence of large natural history museums, only private collections, or those of the natural history societies, were available for budding ornithologists intending to learn about the bird life of areas other than their own. Many keen ornithologists exchanged specimens or bought them from professional collectors. Thomas McIlwraith was at the centre of a large network of collectors and ornithologists in Canada and the U.S., and by the 1880s supplied many specimens of Ontario birds to the Smithsonian Institution.[8] Study skins were important in nineteenth century ornithology. Because of

the lack of such study aids as binoculars and field guides, taken for granted by twentieth century field ornithologists, identification of birds was accomplished mainly by collecting and studying specimens and not by observing living birds. Local taxidermists and food markets provided many of the specimens. Charles-Eusèbe Dionne (1845-1925) discovered many birds of the Quebec City region at the various Quebec food markets. Ernest Wintle (1852-1917) of Montreal collected much of his information on occurrence of birds by frequenting the Bonsecours market in Old Montreal. Their findings were incorporated in Oiseaux du Canada (1883) and the Birds of Montreal (1896) respectively.[9]

A perusal of some of the titles of ornithological papers published after 1850 in Canada will illustrate the importance of local birds. The construction of lists was a typical occupation for nineteenth century naturalists, together with the description of new species. The preparation of such lists enabled local naturalists to contribute to science and indicated a change-over from the sporadic observations of visiting European naturalists, to more systematic studies which formed the basis of an indigenous Canadian ornithology. Although some local ornithologists were active for a short period and published few papers, McIlwraith, Chamberlain and Saunders updated and improved their lists. The additions and deletions of species from bird lists demonstrate changes in bird populations caused by man-made ecological changes.

In addition to the rather dry lists of birds found in scientific journals, popular descriptive articles were also published in a variety of newspapers. These were important in encouraging local observers, whose sighting could then be incorporated into the works of active ornithologists.

James MacPherson Lemoine contributed much to the popularization of ornithology in Quebec. In the 1850s and 1860s his talks at the Literary and Historical Society of Quebec and to high school students were illustrated with specimens from his own collection. His book, L'Ornithologie du Canada was published in 1860 and was soon sold out; a second printing was necessary after only a few months. The book was also published in English. These works, aimed at popular audiences, were not original, for Lemoine incorporated passages from the books of American ornithologists, but they did reflect a sound knowledge of the history of ornithology. They also showed familiarity with current concerns in American ornithology.

Lemoine saw the need for government-funded museums of natural history in Canada - half a century before such a museum became the reality. In 1861 he wrote,

> N'est-il pas étrange que des villes européenne telles que Londres et Edimbourg aient des cabinets complet de l'ornithologie d'Amérique et que la métropole des Canadas-Unis n'ait pas même les commencements d'un musée d'histoire naturelle?...Quoi de plus facile, avec les taxidermistes fixés parmi nous, que de commencer, sous la direction d'une personne entendue, une collection de l'histoire naturelle du pays dans

toutes ses branches...[10]

Lemoine during his long life developed contacts with many other ornithologists in Canada and the U.S. These included Quebec City observers J. Neilson, D.N. St-Cyr, C-E. Dionne, and others, and New Brunswick ornithologist M. Chamberlain, himself interested in popularizing ornithology in Canada. While Lemoine's work was considered "light" by Elliot Coues and other American ornithologists, his influence as a popularizer, at an age when very few Canadians knew anything about birds, was significant and undeniable.

In contrast, Chamberlain was not merely a popularizer. In addition to his own contribution to New Brunswick ornithology, he earnestly desired to raise the level of ornithological studies in Canada, as did Ontario ornithologists McIlwraith and Saunders. Chamberlain was incensed at the appearance of some "mischievous" books, which contained little original material and perpetuated mistakes found in earlier works. He was also concerned about the opinion American ornithologists would form of Canadian ornithology on the basis of these books. "It is not quite fair to allow it to be thought that we know so little about our birds that we cannot form a correct estimate of such a book,"[11] wrote Chamberlain in 1883 in an all-out attack on Charles-Eusèbe Dionne's Oiseaux du Canada.

Dionne was a farm boy who began working at the Quebec Seminary in 1865. By 1883 he was curator of the small natural

history collection at the museum of Laval University. A self-taught naturalist, Dionne benefited considerably from associations with Ovide Brunet and other learned priests. Another influential contact was William Couper, British born printer, taxidermist, naturalist and later publisher, who lived in the Quebec City region in the 1860s. Dionne's experience with Canadian birds was purely local, however, and much of his Oiseaux du Canada (1883) consisted of a translation of Elliot Coues' Key to North American Birds, (1872). Reactions to Oiseaux du Canada were mixed. Coues, usually a scathing critic of lesser writers, was uncharacteristically mild (possibly because of Dionne's extensive use of both his book and his classification system). In a letter to Boston naturalist J.A. Allen, Coues wrote, "It is largely translated from my old Key with many of the figures reproduced. We must notice it...seems pretty good enough sort of thing, about the style of Lemoine."[12] Nevertheless, Coues did not consider the book worthy of a review in the Bulletin of the Nuttall Ornithological Club. However, he did send an encouraging letter to Dionne.[13] Couper, mildly reprimanded Dionne in the Canadian Sportman and Naturalist for not including birds found in Manitoba and the western regions in a book entitled birds of Canada.

Chamberlain's review, in the same issue of the Canadian Sportsman and Naturalist stressed the need for original study

and deplored the "utter worthlessness" of Dionne's book as an authentic work. He wrote that:

> many of the statements would be correct if applied to prescribed districts...but...it is a mistake to suppose that what applies to the fauna of one limited locality must perforce be equally applicable to the entire Dominion. Each faunal area, and there are a number of such divisions in Canada, has a bird-life peculiar to itself; even though some species having a much wider range of distribution than others, are found in several areas.[14]

Moreover, Chamberlain faulted Dionne for not consulting up-to-date journals, and for giving references to many western species of birds but not indicating their exact range. An exchange of letters on the subject also appeared in the Quebec Morning Chronicle. Dionne quoted excerpts from Coues' letter. Chamberlain, who was critical of Coues' classification system, continued the attack. His criticism, while harsh, was instrumental in contributing to the subsequent improvement of Dionne's ornithological studies and writing. "Dionne sentit le bien fondé de ces remarques et les mit a profiter," wrote his biographer.[15] Although the popular interest in birds in Quebec, awakened twenty years earlier by Lemoine, ensured that Dionne's book was soon sold out, his next book was much more thorough. Catalogue des oiseaux de la province de Québec avec des notes sur leur distribution géographique (1889) was organized along lines suggested by Chamberlain in 1883. This time Dionne's book merited a review in The Auk, the journal of the American Ornithologists' Union. While not entirely favourable, it admitted that the book gave "much valuable

information."[16]

Thomas McIlwraith succeeded in raising the standard of Canadian ornithology through both his own capable work and his encouragement of others. He was always pleased to see the accomplishments of Canadian ornithologists, and gave a good review of J.A. Morden and W.E. Saunders, "A List of the Birds of Western Ontario," which was published in the Canadian Sportsman and Naturalist in 1882. He wrote :

> It is very complete, yet by no means a compilation of the labours of others as such lists frequently are; on the contrary it bears (with very few exceptions) the impress of direct personal contact with the objects described. Great diligence and perseverance must have been bestowed on the subject to enable the collectors to bring it before the public in so complete a shape; yet I can also imagine their having much real enjoyment and many a pleasant ramble which only the enthusiastic student of nature can understand.[17]

McIlwraith took exception only to a few of the authors' statements arising from the nomenclature used by them.

The publications of McIlwraith, Chamberlain and Saunders attracted the attention of the leaders of the emerging American ornithological community. Their pre-eminence among Canadian ornithologists resulted in their being asked to help form an American ornithologists' Union in 1883.

III.

It was during the spring and summer of 1883, that three American ornithologists, Joel A. Allen and William Brewster of

Boston, and Elliott Coues of Washington, decided to form a national disciplinary organization to deal with the most irksome problems facing American ornithologists. The problem areas included the necessity of a uniform system of classification and nomenclature, of which at the time two different systems were used in the U.S., the need for a large-scale organized study of the migration and geographic distribution of North American birds, the pressing needs of conservation of birds, and the establishment of the status of the House Sparrow, introduced in America from Europe around the middle of the century. Brodhead writes that in the 1860s people still believed that the House Sparrow (Passer domesticus) "could rid the urban centers of caterpillars, cankerworms, and other pestiferous insect larvae."[18] Instead, the bird, a hardy and fecund species with practically no enemies in America, spread to the farming country, where it fed on seeds and grain. It also displaced many native birds from their habitats. Coues had waged a war against the sparrow for nearly two decades before the establishment of the A.O.U.

Coues, who regarded himself as chief organizer of the proposed disciplinary association, suggested to Allen that fifty ornithologists from all over North America should be invited to attend a founding meeting of the American Ornithologists' Union. "Out of fifty, we might count on 20 or 25 of the most earnest ones to be present- and that must be

ample basis for founding the A.O.U." He added, "I should advise several Canadian names -doubtless you won't get them in person." Coues also recommended two major membership categories, "Active" for authors of "recognized works of good repute," and "Associate" for less well-known ornithologists.[19] Chamberlain, McIlwraith and Saunders, as reputable authors, were invited to attend, but only Chamberlain and McIlwraith were present in New York in September 1883. Saunders, nevertheless, was elected Active Member, a great honour for the twenty-two year old pharmacist-ornithologist. Among the Associate Members elected at the first meeting were the Canadians Henry Vennor of Montreal, William L. Scott and John Macoun of Ottawa, and Ernest E. Thompson [Seton] of Toronto.

The irascible Coues almost blocked Chamberlain's invitation, because Chamberlain, taking a strong stand against having two conflicting systems of nomenclature, favoured the Smithsonian system as opposed to the one proposed by Coues. Allen and Brewster over-ruled Coues' objections.[20] Brewster had been Chamberlain's correspondent and friend for a number of years, and held a high opinion of the Canadian both as an ornithologist and as a "gentleman."[21] The invitation greatly pleased Chamberlain, who wrote to Brewster:

> I am in receipt of a letter of invitation to attend the first congress of the American Ornithologists' Union which I accept with great pleasure, and I shall certainly attend the meeting unless something beyond my present knowledge should occur... It is a great compliment to be invited to be one of the founders,

> for which I presume I must thank the fact of my being one of the few Canadians eligible....[22]

Because of the prominence of Chamberlain and McIlwraith in late nineteenth century American ornithology they must be dealt with in some detail.

Montague Chamberlain was born in St. John, New Brunswick in 1844, the son of a schoolteacher. At the age of fourteen he began a long association with the firm of J. and W.F. Harrison, wholesale grocers, first as accountant and book-keeper, later, in the 1880s as partner. Chamberlain was a cultivated man, well-read and deeply interested in natural history and native Indian languages. What prompted his ornithological interest is not known, (unfortunately very little of his correspondence is available to us), but it is known that he spent his summer holidays in the woods of New Brunswick, often with Indian guides. It is possible that Chamberlain, who was for some years a member of the St. John Volunteers, rising to the rank of Captain and Chief drill-master of his regiment, met Dr. A. Leith Adams, who was attached to the 22nd Regiment in St. John in 1867-68. Adams' book, Field and Forest Rambles, based on his New Brunswick natural history studies, was published in London in 1873. It contained only sporadic bird notes, however.

Chamberlain apparently began his ornithological activities around 1870; in 1880 he joined the New Brunswick Natural History Society, and together with other interested

naturalists, began to build up the society's collection of birds. He was also instrumental in establishing the Bulletin of the society in 1882. The new natural history journal was favourably reviewed by Couper in the Canadian Sportsman and Naturalist, as was Chamberlain's "Catalogue of the Birds of New Brunswick" published in the first issue of the Bulletin. Couper wrote:

> From Mr. Chamberlain's notes we obtain information regarding a few species which were heretofore considered mysterious as to their breeding places, and we wish other Oological [meaning ornithological] students would follow his example and penetrate the primitive forests of New Brunswick to add additional facts to this excellent list.[23]

In the introduction to the "Catalogue" (which was also published as a book in 1882), the author cautioned the readers that "The notes are neither complete nor exact as could be made; many questions being yet undetermined; but as a whole the Catalogue will serve as a starting point...."[24] In later years Chamberlain updated and expanded this early work. The "Catalogue" contained observations not only by the author, but also by other local naturalists-ornithologists.

Chamberlain was far more than a mere local ornithologist. He published in a variety of journals, including the prestigious Bulletin of the Nuttall Ornithological Club, and its successor The Auk. He was concerned with issues of nomenclature and classification in addition to those of geographic distribution and migration. He was a corresponding member of the Nuttall Ornithological

Club, and was delegate of the New Brunswick Natural History Society to the Royal Society of Canada. He was elected to the Council of the A.O.U., and was involved in the work of several of its committees. He was superintendent for the Maritime Region of the Committee on the Migration of Birds, and was member of the Committee studying the status of the House Sparrow in America. He also served as Associate Editor of The Auk from 1884-1887, where he was unofficially in charge of "amateurs," that is field ornithologists. In this capacity he secured interesting field notes from collectors, and other field oriented ornithologists, including some Canadians.

An enthusiastic teacher, Chamberlain gave many illustrated talks to schoolchildren on the birds of Canada, and some of his publications were prepared as teaching aids. In 1888 he published a Systematic Table of Canadian Birds, which he hoped would be used in the schools of the various provinces.[25] In 1895 he published Some Canadian Birds, an inexpensive book for Canadian schools.

In 1888 Chamberlain, whose attempt to become naturalist-ornithologist with the Geological Survey of Canada met with failure (as will be described in the next chapter), moved to Cambridge where he became Assistant Secretary to the Harvard Corporation. Living in the U.S. prevented him from carrying out long-term systematic studies on Canadian birds; nevertheless, he maintained his interest in ornithology. His

last major effort was the updating and editing of Thomas Nuttall, A Manual of Ornithology of the United States and Canada (1891 and 1894).

The other Canadian founder of the AOU was Thomas McIlwraith who studied the ornithology of western Ontario and Canada for nearly half a century. McIlwraith was born and educated in Scotland, and it was there that he developed an interest in natural history. Before emigrating to Canada in 1853, McIlwraith worked in the Edinburgh Gas Works, and it was at the Hamilton Gas Works that he was employed as manager during the 1853-71 period. In 1871 McIlwraith purchased the "Commercial Wharf" with its "coal and forwarding business,"[26] Arriving at Hamilton during its period of expansion, McIlwraith soon became involved in civic affairs. He was on the boards of directors of banks and insurance companies, was President of the Mechanics Institute and founder of the Hamilton Association. His business and civic interests did not preclude his studying the birds of the Hamilton district, and he soon built up a respectable collection. He was an excellent taxidermist, winning prizes for mounted bird specimens.

His first articles on the birds of Hamilton appeared in the Canadian Journal in 1860 and 1861. An updated and expanded version was published in the Proceedings of the Essex Institute (Mass.) in 1866. This publication was based on ten years of observations, but McIlwraith knew that, because he

could not devote all his time to ornithology, his list was incomplete. "[F]rom the real scarcity of many species and the short stay made by others while on their migratory course, it is not probable that all the species of birds which visit this locality have been observed by one individual...."[27]

McIlwraith later published papers in the Bulletin of the N.O.C., Canadian Sportsman and Naturalist, and The Auk. His books on the Birds of Ontario, were published in 1886 and 1894. The high quality of his work quickly brought him to the attention of American ornithologists. Canadians, such as Lemoine in Quebec, were also familiar with his papers and were aware of his excellent collection. In spite of this McIlwraith was isolated from other ornithologists, particularly during the 1860s and 1870s, when the number of ornithologists in Canada was still small and the absence of good roads and railroads made travel difficult. He did not meet American ornithologists until 1883 when he travelled to New York to attend the founding conference of the A.O.U. McIlwraith enjoyed the experience tremendously. "I look back with much pleasure to the meetings in the large building in the park [The American Museum of Natural History] and forward in anticipation to the benefits to arise from them,"[28] wrote McIlwraith to William Brewster soon after his return to Hamilton. During the following years McIlwraith, as Superintendent of the Committee on Migration of Birds for

Ontario, developed a network of observers in that province. This gave him the opportunity to exchange information with other interested bird students and to instruct others in bird study. Most of his correspondents, however, were beginners.

> The appointing of observers throughout the country has the effect of exciting an interest in the subject not felt heretofore, but after all the progress made generally is very slow, all of the observers having other matters of more importance to attend to, and often the want of attention on a particular day, I might almost say a particular hour, loses the most valuable information of the season.[29]

In addition to the newly-recruited observers, McIlwraith had contact with some promising bird students, collectors and taxidermists. These included the young Allan Brooks (1869-1946) who later became Canada's best known bird artist and a well known North American ornithologist. In the mid-1880s McIlwraith instructed Brooks in taxidermy and impressed upon him the importance of well prepared bird-skins, both for study and exhibition purposes. When Brooks moved to British Columbia in 1894 for a while he made his living by collecting specimens of birds and mammals, which he sold to American naturalists. He also supplied McIlwraith with interesting west coast specimens of birds.[30]

Other new friends were William Edwin Saunders, the young London, Ont. pharmacist, whose list of Ontario birds (written with J.A. Morden) impressed McIlwraith in 1882, and H.P. Attwater, then a London area collector and naturalist. For discussions of tricky problems of classification

McIlwraith still had to turn to American ornithologists Robert Ridgway, A.K. Fisher and William Brewster, who had at their disposal extensive series of study skins from all over North America.

McIlwraith was the acknowledged expert in Canadian ornithology. His considerable collection which contained many specimens of North American birds from the western and southern states, was eagerly studied by his younger colleagues, including Ernest Thompson Seton. The young Seton, who homesteaded in Manitoba in 1882, moved to New York during the winter of 1883-84, but returned to Manitoba in the spring of '84. During the following few years he visited his brother in Manitoba a number of times, and continued to observe birds and mammals. He provided the Smithsonian Institution with a great number of specimens from the Manitoba avifauna.[31] Seton eventually chose to live in New York and became a well-known animal artist and nature writer. For a while he regarded himself as an authority on Manitoba birds and attempted to publish his Manitoba bird notes in Canada. McIlwraith considered this to be premature, but "Seton trusted his own judgement and barged ahead anyway."[32] The book was eventually published by the Smithsonian Institution in 1893.[33] In any case, on his way to see his brother in Manitoba, Seton often visited McIlwraith, sometimes in the company of Saunders, and in 1888 together with Chamberlain.[34]

In spite of these visits McIlwraith felt increasingly

isolated. His business and family affairs often prevented him from going to A.O.U meetings and there is no evidence that he travelled much in Canada. In 1887 he wrote to Ridgeway, "I still take a spell among the birds as opportunity offers, but have little intercourse with AOU members, or indeed with anyone on the subject."[35] McIlwraith exaggerated his isolation. As we have seen, he had visitors. At the time of the letter he was much hurt by an unkind review by Saunders of his Birds of Ontario. "Mr. Saunders and I had always been very friendly....I feel as one 'wounded in the home of a friend'...I am sorry to see the spirit evinced in the article," wrote McIlwraith to Brewster.[36] In another letter he added, "Mr. Saunders is possessed of a large amount of self-conceit- the drift of the article was intended to show the readers of the 'Auk' how much more he knew about the birds of Ontario than the writer of the book did."[37] Despite Saunders' criticism the book was a success. The critical Coues gave it a favourable review, and wrote that this work "places Canadian ornithology more nearly au courant with the progress of science in other parts of America, and easily advances its author to the first place in his own field."[38]

By the following year the two Canadians had "made up" as judged by Saunders' repeated visits to Hamilton to see the older ornithologist. The sporadic visits of Saunders, Seton and other Canadians apparently did not fill the need for

exchange of ideas with peers, "My collection keeps increasing but I have little intercourse with Naturalists- too far north I presume," wrote McIlwraith to Ridgway in 1889.[39]

McIlwraith retired from business in 1893 and had time to revise the Birds of Ontario. The second edition appeared in 1894; J.A. Allen, reviewing it in The Auk wrote that it was "fully abreast of the subject [of ornithology], the few faults of the first edition having been corrected, and the more important recent discoveries in the field here...duly incorporated."[40]

The second edition of the Birds of Ontario was a fitting final contribution to the career of Thomas McIlwraith. With it his output as ornithologist came to an end. Around the turn of the twentieth century his place was taken by a new generation of Canadian ornithologists, mostly in Toronto and Ottawa. Ornithology, of course, was not neglected in other places: Saunders remained active in London, where he founded the McIlwraith Ornithological Club in 1890,[41] Brooks, in British Columbia, was at the beginning of his long career and Fannin, also in B.C., donated his collection of West Coast birds to the new B.C. Provincial Museum in Victoria and became its first curator. In 1895 the B.C. government sent Fannin to Europe to study modern natural history museums. In Manitoba George Atkinson lectured on the economic value of birds. In Montreal Ernest Wintle published The Birds of Montreal in 1896. His place in southwestern Quebec was soon taken by

Lewis McIver Terrill (1878-1968).

In Quebec, Dionne continued to build up the collection of the Laval University Museum, and publish works on Quebec ornithology. In 1893 he was elected Associate Member of the A.O.U. During the same year he went to the Chicago World Fair, as representative of the University. Later he visited various North American museums, including the American Museum of Natural History and also the Geological Survey Museum in Ottawa. His influence on young Quebec naturalists was considerable. By the end of the nineteenth century Dionne kept in touch with most Quebec naturalists, including Napoleon Comeau (1848-1923) of Godbout and the French Count, Henri de Puyjalon, who in the late 1880s was the first naturalist to advocate the conservation of marine birds in the Gulf of St. Lawrence.[42]

In Ottawa, John Macoun, naturalist with the Geological Survey of Canada, began working on his Catalogue of Canadian Birds, (1900) and joined the Ottawa Field Naturalists' Club. Although originally a botanist, his ornithological studies in the late nineteenth and early twentieth centuries eventually led to the establishment of a position of naturalist-ornithologist in the Victoria Memorial Museum.

In Toronto an active group of naturalists-ornithologists included William Brodie, Charles Nash, James Henry Fleming, and Percy A. Taverner. In 1898 Nash published

The Birds of Ontario in Relation to Agriculture. Brodie, who came to Canada from Scotland around 1838, founded the Natural History Society of Toronto in 1878. This later became the Biological section of the Canadian Institute. In 1903 Brodie, a dentist by profession, became Ontario's first provincial biologist. Fleming (1872-1940) began his observations on the living bird at a time when most ornithologists still preferred to observe them at the end of a shotgun. He also began what grew to be a major collection of ornithological books and world wide specimens of birds. Fleming came to prominence in the twentieth century, but even in the late 1890s he attracted many interesting naturalists-ornithologists into his circle. One of these was Percy Algernon Taverner. Taverner (1875-1947) was but one of many keen naturalists who made Fleming's acquaintance in Oliver Spanner's taxidermy shop in Toronto, where Fleming worked as assistant taxidermist.[43] The consequences of this meeting had important implications for twentieth century Canadian ornithology. These will be discussed in the following chapters.

Notes

1. Centenary Volume of the Literary and Historical Society of Quebec, 1824-1924, (Quebec: L'Evenement Press, 1924).

2. S.B. Frost, "Science education in the nineteenth century. The Natural History Society of Montreal, 1827-1925," McGill Journal of Education, 17(1982): 31-43; also the Annual Reports of the MNHS in the Blacker-Wood Library Rare Book Room, (hereafter B-W).

3. The Canadian Naturalist and Geologist was actually established in 1856 by Elkanah Billings. The following year the MNHS adopted it as its organ.

4. Annual Report of the MNHS, 1857:11.

5. Vennor's notebooks are in B-W as are some of his letters concerning ornithology.

6. K. Martin, "Francis Bain, Farmer Naturalist," The Island Magazine, Spring-Summer 1979, pp. 3-8.

7. Unfortunately very few of McIlwraith's letters exist. The same is true of Chamberlain. McIlwraith's correspondance both with J.A. Allen and Robert Ridgway in 1885 (MCZ and S.I. archives respectively) mention the Hamilton Association's plan to publish the Birds of Ontario.

8. See McIlwraith-Ridgway correspondence- Smithsonian Institution Archives. (SI).

9. V. Gaboriault, Charles-Eusèbe Dionne-Naturaliste, (La Pocatière: La société historique de la côte-du-sud, 1974), pp. 37-38. Wintle in his book often mentions rare ducks and other birds, such as the Western grebe, seen or purchased at Bonsecour, or the Montreal market.

10. J.M. Lemoine, L'Ornithologie du Canada, (Quebec: J.T. Brousseau, 1861), pp. 10-11.

11. M. Chamberlain, "M. Dionne "Les Oiseaux du Canada"," Canadian Sportsman and Naturalist, 3(1883): 248.

12. B-W, Uncatalogued papers of J.A. Allen (hereafter Allen papers). Elliott Coues to J.A. Allen, 30 June 1883.

13. Gaboriault, Ibid., p. 56.

14. Chamberlain, Ibid., p. 250.

15. Gaboriault, Ibid., p. 63.

16. C.F. Batchelder, The Auk 7(1890): 387.

17. Thomas McIlwraith, "Correspondence" in Canadian Sportsman and Naturalist 3 (1883): 198.

18. M.J. Brodhead, "Elliott Coues and the Sparrow War," The New England Quarterly 44(1971): 421.

19. B-W, Allen papers, Elliott Coues to J.A. Allen, 8 June 1883.

20. P.R. Cutright and M.J. Brodhead, Elliott Coues. Naturalist and Frontier Historian (Urbana: The University of Illinois Press, 1981), p. 266. See also K.B. Sterling and M.G. Ainley, A Centennial History of the A.O.U., 1883-1983 (Washington: A.O.U., 1985) [in press].

21. Museum of Comparative Zoology, uncatalogued papers of William Brewster (hereafter MCZ, Brewster papers). William Brewster to J.A. Allen, superscript on a letter from Montague Chamberlain to William Brewster, 11 October 1883, "he is a staunch, highminded gentleman of unusual ability and intelligence."

22. MCZ, Brewster papers, Montague Chamberlain to William Brewster, 20 August 1883.

23. William Couper, in Canadian Sportsman and Naturalist 2(1882): 136-37.

24. Montague Chamberlain, "Catalogue of the Birds of New Brunswick," Bulletin of the New Brunswick Natural History Society 1(1882): 26.

25. B-W, letter from M. Chamberlain to Sir J.W. Dawson, 23 March 1888, pasted inside the presentation copy of Systematic Table...

26. A.K. Fisher, "In Memoriam. Thomas McIlwraith," The Auk 21(1904): 2.

27. T. McIlwraith, "Birds of Hamilton, Canada West," Proceedings of the Essex Institute, 1866, p. 87.

28. MCZ, Brewster papers. Thomas McIlwraith to William Brewster, 27 October 1883.

29. Smithsonian Institution Archives, Division of Birds, Uncatalogued papers of Robert Ridgway (hereafter SI. Ridgway papers). Thomas McIlwraith to Robert Ridgeway, 24 February 1885.

30. Mentioned both in the McIlwraith-Ridgway correspondence, SI., and in H.M. Laing, Allan Brooks. Artist-Naturalist (Victoria: B.C. Provincial Museum, 1979).

31. See C.S. Houston, "Introduction" to Ernest Thompson Seton in Manitoba, 1882-1892 (Winnipeg Premium Ventures and Manitoba Natural History Society, 1980), and also John

Wadland, Ernest Thompson Seton: Man in Nature and the Progressive Era, 1880-1915 (New York: Arno Press, 1978).

32. Wadland, Ibid., p. 96.

33. Ridgway, curator of the Smithsonian Institution felt obliged to publish it, because of Seton's considerable contribution to the Smithsonian's collections. However, Ridgway, who considered Seton too subjective to be a good scientist, had to remove much "superfluous" material. Needless to say that Seton was greatly displeased.

34. American Museum of Natural History, Seton letterbooks.

35. SI. Ridgway papers, Thomas McIlwraith to Robert Ridgway, 13 December 1887.

36. MCZ. Brewster papers, 13 July 1887.

37. Ibid., 9 September 1887.

38. The Auk 4(1887): 246.

39. SI. Ridgway papers, 12 July 1889.

40. The Auk 11(1894): 240-41.

41. See R.J. Rutter, W.E. Saunders, Naturalist (Toronto: FON, 1949).

42. D. Potvin, Puyjalon (Quebec: N.P., 1938).

43. Royal Ontario Museum (hereafter ROM), uncatalogued files of the Brodie Club, P.A. Taverner, "The old taxidermy shop," Fleming memorial papers, read to the Brodie Club 5 November 1940.

CHAPTER 3

ORNITHOLOGY IN THE CANADIAN SCIENTIFIC ESTABLISHMENT

STRUGGLES AND STRATEGIES 1887-1911

I.

The study of ornithology in late nineteenth century Canada, as we have seen, was pursued mostly by individual naturalists. The more serious among these belonged to natural history associations, published in a variety of American and Canadian natural history journals and, after the establishment of the American Ornithologists' Union, became members of that organization. Formal education in ornithology at th[redacted]as non-existent, although there were some natural histo[redacted]ourses at various colleges and universities, and natural history professors, like the Rev. William Hincks of University College, Toronto, and J.W. Dawson of McGill University, Montreal, encouraged the observation and collection of birds. In addition to individual collectors, natural history societies and colleges also had small bird collection[redacted] There were even some positions for curators: Dionne was appointed as curator at the Laval University Museum in 1882, and John Fannin became curator at the B.C. Provincial museum in 1887. Government exploration and surveying parties, organized and funded by Britain and Canada, also collected some birds, mostly due to the interest of individual members

of the surveys, as opposed to any clear-cut policy of the respective governments to encourage ornithological studies in Canada. In contrast, the U.S. government's geological, railroad and boundary surveys considered the study of birds an important subject and naturalists were required to keep notes, study the habits and migration of birds and make appropriate collections. These surveys, together with various state departments of agriculture, and natural history museums, were among the first to provide professional opportunities for naturalists-ornithologists in the U.S.

In Canada, where the government's scientific orientation was exclusively utilitarian, ornithology did not become a part of governmental scientific establishment until the second decade of the twentieth century. Ironically, while in the U.S. the federal and various state departments had recognized the importance of birds, and provided career opportunities for ornithologists, in Canada not even the Experimental Farms in the Department of Agriculture employed naturalists-ornithologists.[1] Provincial governments demonstrated more awareness of the economic importance of birds. At the end of the nineteenth century, the Ontario government hired Charles Nash to lecture and write on the relation of birds to agriculture. At about the same time, the governments of Manitoba and the North West Territories, employed George E. Atkinson as consulting naturalist. In this

capacity he gave a number of talks and published pamphlets on economically important species of birds. When, at last a position opened up within the federal government for a naturalist-ornithologist, it was not in the Department of Agriculture but in the Geological and Natural History Survey of Canada.

The Geological Survey of Canada, founded in Montreal by William Logan in 1842, was the oldest scientific establishment in the Canadian government, even though during the period of 1842-77, the Survey functioned more or less like a private organization under contract to the government.[2] In 1877 a new "Survey Act" was passed which resulted in a number of important changes for natural history study of Canada. With the new Act the Geological Survey became a branch of the Department of Interior, and steps were taken to move the headquarters of the Survey, together with its Museum, to Ottawa. At the same time all permanent employees of the Survey became eligible, under the provisions of the Civil Service Act, for various benefits including superannuation.[3]

During the initial 1842-77 period natural history work was carried out on an individual, part-time basis by Survey personnel. Mining and exploration field trips in Upper and Lower Canada resulted in a few ornithological papers by W.S.M. D'Urban, Dr. Robert Bell and Henry G. Vennor in the Canadian Naturalist and Geologist beginning in the late 1850s. Moreover, Vennor's observations on hawks and owls during a

decade with the Survey culminated in the publication of Our Birds of Prey in 1876. Geological specimens, together with those of the flora and fauna of the newly surveyed areas, became part of the collection of the Survey Museum.

The Survey Museum, which in time came to be regarded as a "National" museum, was an important establishment in Montreal scientific-educational circles, and its proposed removal to Ottawa created considerable opposition. Without the extensive collections of the Museum, particularly in the fields of paleontology and geology, McGill University students and Montreal naturalists were left with only the much smaller Montreal Natural History Society museum, McGill's own museum and some private collections. Sir William Dawson, whose own collection of geological and paleontological specimens were used for educational purposes, eventually placed his collection in the new Peter Redpath Museum, which opened on the McGill campus in 1882.[4] This new, centrally-located museum building provided Montrealers with an extensive study and exhibition collection; the Survey Museum on the other hand moved into cramped quarters in Ottawa.

Since the 1877 Survey Act expanded the Survey's mandate to include natural history, designating it officially the "Geological and Natural History Survey of Canada", its function became to "study and report on the fauna and flora of the Dominion [and] to continue to collect the necessary

material for a Canadian museum of natural history, mineralogy and geology."[5] A.R. Selwyn (1824-1902) Director of the Survey since 1869, had not encouraged the part-time natural history activities of his men before 1877. After the reorganization of the Survey he had no choice. Moreover, under the new Act, the Survey's finances improved to such an extent, that for a while, during the 1880s, Selwyn was able to expand his staff and hire naturalists in addition to geologists. The first of these was the Irish-born botanist John Macoun (1831-1920), whose exploratory work on the northern plains of western Canada, and voluble support of the agricultural potential of those regions, made him a well-known, if somewhat controversial figure in Canadian government circles.[6] Macoun was hired in 1882. The following year Samuel Herring, a taxidermist, joined the staff to look after the preparation of zoological specimens under the supervision of J.F. Whiteaves, curator and paleontologist.

The British-born Selwyn, himself a controversial figure, had many idiosyncrasies. His difficulties with the Survey staff and with the Canadian government are well documented by Morris Zaslow in a history of the Geological Survey of Canada. For our purposes suffice it to say that Selwyn was concerned with upgrading the professional status of the Survey by hiring university graduates for geology "and its laboratory ancillaries."[7] In other branches, however, only a few specialists were hired. It is ironical, that while Selwyn

was accused by the utilitarian Canadian public and government of trying to turn the Survey into too scientific an institution, his shortsighted natural history policy prevented the development of the various branches of zoology in the Canadian government. The only exception was entomology, a field that did not come under the jurisdiction of the Survey. Entomology was of the greatest economic importance to the settlers of western Ontario, Manitoba and the North West Territories. This prompted J.H. Pope, Minister of Agriculture, to create a position of Dominion Entomologist in 1884, which "launched Canada into the era of professional entomology." With the appointment of James Fletcher as Dominion Entomologist, "the fledgling science had been officially recognized."[9]

In contrast, no special men were hired to pursue studies in mammalogy and ornithology, and consequently the status of these fields remained relatively low. This was partly due to Selwyn's rigid ideas, which prevented him from fully excercising his mandate in developing the natural history work of the Survey, and partly to a reduction in the Survey's budget by the late 1880s. Selwyn, who insisted on specialized training for geologists and mining engineers, was content to allow John Macoun to carry out ornithological and mammalogical investigations under the auspices of the Survey. Although an excellent field botanist, Macoun was less than

competent in these fields. His monumental conceit, coupled with Selwyn's policy, led the botanist to consider himself an expert in these branches. As associate Member of the A.O.U. since 1883, and a member of the Ottawa Field Naturalists' Club, Macoun was well aware of the ornithological studies of other Canadians, like Chamberlain, McIlwraith and Saunders. Nevertheless, in 1888 he wrote to C.H. Merriam, Chief of the Division of Economic Ornithology and Mammalogy in the U.S. Department of Agriculture, that "I have done more ornithological work in Canada than any other single man...."[10] This was patently untrue and Merriam knew it. Merriam had collaborated with McIlwraith and Chamberlain on various A.O.U. committees but since he needed a naturalist as contact with the Canadian government to provide him with specimens collected from large areas of the country, he refrained from deflating Macoun's ego. Further bolstering the botanist's healthy self-esteem were two related facts. The first was his appointment as Naturalist and Assistant Director in late 1887, effective in the spring of 1888, which "placed him over" Whiteaves, the Curator. The second was that his own appointment prevented Montague Chamberlain, one of the best-known Canadian ornithologist of the 1880s, from securing a position as ornithologist with the Survey.

J.F. Whiteaves, an English born paleontologist, had been interested in natural history in general and acted as honorary curator of the Montreal Natural History Society

Museum until 1876, when Selwyn appointed him paleontologist and "Director" of the Survey Museum. Unfortunately, Whiteaves was an inefficient curator and during his tenure many bird skins deteriorated. Macoun, ambitious to become Whiteaves' superior, exploited this neglect in his attempt to become chief naturalist of the Survey. Chamberlain, with his expertise in ornithology, widespread friendship with Canadian and American ornithologists, and awareness of the state of the Museum's collection, also found the time ripe for mounting a campaign to secure a position with the Geological and Natural History Survey of Canada.

The complete story of Chamberlain's attempt to create a position for an ornithologist with the Survey, and to obtain it for himself, is not known because of the paucity of source material. Only part of the Chamberlain correspondence has survived. The papers of Thomas White, Minister of the Interior in 1887-88, who was approached by both Chamberlain and Macoun is the fall of 1887, are also missing. Moreover, of the Selwyn correspondence for the years of 1887-88 only the outgoing letterbooks were preserved in the Public Archives of Canada. The following reconstruction, while incomplete, illuminates the difficulties Canadian ornithologists had to face in their attempts to have their science officially recognized.

As we have seen in Chapter 2, Chamberlain, in the

1880s, became well-known among American ornithologists as one of the few experts of the science in Canada. His publications were well received and he was one of the two Canadian founders of the A.O.U. in 1883. He travelled extensively in the Eastern United States and in Canada and during his trips to Boston, New York, Washington, Ottawa, Quebec, Montreal and Hamilton, he visited various natural history museums and collections. Comparing the burgeoning American institutions to the rudimentary Canadian ones made him realize the need for a Canadian museum, containing extensive collections of Canadian birds for the study of their geographic distribution. In the "Introduction" to a Systematic Table of Canadian Birds (1888), written for educational purposes, Chamberlain stated clearly the position of ornithologists and of ornithological collections in Canada:

> It has been suggested that an association of Canadian ornithologists be organised and that this society undertake the formulation of a system of classification and nomenclature which shall...truly reflect the ideas on the subject which are current in the Dominion. The formation of such an association would be a good move - nothing perhaps would tend more surely to the advancement of the science within our borders, but would the framing of a new code [of nomenclature] be either wise or practicable? In the first place, where is the Canadian, or body of Canadians, who have the equipment of technical knowledge and experience necessary for such as undertaking - who could give an intelligent vote on all points involved? And supposing that they had the skill where would they find a sufficiently large collection of the birds of the country to enable them to settle many of the questions in dispute? Most certainly no such collection can be found in Canada at present. If all the bird skins in the Dominions were combined, they would not make a good working

> collection. In not one Museum in the country are the birds of even a small locality well represented. There are a few creditable private collections, but none of these contain a sufficient series of skins to show the variations of sex and age and seasons, to say nothing of individual and geographic variations.[11]

It is hardly surprising that Chamberlain, who at the age of forty-three had the opportunity, for the first time in his life, to choose a profession, applied for the position of naturalist-ornithologist at the Geological and Natural History Survey of Canada. The position Chamberlain wanted did not exist at the time. He began a campaign, therefore, to persuade both the Minister of the Interior and the Director of the Survey of the necessity of establishing such a position and that he was the best person to fill it.

During the summer of 1887 Chamberlain, employed at a commercial firm for the previous twenty years, found himself in serious financial difficulties. After the death of the senior partner of the company, Chamberlain had to "wind up the estate" and his future was uncertain. Chamberlain, who for a long time had been longing to leave the commercial world and become a naturalist, wrote to his friend William Brewster, Curator of the Museum of Comparative Zoology at Harvard University, that he thought "a year or so in some of the museums would be an acceptable change, and gradually from that has arisen the thought that possibly I might drift into making a profession of Natural History."[12] Brewster's encouraging reply "put a stop to all dreaming over the matter" and in

the same letter to Brewster, Chamberlain wrote:

> I have carefully thought over the entire question - the distant future as well as the present - ...I purpose to fit myself to fill the position of Naturalist on the "Canadian Geological and Natural History Survey" which I think I can obtain, or failing that, to fill the post of Curator at some of our Museums. No one in Canada has given attention to Birds (excepting in an amateurish way) or to Mammals or Fishes or Reptiles. The man who now holds the position of "naturalist" on the Survey [John Macoun] is a Botanist who knows little or nothing of the other departments [of natural history].[13]

Chamberlain soon gave up the idea of acquiring expertise in an American museum, as originally suggested to Brewster, and by the late summer of 1887, put all his energies into pulling strings to convince the right people to create the position he coveted in the Survey. According to the Chamberlain-Brewster correspondence, sometime during the fall of 1887, Chamberlain went to Ottawa and had an interview with Selwyn, which turned into a "scene" with the Director.[14] In the meantime he enlisted the aid of some "politically influential people" in New Brunswick, because he felt that this provided him with a better opportunity to persuade the Honorable Thomas White, Minister of the Interior, "that the office of ornithologist is necessary and that I am capable of filling it."[15] In his opinion the time was right in persuading the government into expanding the Survey personnel, because St. John was the government's "weak point" and Chamberlain was "one of the leaders of a coterie of young men whom the government supporters here desire to conciliate and would be most anxious

not to offend."[16] Moreover, because of his network of acquaintances in the business, military and political life of New Brunswick, who knew of his financial misfortune, Chamberlain was sure of the sympathy of local friends, even including some "influential people in the Govt. party."[17] He felt, however, that he had to act swiftly, and could not afford to wait a year or so as originally intended, while obtaining more training in an American museum.

According to Chamberlain, White, a former newspaper man, was a person "of wide experience, considerable intellectual ability and common sense" and he thought that White would be influenced by the opinion of noted scientists.[18] Chamberlain wrote a number of letters, therefore, to such scientists as Dawson at McGill and Ramsay Wright, biologist at the University of Toronto, and a few well-known American ornithologists, to ask for recommendations for the position of naturalist-ornithologist. Many of the letters sent on his behalf stressed not only Chamberlain's qualifications for the position, but also emphasized the need for a proper natural history museum in Canada, containing a department of ornithology. Chamberlain even received unsolicited support when a Dr. Stewart, a Fellow of the Royal Society of Canada, and apparently a "very influential political man," had written to the Minister of the Interior "urging the necessity of curating a branch of ornithology in connection with the Geological Survey and asking me if I would

accept the charge of it if he succeeded in his effort." Chamberlain answered Stewart that he was "arranging to apply for the position."[19] By the middle of November 1887 White had apparently received a dozen letters of recommendation but to no avail.[20]

Chamberlain was level-headed enough to realize that "the hardest point will be to convince White that there is any need of the office or any work to be done - for Selwyn will say there is not." and that under the "present Management" of the Survey his chances of an ornithology department being created were slim.[21] He foresaw that the curating of the specimens would remain in the hands of Whiteaves, whom he considered a "splendid paleontologist, but his ornithology is damnable."[22]

Unfortunately for Canadian ornithology Chamberlain's assessment was correct. Selwyn opposed both the idea of creating an ornithology department and the appointment of Chamberlain, and the New Brunswick ornithologist began to accept the possibility that Selwyn would say "that he does not intend to make any additions to the Survey Staff, nor increase at present, the departments of the Survey."[23] It is not known whether the Minister ever communicated with Chamberlain. Selwyn, in his reply to Chamberlain's application, cited the "enclosed testimonials" and wrote:

> While not in the least doubting your fitness for the position, nor undervaluing the importance of

> Ornithological Study and investigation, I consider that the position and circumstances of the Survey and the Museum connected with it make it at present...unnecessary to [make] a special appointment such as named in your letter and I have already informed the Minister.[24]

In rejecting Chamberlain's application Selwyn remained loyal to Whiteaves, a misplaced but understandable action, considering that Whiteaves had been one of the few Survey men who supported Selwyn during the controversial 1884 parliamentary hearings into the activities of the Survey.[25]

In the meantime, unbeknown to Selwyn and Chamberlain, John Macoun had an interview with White, and in a subsequent letter to the Minister expressed his dissatisfaction with his own Survey position. In his Autobiography Macoun wrote that he asked:

> that I might be appointed Assistant Naturalist, as Dr. Selwyn had led me to believe that Mr. Whiteaves was Naturalist and I only Botanist under him. At this time, Mr. Whiteaves wished to appoint a gentleman called Chamberlain of St. John, New Brunswick as Ornithologist, a position to which I aspired.[26]

White responded to Macoun's letter by offering the post of Naturalist and Assistant Director to Macoun as "a Christmas box" in December 1887, without even notifying Selwyn of this appointment.[27] This somewhat bizarre development may be attributed to the fact that White aimed at replacing Selwyn with George Mercer Dawson in 1888 and did not feel it necessary to consult Selwyn.[28]

It was unfortunate that the poor financial position of the Survey in the late 1880s, together with bickerings of the

Survey staff and Macoun's influence, delayed the establishment of a branch of ornithology within the Survey. The idea of the versatile scientist, and of expertise acquired on the job, worked in Macoun's favour during a period of financial difficulty. It was also not unusual during the Macdonald administration that criteria for employment included not only competence in a given field, but also political allegiance and family connections. Macoun was already safely entrenched in the Survey (on territory as it were) and Chamberlain's greater expertise, numerous supporting letters and political friends could not unseat him.

Despite Selwyn's refusal, Chamberlain continued to fight, this time in the public arena. To advertise the plight of Canadian ornithology Chamberlain decided to include excerpts from letters, with the authors' permission, in the "Preface" to the Catalogue of Canadian Birds published in December 1887. The letters quoted in the "Preface" were written by well-known American ornithologists, who stressed the need for more ornithological work in Canada and for large museum collections of the Canadian avifauna. They were very much to the point concerning the state of Canadian ornithology and showed an awareness of the comparative status of American and Canadian ornithological developments in the late 19th century. In the United States, as of 1885, there was a government position for an ornithologist in the Department of

Agriculture, with sufficient yearly appropriation to aid the large-scale migration and distribution studies of North American birds initially organized by the newly established A.O.U. in 1883. A similar position in a Canadian government institution would have considerably furthered the study of ornithology in North America, and at the same time raised the status of ornithology in Canada, as it had in the U.S. Elliott Coues, Chamberlain's erstwhile opponent, wrote to him that:

> as you are aware there has of late been a good deal of discussion, here [the Smithsonian Institution] and among the leaders of the American Ornithologists' Union, respecting the comparative status of Canadian ornithology. I am tempted to write to you, as our leading Canadian member, and I trust you will not take it amiss if I call your attention to the great amount of work that needs to be done before your country can stand side by side with the United States in this branch of science. With the exception of Mr. McIlwraith's work - the best manual we have on the special subject - most of the recent advances are due to the Geological Survey, directly or indirectly. And this leads me to inquire whether it would be possible for the Survey to undertake the requisite work in a more systematic manner, even to the extent of including some professed Ornithologist in its corps.[30]

C.H. Merriam, government ornithologist in the U.S., had been a correspondent and mentor of Macoun's since 1884. He knew McIlwraith and Chamberlain since the establishment of the A.O.U. in 1883 and was familiar with their accomplishments in ornithology. Merriam, in his letter, stressed the amount of good work the Geological Survey had done in botany and raised the question, "Why should it not do equally good work in ornithology? Surely the economic importance of the subject would justify many times the expenditure."[31] As we have seen,

the Survey by that time had recognized the economic importance of botany and agriculture, as had the government with entomology, but ornithology had to wait. Neither Merriam, nor any of the other ornithologists' strong recommendations influenced either the Minister of the Interior or the Director of the Survey.

William Brewster's letter came out strongly against the Canadian government. The usually mild-mannered Curator of the Museum of Camparative Zoology was one of the most repected American ornithologists. He was also a long-time friend of Chamberlain. Brewster pointed out that Canada had done nothing for ornithology, because all advances had stemmed from "purely private investigations, or from work instigated, and in some cases paid for, on this side of the line."[32] While Brewster exaggerated somewhat to make the point, on the whole he was right. Only a few minor, local investigations had resulted from the part-time ornithological activities of the Geological Survey up to that time.

J.A. Allen, President of the A.O.U. and editor of its journal, The Auk, was at the time Curator of Mammalogy and Ornithology at the American Museum of Natural History in New York. Allen's letter set out, in detail, the scientific work that needed to be done in Canadian ornithology, and to a lesser extend in mammalogy:

> The birds and mammals of British North America offer a particularly attractive field for research. While we

> know in a general way what species occur there, and somewhat of their distribution, many problems of exceeding interest in relation to North American birds and mammals can be settled satisfactorily only by means of extensive field-work and large series of specimens gathered in the great regions north of the United States. It is in this vast territory we are to look for many of the connecting links between various new species, and a considerable number of new sub-species await discovery in Canadian territory; while our knowledge of the manner of occurrence and distribution of the birds and mammals generally in this region is extremely unsatisfactory. No portion of the continent north of Mexico offers so inviting a region for natural history exploration as the great northern interior, where only the most superficial harvest has been reaped.[33]

Since the published letter had no more effect than those sent to Selwyn and White, Chamberlain eventually had to give up the idea of becoming a professional naturalist-ornithologist in Canada. When the Harvard Corporation offered him employment in 1888, Chamberlain moved to the United States.

Macoun, firmly established as Naturalist with the Survey, privately agreed with Chamberlain's assessment of Whiteaves' shortcomings as ornithologist. He did not, however, welcome public criticism of the Museum's collection. "I cannot understand why he [Chamberlain] makes out that we have done nothing as we have over 400 species of Canadian birds in our Museum and he knows it," complained Macoun to a correspondent.[34] Four hundred species in 1888, when many subspecies of North American birds were still given full specific designation, was a very poor collection indeed, especially for a "national" museum. The Survey Museum's bird collection compared unfavourably with those of the various

natural history societies' and well-known private collections, such as Lemoine's in Quebec and McIlwraith's in Hamilton. Moreover, most of the museum's bird skins were insect infested, due to inefficient preparation and poor storage conditions.

Macoun was determined to increase the collections of the Survey Museum - it was actually part of his mandate. The hiring of William Spreadborough (1856-1931) in the late 1880s, first officially as a camp cook, later as collector, enabled Macoun to add to the bird collection of the Museum, but since Macoun's ornithological investigations remained a side-line to his botanical activities, the bird collection remained unsatisfactory for a long time. Roderick Ross Macfarlane (1833-1920), retired Chief Factor of the Hudson's Bay Company and a long time expert of northern birds, in his 1908 list of birds of Arctic America consistently pointed out the paucity of bird material in the "National Museum". According to Macfarlane, many species of Canadian birds were represented only by one or two skins, and some species only by a set of eggs. Twenty years after Chamberlain had called for "sufficient series of skins to show the variations of sex and age and seasons, to say nothing of individual and geographic variations,"[35] the Museum's collection was far from fulfilling these requirements.

The lack of a specialist in ornithology showed in other

ways. Macoun, because of his limitation in zoological studies was "forced to turn to American specialists, such as [C.H.] Merriam, for critical determination of specimens, as well as advice on field methods."[36] Thus he was less efficient than Chamberlain, McIlwraith or Saunders would have been, all of whom were thoroughly familiar with up-to-date field methods and current scientific issues in ornithology, and only the lack of an extensive national collection forced them to rely on American experts for the identification or classification of difficult specimens. Macoun's reliance on American zoologists from the 1880s, as in his botanical studies during the previous decades, is another indication that "the influence of American science during this period was much greater than is believed to be the case for Canadian scientific endeavours in general."[37]

In fairness, it must be stated that with time Macoun developed into a reasonably good ornithologist and familiarized himself with the work of local and regional experts throughout Canada. This was absolutely necessary, because from the late 1880s Macoun planned to compile a Catalogue of Canadian Birds, along the lines of his successful Catalogue of Canadian Plants. It was only in the late 1890s that his plan was finally put into practice. In a letter to Toronto ornithologist J.H. Fleming, Macoun explained, that

> My plan was to give the geographical distribution of each species beginning in Greenland and ending with B.C. Then breeding notes given generally in the words

of the man who found the nests and thirdly short notices of our own collection.[38]

In extending the range of birds discussed, beyond Canada and Newfoundland, Macoun had to rely on the authority of American and Danish ornithologists, such as Lucien M. Turner for the birds of Labrador and Alaska, and A. Hagerup and Herlof Winge for Greenland. Ironically the English verision of Hagerup's book was prepared by Montague Chamberlain, from the author's notes. Catalogue of Canadian Birds was published in English in 1900. A French edition followed soon after.

II.

Despite the fact that the collections of the Survey Museum remained insufficient for scientific study, overcrowding soon occurred in what was increasingly known as the "National Museum." Selwyn, unhappy about the crowded condition, asked for more space. The shortage of space became an increasingly important issue, particularly because the Museum attracted five times as many visitors during its first year in Ottawa than it had done during its last year in Montreal. Unfortunately for the Survey Museum, the Conservative government of John A. Macdonald was more inclined at the time "to reduce expenditures rather than assume...additional burdens,"[39] particularly for a government institution that was so controversial as to require a select committee to investigate its operations.[40]

The Ottawa City Council, aware of the popularity of the Museum, sent a petition to the government in 1887 to request a new building for the Survey and its Museum. The Royal Society of Canada also supported the request. Sir John William Dawson "spoke of the need for a national museum to represent the resources of the Dominion and act as a scientific workshop for practical research."[41] The Canadian mining industry also supported Selwyn's attempt to obtain larger headquarters. Even the Governor-General, Lord Lorne attempted to reassure the government, but to no avail. All this had deleterious effects on the functioning of the museum, because by the end of the 1880s the accumulated material could neither be displayed nor stored properly. Zoological specimens were ruined by insects, inflammable material was crowded everywhere, and Macoun was in constant fear of fire.[42] The fire hazard was stressed in a memorandum by the Director and scientists of the Survey. Finally in 1892, more than a decade after the Survey's move to Ottawa, members of the Parliament agreed that a new building was needed.[43] The poor state of the Canadian economy made the erection of a new Survey building yet another pipe-dream.

The election of Sir Wilfrid Laurier's Liberal government in 1896 did not improve the prospects of acquiring a new national museum. George Mercer Dawson (1849-1901), Director of the Survey since 1895, continued to press for a new safe building, mostly by working behind the scenes where

he brought both the value of the collections and the inadequacy of the building housing them to the attention of the members of the government. Dawson was well aware of the Liberal government's emphasis on development and stressed the importance of the collections in illustrating the economic resources of Canada. However, it was only after the death of Queen Victoria in 1901 that the government decided to erect a new Museum building as a "memorial project."[44]

In late 1906 it became apparent that the original plan to finish the Museum by 1907 was not feasible. At the same time members of the staff, looking forward to larger quarters, knew that in the new environment a number of new administrative and scientific positions would be created. Wire-pulling began as early as 1906 to secure positions in the new Museum.

During the long drawn-out and difficult process of acquiring a new building, Macoun attempted to assemble a representative collection of Canadian zoological and botanical specimens practically singlehanded. There was no way to do a thorough job of collecting. In a letter written to his old friend and mentor, C.H. Merriam, in early 1906, Macoun brought into sharp focus the unenviable state of government funded natural history work in Canada:

> As you are aware, the branches of natural history including botany are all saddled on my shoulders. My son...is the botanical curator and the only one beside myself who does any work in botany. The man

> Spreadborough was taught his work by my son...He is our only field assitant in all branches and his expenses last year over and above his wages and food were $69. My expenses were under $400 and my son's...less than $300....Keeping this in mind I would like to ask you what more could you expect of us than what you find. Your government has got an intelligent idea of the work necessary where our government has no idea of the subject at all, and at present, is too engrossed in politic and party tactics so that the practical work of natural history is left altogether out of the question.[46]

Furthermore Macoun admitted to Merriam that "were my years not near their close I would feel greatly depressed when considering the position that our work is placed on account of the ignorance and carelessness of those in power."[46] It is hardly surprising that Macoun, at the age of 75, was feeling overworked. After having published numerous government reports and seven sections of the Catalogue of Canadian Plants (1883-1902), he was working on the second, updated version of the Catalogue of Canadian Birds, at a time when the Museum's ornithological collection was far from being representative of the Canadian avifauna. The idea of moving to large and fireproof headquarters with plenty of space for both study and exhibition collections pleased Macoun, but he was also worried about the future and particularly anxious to get rid of the bird work.

Throughout more than a decade of correspondence with Canadian ornithologists, soliciting their manuscript notes, publications and specimens for use in the Catalogue, Macoun became familiar with the rising generation of ornithologists

in the country. Of these J. Henry Fleming and Percy A. Taverner were the most important. During the first years of the twentieth century Macoun increasingly relied on Fleming's wide knowledge of the birds of Ontario on which the Toronto ornithologist had published more than a dozen papers since 1890. Macoun was also impressed with Taverner's studies of distribution, life history, and, most importantly, migration, resulting in an increasing number of papers in both Canadian and American journals.

In the fall of 1906, after a summer of surveying and collecting from Portage La Prairie, Manitoba, to Edmonton, Alberta, the old botanist was faced with the task of arranging and cataloguing the bird and mammal collection to the museum. It was during this busy time that Fleming, on a trip to Ottawa, visited Macoun. The discussion, inevitably, centred on the Museum's collection and its hoped for move into the new building. The change of Directors of the Geological Survey was also discussed.

This was a time of upheaval for the Survey. Dr. Robert Bell, Acting Director since Dawson's death in 1901, was finally replaced by A.P. Low. With a new Director the Survey staff felt that things looked bright for the future. Low was considered a good executive, who "stood well with parliament and has been promised a free hand."[47]

Macoun, during his discussion with Fleming, told the ornithologist that the Director intended to fire Samuel

Herring, the Museum's taxidermist, who has been on temporary staff since 1883 and according to the staff "got $ 1200 for doing nothing and is a general drag on the whole concern." Instead of Herring "they want some one to take hold of the museum, not necessarily a taxidermist, some one of sufficient artistic taste and needful knowledge to arrange the new museum and take the burden off the hands of the present staff." This was a job for a curator. Macoun, while not telling Fleming specifically that they had him in mind intimated that they wanted "the right man." Fleming was also approached by another member of the Survey who "said straight they wanted me or at least I understood so" wrote Fleming to Taverner.[48] Fleming, who was independently wealthy, considered the position more suitable for his friend Taverner, at the time working as an architectural draftsman in Detroit.

Percy Algernon Taverner was born in Guelph, Ontario in 1875, the son of a highschool principal. He received his education in Port Huron and Ann Arbor, Michigan. It was during his high school days in Ann Arbor that he first met A.B. Covert, taxidermist at the Museum of the University of Michigan. This friendship provided Taverner with the opportunity to learn both taxidermy and systematic ornithology by studying the museum's collection of birds. He became friendly with many of the students, particularly Robert Woolcott, who later became a well-known ornithologist and

educator in Nebraska.

In the winter of 1896-97 Taverner, then living in Toronto, and supporting himself from taxidermy and photography, met J.H. Fleming, at the time assistant in the Spanner taxidermy shop. He soon made friends with other naturalists-ornithologists, such as William G. Lambe of Toronto, and George E. Atkinson of Toronto and Winnipeg. When Taverner returned to Michigan at the turn of the century, he worked in an architect's office, while pursuing a correspondence course in architecture. He supplemented his income with taxidermy (and even considered making it his profession), and by ferrying passengers between Michigan and Ontario in a rowboat! In 1902 he moved to Chicago to practice architecture, and took evening courses at the Art Institute. During the next two years he frequented the Field Columbian Museum in Chicago and became friendly with ornithologists Ned Dearborn and Lynds Jones. Taverner also initiated correspondence with other American ornitholgists, including W.W. Cooke, J.A. Allen, Frank M. Chapman and Jonathan Dwight.

On his return to Michigan in late 1904, Taverner renewed acquaintance with Charles C. Adams, professor at Ann Arbor, W.B. Barrows, professor at the Michigan Agricultural College, and other members of the Michigan Ornithologists' Club. The congenial company of local ornithologists, the proximity of his Canadian friends, and the facilities of the University of Michigan Museum all enabled him to expand his

ornithological studies. Adams and Barrows were interested in all areas of the study of living birds. These included geographic distribution, migration, economic importance, and conservation. Adams also emphasized ecology; Barrows stressed life history studies, even of the most common birds, and Leon J. Cole, a graduate assistant at the university, was interested in migration.

Taverner's interest in bird migration and distribution, two subjects which gained pre-eminence in American ornithology in the late nineteenth century, were also encouraged by members of the Great Lakes Ornithological Club (GLOC). The GLOC was the first Canadian attempt at organized ornithological work. Its membership included W.E. Saunders, P.A. Taverner, J.H. Fleming, A.B. Klugh, and other lesser known Ontario ornithologists. The American Lynds Jones also became a member. The Club was established in 1905, to advance ornithological work in the Great Lakes region.[49] One of its mainstays was Alfred Brooker Klugh, a British-born Guelph area naturalist. Klugh, at the time a student at the Ontario Agricultural College, also worked as instructor of nature study and ornithology at the college. In 1906 he went to Queen's University, and later to Cornell, where he received his Ph.D. in zoology in 1926. Klugh, like so many of his contemporaries in North America, was a good all-round naturalist. However, unlike many of his contemporaries Klugh was also a good

specialised biologist. His keen interest in the migration and distribution of birds made him an important companion to Taverner, at a time when the latter's interest in ornithology became increasingly more scientific. While they lost touch after Taverner's move to Ottawa in 1911, Klugh's influence on Taverner is evident.

Taverner, as one of the charter members of the GLOC, participated in the Club's project to make preliminary maps for the faunal divisions of Ontario. His ideas on bird distribution were published in the Bulletin of the Club, which was circulated to members. Other articles on migration, distribution, and on the subspecies question were included in the Ontario Natural Science Bulletin, the Wilson Bulletin, and The Auk.

J.H. Fleming was born in Toronto in 1872. His father came to Canada from Scotland in 1834, and two years later established a seed-growing business, in what was later to become downtown Toronto. Harry Fleming was educated at the Model School and Upper Canada College, and in his spare time he began to collect birds. At the age of sixteen he became an Associate Member of the Canadian Institute, at twenty-one he was elected Associate Member of the A.O.U. In the meantime he built up a sizable private collection, which in quality and quantity far surpassed any natural history museum's bird collection in Canada, and many in the U.S.

Early in the 20th century Fleming found out that Whiteaves

was ready for superannuation and he would have liked to replace Whiteaves as curator, a position that the paleontologist had held for more than thirty years. At the same time he felt that "it would have to be a pretty substantial salary to make it worth my while."[50] The loss of his independence was a thought that put Fleming off from trying for any museum position, even though curatorship was the sort of work that he felt he "had been gathering knowledge about for many year and there is nothing I would like better...a staff of my own choosing would be essential and I could lay my hands on just the men I wanted."[51]

Fleming was one of many Canadians who had advocated the creation of a Natural Museum during the last decade of the nineteenth century and the early twentieth century. Such a museum could "receive and care for the collections of the Survey and government departments,"[52] and members of the Survey were also in favour of such an arrangement. Apparently for a long time "the staff have fought shy of adding to the collection for there was no place to put it and no one to look after it properly."[53]

Once Fleming made up his mind that he would rather keep his independence than work for the government, he began promoting Taverner for the position of curator. He informed his friend that "I shall aim at your being offered the post of ornithologist but that may not be possible...as far as ornithology goes you would have a far wider field in Canada

than in the States for you could create the position and go ahead without playing second fiddle."[54]

Fleming's assessment of Taverner's chances at the time and in the future turned out to be correct. Low and the Survey were not ready to create a department of ornithology or a position for an ornithologist in 1906. Fleming wrote letters on Taverner's behalf both to Low and Macoun, and was trying to arrange Taverner's introduction to influential people in Ottawa. Macoun seemingly "got cold feet," however, after Fleming told him that "if he wanted some one competent to take the burden of ornithologist off his hands" Taverner would be the man.[55] Low replied to Fleming that what they wanted was a practical taxidermist. When Fleming in turn stressed that a taxidermist could not do the job required, the Director answered that:

> we are only beginning and consequently cannot make heavy expenditures, especially as the building will not be completed for at least three years. My idea is to procure, if possible, an intelligent young man (Canadian preferred) with some aptitude for animal taxidermy and educate him to the best ideals.[56]

Obviously, under the present condition of the Survey Museum, with all available funds going into construction, the position of a curator was not feasible. Herring was kept on staff to save expenses and, in spite of everyone's dissatisfaction with his work, remained in the museum until 1919.

Taverner did not want the position of taxidermist in

any case. While he had toyed with the idea of becoming one in 1900, and even wrote to Seton in New York concerning taxidermy as a profession, by 1906 his interest in ornithology was too scientific to be satisfied with the prospect of devoting his life to the preparation of bird skins. He wrote to Fleming that:

> I do not care to do a taxidermist's work and beside were it not otherwise the effect of the arsenic upon me would render it impossible for me to do it regularly. Of course I would never object to making a reasonable number of bird skins when it is not convenient to have them done otherwise but this is no more than any one would do in a museum position.[57]

With his interest in systematics, geographic distribution, life history and migration, Taverner saw that his future lay in museum work. He wrote to his friend Fleming:

> I think I have some qualifications for [museum work]. If I ever achieve anything it will be along such lines. Architecture will never offer me anything but a living as I do not take enough interest in it to develop any latent talent I might have in that direction.[58]

Because of this aspiration, he was not, as yet, very disappointed at failing to secure a position with the Survey. In fact he was quite prepared to wait until Fleming would be in charge of the department of ornithology at the Museum. It was Fleming who was disturbed by the turn of events. Having given up the idea of a position for himself at the Museum, Fleming was upset that Taverner missed out on a promising opportunity and he was also annoyed by having been taken in. He complained, "I ought to have known that what one official

proposes the one higher up reverses, as it ever is in government work."[59]

In spite of Director Low's estimate that the Victoria Memorial Museum would be ready in three years, by the time the staff and collections began moving into a still partially finished building it was late 1910 and Low had been replaced by Reginald W. Brock as Director of the Survey.

The impending move to new headquarters brought to the fore the question of enlarging the Survey staff. In the spring of 1910 the seventy-nine year old Macoun brought up Taverner's name to the visiting artist-naturalist Ernest Thompson Seton. Seton in turn told Fleming of the new chance for a position opening up at the Museum. This prompted Fleming to write to Macoun immediately, suggesting an interview with Taverner, who was still working as an architectural draftsman in Michigan. According to Seton "two classes of positions [were] available, one at $1600 another at $2200, the latter...not on the permanent list, the first subject to a $50 a year raise."[60]

The need for new personnel was caused not only by the proposed move to larger quarters but also by the reorganization of the Survey's departments. After Whiteaves' death in 1909 the "unnatural combination of paleontology and zoology was terminated. Zoology was merged with natural history to form a Natural History Division in 1910."[61] This was renamed Biology Division in 1912. Plans were made for the

new Natural History Division to prepare up-to-date exhibits of the zoological material in the new museum. In early 1910 it was still not clear what sort of person was needed to replace the late curator, take over the arranging of the zoological specimens collected by Macoun and also look after the taxidermy and exhibition work of the Museum. Misunderstandings abounded, stemming from the Director's hazy notions concerning the abilities and requirements needed for such a demanding position. For instance, Horace H. Mitchell, an aspiring Toronto taxidermist was told by Brock that there would not be any change of staff for at least another year, and as he told Fleming later, he was not given much hope by Brock.[62] During the summer of 1910, however, Brock decided to visit a number of natural history museums in the U.S., to see their organization, and particularly the way specimens were exhibited. He was most impressed with the American Museum of Natural History in New York, which by that time arranged exhibits in habitat groupings.

Macoun in the meantime carried on his work and spent the summer collecting in Nova Scotia. By the time he returned from the field, with yet another collection of natural history specimens, the need for a new zoologist-preparator became imminent. Macoun recommended Taverner for the position, and outlined what he thought was needed. "A bird man, not necessarily a taxidermist but a judge of taxidermy and capable

of doing scientific work. Salary at $1500 a year with rapid advance to $2500. A Canadian would be preferred."[63] He discussed these qualifications with Seton and later Macoun wrote to Taverner suggesting that he get in touch with the Director, advising him to stress that he was Canadian.[64]

Taverner complied immediately and his letter to Brock elicited a swift reply:

> I may say that it is altogether likely that we shall have an opening for a Naturalist and Preparator in the immediate future. What is wanted is some one who is fond of birds and animals, knows something about them and their habits, and who is something of an artist so that he can have specimens collected, mounted in natural positions with natural surroundings and exhibit them tastefully in the Museum. In addition to these rather rare qualifications if he could also write well it would be a further recommendation. In accordance with Civil Service regulations the position will be advertised and applications received. Some testimonials regarding work and samples and specimens of work done would be helpful.[65]

Taverner had no difficulty in providing samples of his work and letters of recommendations. In addition to Macoun who promised to support him, Fleming and Seton had already written to Brock on his behalf, and Saunders in London, Ontario, (who was well-known in government circles, because his father had founded the Experimental Farm in the 1880s) also promised to write. The Civil Service examinations and language requirements worried him, however.

Fleming, who was prepared, if necessary, to bring a strong political influence to advance Taverner's cause, decided to lobby in Ottawa.[66] However, he could not do any of

the proposed wire-pulling, because he had forgotten that since 1907 the Survey had been under the Department of Mines and not, as previously, under the Department of the Interior (where Fleming had his connections) [67] In spite of this "setback" Fleming felt that after a long talk with Brock he had advanced Taverner's cause considerably. The telegram he sent to Taverner from Ottawa was proof that Fleming wasted no time:

> Have talked matter over with Brock Showed my letter to Low of four years ago favourable reced and brocks description of position fits in nicely saunders has already written I am to write formally dont think position is immediate Macoun is favourable can only wait for things to move[68]

A subsequent letter explained what happened in more detail. Fleming had a long talk with Brock,

> a young man with a determined face...a born director of men. I showed him my letter to Low of four years ago and he said that is exactly what we want and then he began to outline what he thought he wanted, remember Brock is a geologist on the economic side, after a little careful guiding I got him to describe the position I wanted, outlined in much my own words...Brock said we cannot afford to ignore the public after all it is their museum and we have no one to take over the preparing of exhibits.[69]

There was only one possible obstacle. The Civil Service Commission "announced that positions in the Survey will only go to University men," wrote Fleming, but "Brock makes light of the matter."[70] Brock's attitude is interesting, because in 1908 he "specified education to the Ph.D. level as the standard of qualification," a practice that was actually instituted by Selwyn in 1890.[71] However, Fleming's interview

with Brock came soon after the Director's return from a series of visits to American museums of natural history, where he encountered many museum curators. Most of the American curators in 1910 had no university training, and this may have influenced the Director's view concerning requirements for a zoologist-curator in the Survey Museum. The only government scientist with a Ph.D. in zoology at the time was C. Gordon Hewitt, Dominion Entomologist, whose appointment was in the Department of Agriculture.

The museum position was not only for an ornithologist, although as Fleming found out from Brock "by consent that will go with it." It was rather "one of arranging the exhibits of zoology, groups will have to be built up...what is wanted is some one to take the whole burden of arranging and exhibiting the specimens with an eye to the public."[72] Taverner's hopes were high; he was delighted with his prospects and with all that his friends had done for him. He wrote to Fleming that if "the position does come my way I hope I will make good though I fear I will have to live to pretty high standards if all that has been inferred has been said [in the various letters of recommendation]."[73]

Throughout the winter of 1910-11 Brock and Taverner exchanged letters with increasing frequency. Most of the letters discussed such items as salary (starting at $1600), the possibility of field work and the necessity of advertising

the position in the Canada Gazette. Early in January 1911 Taverner went to Ottawa, where he finally met Macoun, his correspondent for the past twenty years, and Reginald W. Brock, Director of the Survey. Within a few weeks, Brock wrote "that the position was open and the matter would probably be settled within a fortnight."[74] The position was not advertised in the Canada Gazette until February 18, however, and since a month had to be given for others to apply, selection of a likely candidate did not occur until after the middle of March. Then a setback occurred, because the Civil Service Commission did not find Taverner's application "formal" enough. Brock telegraphed Taverner to send a formal application to the Commission "for position as Naturalist, Preparatory and Assitant Curator Natural History."[75] In a subsequent letter he assured Taverner that "there is no reasonable doubt of your selection as you have no serious competitors."[76] Finally, at the end of March 1911, four and half years after Taverner's hopes were first raised about the possibility of a position at the Survey Museum, he received a letter from the Director of the Survey advising him that it was "quite safe for you now to plan to come to Ottawa, as I understnad the Civil Service Commission is notifying you that your application has been successful."[77]

With Taverner's appointment, ornithology, in the guise of natural history-zoology, entered the oldest institution of the federal scientific establishment. Ornithology was not

recognized by the government as a separate specialty until 1918, however, when Hoyes Lloyd (1888-1978) was employed as Dominion Ornithologist to administer the Migratory Bird Regulations in the Dominion Parks Branch. The Parks Branch belonged to the Department of Interior.[78] Thirty years previously Montague Chamberlain tried to persuade the Minister of Interior to create a position for an ornithologist in the Museum of the Survey, then under the jurisdiction of the Department of Interior. Official recognition of ornithology in the Museum, however, did not occur until 1919, when Taverner was "reclassified" as Ornithologist.

Meanwhile Taverner became ornithologist in 1911 in all but name, and his friends were jubilant. Fleming wrote:

> I am delighted that the position is at last secure. I have no fear of the result it is a great opportunity the opportunity that comes just once in a lifetime....No doubt you will have all sort of troubles to contend with but it is for you to decide if you will accomplish anything and I hope at no time will you get discouraged and settle down to the routine of a civil servant to draw your pay.[79]

Taverner moved to Ottawa in May, but his troubles were not over. The Civil Service medical examiner discovered a weakness in his heart, the result of a bout with pneumonia nearly ten years previously. While waiting for a second opinion, Taverner was not eligible for pay because his name did not get on the payroll. Macoun promised to help in every possible way, including that of financial assistance. Brock, whose own position as Director depended to a large extent on

the success of the Museum in the public eye, particularly the success of the proposed exhibits, which were to be Taverner's responsibility, was confident that he could circumvent the Civil Service medical regulations, should this be necessary. The Commission was understandably wary, since in the past some "hopeless invalids", who became ill after one field season, had to be paid for the rest of their lives.[80]

Taverner was hopeful that the heart weakness, which had never prevented him from strenuous field work in the past, would not prevent his acceptance by the Civil Service Commission. A few weeks in the Museum showed him that he was much needed for the job, that there were no rivals in sight, and that Macoun, indubitably an excellent field man, was of "very little use as a museum head." According to Taverner, Macoun knew this and wanted "some one who is perhaps to cover up this weakness in him and perhaps Jim [Macoun, the botanist's son] who is scheduled to take his place."[81]

With a second medical opinion "favourable," Taverner's position was safe at last and he plunged into the arduous task of inventorying the Museum's collection.

During the next three decades Taverner built up a representative collection of Canadian birds from less than 3,000 specimens in 1911 to over 30,000 in 1942.[82] He also organized and coordinated ornithological work in Canada. This

resulted in the development of regional ornithology and stimulated study in the areas of geographic distribution, life-history, behaviour, migration and ecology of birds. Taverner was an ardent conservationist and through his popular bird books and cooperation with the Dominion Parks Branch he contributed considerably to wildlife conservation in North America. Most important of all, Taverner served as friend and mentor to a generation of Canadian ornithologists, giving advice, providing information, exchanging specimens, and helping to secure positions when possible. Through his official position in the National Museum Taverner shaped the development of twentieth century Canadian ornithology. This will be discussed in the following chapters.

Notes

1. G.M. Dawson, "The Progress and Trend of scientific Investigation in Canada," Transactions of the Royal Society of Canada, Series 1, Vol. 12, 1894, p. 13.

2. Morris Zaslow, Reading the Rocks. The Story of the Geological Survey of Canada, 1842-1972 (Toronto: The Macmillan Company of Canada, 1975), p. 123.

3. Ibid., p. 124.

4. Susan Sheets-Pyenson, "Stones and Bones and Skeletons," McGil Journal of Education 17 (Winter 1982): 49-62.

5. Zaslow, Ibid., p. 124.

6. W.A. Waiser, "Rambler: Professor John Macoun's Career with the Geological Survey of Canada, 1882-1912." Unpublished Ph.D. Thesis, University of Saskatchewan, 1983. See also, J. Macoun, Autobiography of John Macoun. Canadian Explorer and Naturalist, 1831-1920 (Ottawa: The Ottawa Field-Naturalists' Club, 1979).

7. Zaslow, Ibid., p. 132.

8. P.W. Riegert, From Arsenic to DDT, A History of Entomology in Western Canada (Toronto: University of Toronto Press, 1980), p. 59.

9. Ibid., p. 63.

10. Public Archives of Canada, Manuscript Division. Uncatalogued papers of John Macoun (hereafter PAC, Macoun papers). Macoun Letterbooks, vol. 1, p. 450, John Macoun to C.H. Merriam, 6 April 1888.

11. M. Chamberlain, A. Systematic Table of Canadian Birds (St. John: Published for the Author, 1888), p. iii.

12. MCZ, Brewster papers, Montague Chamberlain to William Brewster, 16 July 1887.

13. Ibid.

14. Ibid., 6 November 1887.

15. Ibid.

16. Ibid.

17. Ibid.

18. Ibid.

19. Ibid., 15 November 1887.

20. Ibid.

21. Ibid.

22. Ibid., 29 November 1887.

23. Ibid.

24. PAC, Records of the Geological Survey of Canada, RG 45, vol. 82, R.A. Selwyn letterbooks, R.A. Selwyn to Montague Chamberlain, 14 December 1887; see also W.A. Waiser, "Rambler..." pp. 96-99.

25. Zaslow, Ibid., p. 138.

26. J. Macoun, Autobiography, p. 254. There is no evidence that Whiteaves "wished" to appoint Chamberlain.

27. Ibid.

28. Zaslow, Ibid., p. 145.

29. Vittorio de Vecchi, "Science and Government in Nineteenth-Century Canada," unpublished Ph.D. thesis, University of Toronto, 1978, p. 222.

30. M. Chamberlain, Catalogue of Canadian Birds (St. John: J. and A. Macmillan, 1887), p. iii.

31. Ibid., pp. iii-iv.

32. Ibid., p. iv.

33. Ibid., p. ii.

34. PAC, Macoun letterbooks, Vol. 1, pp. 358-59. John Macoun to J. Vroom, 19 March 1888.

35. Chamberlain, A Systematic Table, p. iii

36. W.A. Waiser, "The Macoun-Merriam Connection: CAN/AM Natural Science in the late 19th century," Paper presented at the History of Science Society Conference, Toronto, 1980.

37. Ibid., p. 10.

38. Royal Ontario Museum Archives (hereafter ROM), SC 29, Uncatalogued papers of J.H. Fleming (hereafter Fleming papers), John Macoun to J.H. Fleming, 18 June 1898.

39. W.A. Waiser, "Canada on Display. Towards a National Museum, 1881-1911," in R.A. Jarrell and A.E. Ross, eds. Critical Issues in the History of Canadian Science, Technology and Medicine (Thornhill: HSTC Publications, 1983), p. 168.

40. Zaslow, Ibid., pp. 131-150.

41. Waiser, "Canada on Display," p. 169.

42. Ibid., p. 170.

43. Ibid., p. 171.

44. Ibid., p. 174.

45. National Museums of Canada, National Museum of Natural Sciences, Vertebrate Zoology Division (hereafter NMNS), Uncatalogued papers of R.M. Anderson, (hereafter Anderson papers), John Macoun to C.H. Merriam, 2 March 1906.

46. Ibid.

47. ROM, SC 51, Uncatalogued papers of Percy Algernon Taverner (hereafter Taverner papers), J.H. Fleming to Percy Taverner, 6 October 1906.

48. Ibid.

49. Jack Cranmer-Byng, "The Great Lakes Ornithological Club. The Origin and Early Years, 1905-1911," Ontario Birds 2 (1984): 4-12.

50. ROM, Taverner papers, J.H. Fleming to Percy Taverner, 6 October 1906.

51. Ibid.

52. Ibid.

53. Ibid.

54. Ibid., 14 October 1906.

55. Ibid., 16 October 1906.

56. PAC, RG 45, vol. 113, C-14464, A.P. Low to J.H. Fleming, 20 October 1906.

57. ROM, Taverner papers, Percy Taverner to J.H. Fleming, 19 October 1906.

58. Ibid.

59. Ibid., J.H. Fleming to Percy Taverner, 9 October 1906.

60. Ibid., quoted by J.H. Fleming to Percy Taverner, 23 March 1910. The salary was actually $ 2100 per annum and not $2200. These were Dominion Civil Service wages, which as of 1908 applied to the Survey staff. University graduates began at $ 1600, see Zaslow, Ibid., p. 286. Taverner's position was advertised, "initial salary $ 1600" Canada Gazette 18 February 1911, p. 2704.

61. Zaslow, Ibid., p. 270.

62. ROM, Taverner papers, J.H. Fleming to Percy Taverner, 29 March 1910.

63. Ibid., quoted in a letter by Percy Taverner to J.H. Fleming, 21 November 1910.

64. Although Taverner was living in Michigan, he was still a Canadian citizen.

65. ROM, Taverner papers, R.W. Brock to Percy Taverner, 25 November 1910.

66. Ibid., J.H. Fleming to Percy Taverner, 30 November 1910.

67. Ibid., 2 December 1910.

68. Ibid., 1 December 1910.

69. Ibid., 2 December 1910.

70. Ibid.

71. Zaslow, Ibid., p. 285

72. ROM, Taverner papers, J.H. Fleming to Percy Taverner, 2 December 1910.

73. Ibid., Percy Taverner to J.H. Fleming, 7 December 1910.

74. Ibid., R.W. Brock to Percy Taverner, 11 February 1911.

75. Ibid., 22 March 1911.

76. Ibid., 22 March 1911.

77. Ibid., 29 March 1911.

78. J. Foster, Working for Wildlife. The Beginning of Preservation in Canada (Toronto: University of Toronto Press, 1978), p. 159.

79. ROM, Taverner papers, J.H. Fleming to Percy Taverner, 3 April 1911.

80. ROM, Ibid., 13 May 1911.

81. Ibid.

82. W.L. McAtee, "Percy Algernon Taverner, 1875-1947," The Auk 65 (1948): 90.

Chapter 4

MAPPING THE BIRDS OF CANADA: MUSEUM WORK AND EXPLORATIONS DURING THE FIRST HALF OF THE TWENTIETH CENTURY

I

By the time of Taverner's appointment to the Victoria Memorial Museum in 1911, American ornithologists had studied economic ornithology, migration and distribution for half a century and were "preoccupied with coming to grips with the avifauna through taxonomic and distributional analyses."[1] Ornithological studies, as judged by papers published in The Auk, were oriented towards natural history, systematics, distribution, migration, breeding biology and general biology of birds. Although most of American ornithological research was still carried out at natural history museums, academic institutions began to offer ornithology courses, and centres of ornithological education and research were established at Cornell University and the University of California, Berkeley.

In Canada, where the reconnaissance of the nation's avifauna was merely at an embryonic stage, ornithologists were still mainly occupied in establishing local lists, studying nesting habits, geographic distribution, and to a lesser extent the migration and conservation of birds. Only a few works dealt with aspects of life history and systematics.

Bird collections, the basis for many of these studies, were inadequate in most natural history museums. The only representative collection of Canadian, North American, and world-wide birds was the private one owned by J.H. Fleming in Toronto.

For Taverner, familiar with museum collections at Ann Arbor and Chicago, and the private collections of Saunders and Fleming, the one at the Victoria Memorial Museum must have appeared to be woefully inadequate in comparison. Moreover, at the beginning of his employment, the museum was still disorganised after the move to new head-quarters in late 1910. It seemed to Taverner, as he told Fleming, that nobody knew "what space they are going to have or what they are going to do."[2] Moreover, everyone was "hustling about very busily, but as far as I can see no one accomplished anything."[3]

Despite the unfavourable circumstances, Taverner took inventory of the collection and realized the enormous amount of work which awaited him. In a letter to "Friend Fleming" he wrote:

> I have just been down looking over the bird and mammal skins. They have quite a number of western stuff but [they] require to be relabelled and cases provided. The cases they are in are utterly untenable. There is a whole lot of work in sight as soon as things get straightened out it will keep me out of mischief. Young [the taxidermist working mostly on invertebrates] and I are going to hit it off very well. I have seen Herring but once or twice but do not think he will hinder at all.[4]

Less than two weeks after his arrival in Ottawa,

Taverner submitted a report to Macoun and Brock which summarized the assets and needs of the Museum. The needs were extensive: new taxidermy work, new labelling practices, new efficient storage cases for study collections and new glass cases for the exhibition collections. Taverner also set out a desirable course for working in the Museum of the Canadian Government, one that because of the inflexibility of government-directed museum policy he was to regret in the future. He wrote:

> The Museum being under the Geological Survey of Canada gives it a National character at once, nor do I think it advisable to make any great effort to extend it beyond this limit, at least for the present. The time will certainly come when it will be necessary to broaden out and give its collection a world wide character both for the education of people in general and for the benefit of future Canadian zoologists for it is evident that life is so complex in its distribution that knowledge of Canadian conditions cannot be accurately arrived at without taking into consideration extralimital examples and experience.[5]

Taverner further emphasized the immediate need to collect and study Canadian material, because of the imminent danger of extinction of several North American species of birds.

Taverner was correct to stress, in 1911, the much needed work on Canadian birds. But his original decision that zoology in the Museum be "intensively Canadian in character and extralimital only in such manner as would not appreciably disturb our National work,"[6] was later to seriously restrict his work in a broader North American context.

For exhibition Taverner recommended habitat grouping, a

novel method which had been first used by Martha Maxwell of Colorado, and later adopted by the American Museum of Natural History. During his 1910 tour of American museums, Brock concluded that this way of illustrating natural resources, by showing plants and animals in their natural environment, was the best one possible. Taverner concurred; habitat groupings showed "an important aspect of the area [illustrating it] with typical animals and natural accessories carried out botanically, entomologically and in every other way to the last decimal point of zoological accuracy."[7]

This first report illustrated not only Taverner's meticulous research into museum work and management, but also his flair for organization and eye for every small detail. In conclusion Taverner asked Macoun and Brock to "carefully consider" the points he raised and added,

> I am interested in making this institution take its place among the great institutions of the world. My scientific future is wrapped up in it and if I make a name for myself it will be through it. Maybe all the points discussed cannot be carried into effect at once but they form a mark to aim at and will, I think, eventually greatly assist the reputation and the prestige of the museum and incidentally of all who have connection with it.[8]

In less than three months Taverner submitted another report, based on his visits to American museums of natural history in Cambridge, New York, Washington, Ann Arbor and Chicago. He also spent time at the Ward Natural History Establishment in Rochester, New York, a company which specialized in large-scale taxidermy. The American trip did not change the

conclusions of the previous report but it "crystallized thoughts, rendered methods clearer and brought details into sharper outlines."[9] In this second report Taverner outlined his proposed catalogue system to be applied to museum specimens; he also reiterated that specialists were needed to take charge of the reptile and mammal work in the Museum. The appointment of a good taxidermist was of paramount importance, for Herring was incompetent, and C.H. Young, affectionately called "Bugs" Young, although an excellent taxidermist, specialized in invertebrate zoology. Unfortunately good museum taxidermists were hard to find because most museums trained their own specialists, and then paid and treated them well in the hope that they would not move elsewhere. Taverner was exceptionally fortunate that on a trip to New York in 1912 he met Clyde Patch, and American taxidermist, who was willing to come to work in Canada. The following year, Rudolf Martin Anderson (1876-1961), leader of the southern party of Vilhjamur Stefansson's Arctic expedition, was hired as museum mammalogist. But since Anderson accompanied the Canadian Arctic Expedition from 1913 to 1916, Taverner had to carry on all work concerning bird and mammal collections and exhibitions.[10]

Taverner soon began encouraging Canadian ornithologists to make increased contributions. There was an urgent need for more ornithological activity in Canada. The increased

settlement, industrialization, and extension of railway lines into remote areas all threatened to change much of Canada's avifauna and its habitat in drastic ways. American museums, universities, and individual collectors, aware of the impending changes in the north and northwest of Canada, began casting covetous glances to these regions from the Alaskan border to Newfoundland. Because so much ornithological work in Canada had been done by Americans, Taverner emphasized the need for Canadians to seize the opportunity to do original work in their own country. In "Suggestions for Ornithological Work in Canada" published in the Ottawa Naturalist in 1915, Taverner wrote that because of the "blank spaces in our knowledge" in Canadian ornithology, the study of the Canadian avifauna offered "fine field" for original research.[11] He enumerated areas needing investigation: life history, geographic distribution, economic ornithology. He stressed that Canadian ornithology was so far behind American developments that even the fundamental task of collecting specimens had been done only in a sporadic fashion. Birds in the Maritimes, Labrador, Gulf of St. Lawrence, the Prairie Provinces and British Columbia had been studied only in a few localities, and even then only intermittently. The Yukon and its tributaries, and Lake Athabasca to the mouth of the Mackenzie River had been studied more extensively than more populated southern parts of the country, but even so, information on northern areas was still fragmentary. The only

section of Canada that had "anything like adequate attention from an ornithological standpoint," was the well populated southern peninsula of Ontario, from Toronto to Windsor and to the south of that line.[12]

Because of this uneven survey of the Canadian avifauna, Taverner maintained that one of the "greatest desiderata is an accurate investigation of distribution of bird life in the Dominion."[13] He further emphasized that :

> many of the published ranges of our birds are based upon geographic probabilities, a priori reasoning or are copied and recopied from previous writers. Examples are many....To establish the Canadian ranges of our birds, their migration routes and general status, we need skilled observers at all possible points to note and collect local data and specimens. Ideally there should be an observer in every county of the Dominion, each keeping track of his own area and comparing and checking it with results from adjoining stations. Provincial museums should gather up these local results within their sphere of influence and the whole should be amalgamated and correlated by the Dominion authorities, represented by the zoological branch of the Geological Survey at Ottawa. In this way we would have co-operation and series of local collections illustrating intensive work throughout the Dominion.[14]

The importance of such lists for the study of a country's avifauna had long been widely recognized. In Britain, the compilation of local lists was a predominant occupation of ornithologists and botanists during the second half of the nineteenth century, a time characterised by D.E. Allen as the "period par excellence of the production of local Floras and Avifaunas."[15] In North America, local lists also proliferated towards the end of the nineteenth century, and

hundreds of these lists, together with thousands of notes on local observations formed the basis of large comprehensive works, consituting the "backbone" of faunal ornithology, "while they are also the source of much information presented in our treatises and compilation of the life histories of birds."[16]

In Canada, nineteenth century local lists by McIlwraith, Chamberlain, Neilson, Wintle and others had been the first beginnings of faunal investigations. This modest start was expanded in the first decade of the twentieth century by Fleming, Saunders, Klugh and Taverner. Taverner's early experiences acquired at this time provided him with the expertise required to organize the co-operative effort which was needed to map the birds of Canada. This was not an easy task. Poor ornithological "material" in the Victoria Memorial Museum, and the scarcity of "workers" across the country made it difficult to pursue even the most basic of ornithological explorations. Taverner's suggestions concerning ornithological work in Canada were important and timely. Prior to 1911 there was no central organization (academic institution or disciplinary association) to direct Canadian ornithological work. Britain had the British Ornithologists' Union as a central organizing body, and in the U.S. Spencer Fullerton Baird, as Secretary of the Smithsonian Institution, handled the task from the middle of the nineteenth century.

Later, responsibility went to the American Ornithologists' Union. However, by 1911 it was vital to bring the most fruitful lines of research in Canada to the attention of the country's widely dispersed naturalists-ornithologists and it was even more important that their efforts should be co-ordinated.

II

Taverner began collecting off-prints of all ornithological publications relating to Canada soon after his arrival in Ottawa. Moreover, as he explained to Robie W. Tufts, he "attempted to keep in touch with and correlate all ornithological work in the Dominion."[17] He encouraged an increasing number of his correspondents to concentrate on faunal lists and to provide the Victoria Memorial Museum and the smaller provincial museums with specimens of birds, nests and eggs. He also circulated information on a number of difficult problems in the systematics, life history and physiology of birds. His museum position together with his wide interests and knowledge enabled him to encourage others in important lines of research, and at the same time perform his own considerable task as "museum man."

In addition to the usual curatorial activities, such as organizing, preserving, exhibiting and studying the Museum's zoological material, Taverner conducted a number of field expeditions in ornithologically neglected areas of the country

during the 1913-1937 period. These expeditions, and others he had organized under the auspices of the National Museum of Canada, but could not personally participate in, resulted in the securing of important specimens for the Museum's collection. They also provided prospective ornithologists with much needed field experience. But even with Taverner's efforts, Canadian museum parties were greatly outnumbered by American university and museum expeditions to study Canadian avifauna. Moreover, with the extension of roads and railway networks into the north, an increasing number of individual American ornithologists and graduate students conducted research on Canadian birds.

Taverner began his collecting with great enthusiasm, and in 1913, accompanied by Clyde Patch, he had his first field season at Point Pelee, Ontario. Point Pelee, a sandspit extending into Lake Erie, is the southernmost point in Canada, and an excellent place for observing migratory birds. It also provided breeding habitat to a number of southern species of birds not found elsewhere in Canada. Taverner, who spent many happy hours collecting birds at Point Pelee with members of the Great Lakes Ornithological Club early in the century, knew that this was the perfect area to obtain material for a southern Ontario habitat grouping for exhibition.

Later expeditions visited the Gaspe, Chaleur Bay, and the Magdalen Islands in 1914, the Gulf of St. Lawrence and the

North Shore in 1915, Alberta and parts of the Prairies in 1917, and various regions in Ontario in 1918-1919. The following year Taverner's party went to parts of southern Alberta and Saskatchewan. This was followed by another trip to the Prairies in 1921, which included visits to Manitoba, and a western trip, which was enjoyed by all the hard-working field men in 1922. The northern parts of the country, while of theoretical interest, were put on hold, because, as Taverner explained to W.J. Brown of Montreal, he had not "pressed northern work as yet because the conditions up there will be stationary or comparatively so, for some time...." He added that, "in the more southern localities the change is going on very rapidly and I have wished to record [the birds] before they have vanished forever."[18] During the 1913-1928 period Taverner concentrated on the southern regions of Canada, not only because conditions in the north were likely to remain static, but also because the museum had acquired a large number of arctic specimens from the 1913-1916 Canadian Arctic Expedition, which had to be organized and studied. In the meantime, the southern material collected by the various expeditions resulted in a number of "rather important records and extensions of ranges,"[19] particularly from southern B.C., and the Prairie regions, areas which were revisited in 1925 and 1927.

Unfortunately field work had to be carried out with constant financial worries, and without sufficient number of

qualifed field assistants, because Clyde Patch and C.H. Young, the Museum's taxidermists, had other vertebrate and invertebrate work to do in addition to preparing bird skins. Taverner had to recruit other ornithologists to obtain specimens for the Museum, and since many ornithologists were keen to oblige, the Museum had received so many specimens by the early 1920s that Taverner felt that he had no time to "work them up." In spite of his dissatisfaction with the Museum's management, which did not provide him with sufficient funds and assistants, Taverner was pleased that the "study collections are coming on at a reasonable rate."[20] Indeed, the number of specimens was increased from less than 3,000 in May 1911, to 18,000 in February 1922. Since these were all confined to Canada, Taverner had "pretty good series in certain species."[21] By 1933 the collection contained 25,000 specimens.

Taverner's professional field collectors, who accompanied him on the various expeditions were Hamilton "Mack" Laing, of B.C., C.G. Harrold of Manitoba, and Albert Lloyd of Saskatchewan, and also some students and university professors. One of the Museum's most successful collectors was J.Dewey Soper, who later became one of Canada's best known modern-day explorers. Born near Guelph, Ontario in 1893, Soper, like many of his contemporaries, had a childhood interest in nature. After working as a trapper and carpenter

(acquiring skills which later served him well in the Arctic), at the age of twenty-one Soper decided to "make nature his profession."[22] In the early 1920s he enrolled at the University of Alberta and studied zoology under William Rowan. Soper's abilities as a field man and prospective scientist were discussed frequently in the Rowan-Taverner correspondence. In early 1923 Taverner, together with mammalogist R.M. Anderson, arranged for Soper to go to the Arctic as naturalist on the ship "Arctic" under the command of Captain J.E. Bernier. With his rugged physique, love of nature, and knowledge of zoology, Soper was "about the only man available, who had any qualifications and was willing," wrote Taverner to Rowan.[23] The journey was a great success, and in October of that year Soper returned from the Arctic with seventeen boxes of sepcimens, including one hundred and thirty-one birds. The initial journey proved to be the precursor of many others during the following decade. In 1924 Soper, under the auspices of the Museum, began a two-year faunal investigation of southern Baffin Island. The results of his study were published as a Bulletin of the National Museum (the name having been changed from Victoria Memorial Museum in January 1927), in 1928.

Unfortunately for the Museum, its precarious financial position was such that Soper could not be made a member of the permanent staff. Fortunately, the Department of the Interior was also keen to employ him. In the 1920s there were still

several species of birds whose nesting ground in the Arctic was unknown. American ornithologists, in particular, were interested to discover the breeding area of the Blue Goose (Chen cerulescens). This goose is now know to be a colour-morph of the Snow Goose, but in the first half of the century it was still considered a separate species, and from 1923 to 1929 a number of ornithologists conducted an intensive search for it.[24] The North West Territories and Yukon Branch of the Department of Interior, in charge of the administration of the Canadian Arctic Archipelago, employed Soper to conduct the search. In June of 1929, near Bowman Bay, Fox Basin on Baffin Island, Soper found a breeding population of this species. During the following years Soper continued to study the fauna of Baffin Island and later Wood Buffalo Park in northern Alberta. In 1934 he was appointed Chief Federal Migratory Bird Officer for the Prairie Provinces and settled in Winnipeg. Soper was a valuable contributor to Canadian zoology and conservation for nearly fifty years. Even after his retirement from the Canadian Wildlife Service in 1952, he continued to collect birds and mammals for the National Museum and the zoology museum of the University of Alberta, and published many scientific papers.

Not all of Taverner's collectors had such illustrious Canadian oriented careers. C.G. Harrold became affiliated with the American Museum of Natural History and several others

found places in American institutions, where they were assured of more permanent employment. Others, like T.E. Randall of Alberta, collected for the Museum on a part-time basis. William Rowan and V.C. Wynne-Edwards, professors of zoology at the University of Alberta and McGill University respectively, were anxious to go on summer field excursions, not only for the experience it afforded them but also to supplement their incomes. Finally a number of students, Victor Gould and R.W. Smith among them, acquired experience in ornithology until it eventually became their profession.

Taverner visited Labrador in 1928 and made his first "real" Arctic trip in 1929, on the S.S. Beothic to the Arctic Archipelago, and into Hudson Bay to Chesterfield. This, he considered a great experience, although he wrote, "collecting opportunities were not very great, did not expect them to be, but I see more reason for the gaps in our information from there now that I have seen the conditions." Even a short expedition enabled Taverner to see that "there is certainly a very great difference in the avifauna (and Botany so Dr. Malte says) between the east coast and west of Baffin Island."[26] After this initial survey of the north Taverner was enthusiastic about doing further work in the area. As he wrote to H.H. Mitchell, taxidermist at the Saskatchewan Natural History Museum, "we have done the preliminary work in the Southern part of the provinces, and can leave it for future developments, more or less to local effort, while we

concentrate on the more inaccessible areas."[27] The expedition to Churchill in 1930 came at the end of nearly two decades of southern field work, and was prompted by the extension of the railway to Historic Fort Churchill on Hudson Bay. Taverner wrote to Director W.H. Collins that "with Mr. Harrold deceased, Mr. Laing absorbed into the Parks Service and Mr. Soper in the Northwest Territories it becomes of pressing importance that we develop others to take their places and become available for field and other work on behalf of the Museum."[28] With the Director's approval, Taverner organized the Hudson Bay expedition and took two young collectors to the field, Bert Lloyd, and Victor Gould, who at the time was a student at Acadia University. He personally stayed in the field from early May to late July. Gould stayed until September, leaving Lloyd to continue the observation and collection until the beginning of October. During the last month Lloyd was joined by American artist-ornithologist George Miksch Sutton, who "at this time made definite plans to return to Churchill at the first opportunity to search for the eggs of the Harris' Sparrow" (Zonotrichia querula).[29] Sutton was employed by the Carnegie Museum, Pittsburgh, an institution that had funded expeditions into northern Canada since 1901. Sutton had no difficulties in obtaining finances to return to the field during the following seasons. Taverner was less successful with his attempt to convince the Museum authorities

of the importance of continued field work in Hudson Bay to Canadian ornithology. In a proposal for the 1931 field season Taverner wrote:

> In view of the fact that the Southern parts of the Dominion are ornithologically fairly well known it seems well for a time at least...for the National Museum to concentrate its efforts on the more northern and lesser known parts, especially those where there seems less likelihood of private or other institutional research.[30]

Unfortunately, the poor financial position of the Museum precluded any large-scale expeditions for the next few years. Taverner, accepting the inevitable, wrote to Rowan; "No field work this season, Government economising. Will be lucky if I don't loose my job. Heads have been falling right and left in the Civil Service and no one knows who will be next."[31] Although Taverner said that he was content to "stay in...this season," he wished he could have joined "a great gathering of naturalists" at Churchill.[32] The naturalists were G.M. Sutton, O.S. Pettingill (accompanied by collector Bert Lloyd), and J.B. Semple, as members of the Carnegie Museum's field party, and Alberta ornithologist Frank Farley, accompanied by Arthur Twomey and Hugh A. MacGregor.[33]

In the fall of 1931 Taverner and Sutton decided to collaborate on a list of Churchill birds, "covering all that we know of the locality." wrote Taverner to Twomey, requesting field notes from him.[34] The resulting monograph, "The Birds of Churchill, Manitoba," was published in the Annals of the Carnegie Museum in 1934.

III

The 1931 Carnegie Museum Expedition was just one in a long series of American field parties collecting and studying the avifauna of the Canadian north. After numerous eighteenth and nineteenth century European publications containing references to Canadian birds, American naturalists began to investigate the avifauna of the northern regions of Canada. Individual naturalists, such as J.J. Audubon, W. Brewster, C.W. Townsend, G.M. Allen and others reported on the birds of Hudson Bay and Labrador. Since many American species of birds have range extension in Canada, and others nest solely in the northern parts of the continent, it was inevitable that the study of their migration, distribution, life history and physiological adaptation should interest ornithologists in other countries. German ornithologists, for instance, received specimens of birds from the Moravian mission in Labrador in the 1860s and 1870s. In the first decade of the twentieth century Bernhard Hantzsch made an individual attempt to observe and study the birds of the Canadian Arctic. While he did not survive the expedition, his publication remained a classic for a long time.[35] Scandinavian ornithologists were also interested in arctic bird species, many of them similar to those found in the northern parts of Europe.

American universities and museums began frequenting the

Canadian north around the turn of the century. The most numerous and best organized of the expeditions were undoubtedly those conducted by Pittsburgh's Carnegie Museum of Natural History. Twenty-five expeditions were made to the north and east of Canada between 1901 and 1958, with the "definite plan and purpose...to map (as nearly as possible) the respective ranges of the birds of the area, and to ascertain the character and extent of its natural life-zones, as shown by their avian indicators."[36] W.E.C. Todd, the museum's ornithologist was a product of an era, when

> with so few workers on avian distribution...it was perfectly feasible to divide up the world on a "gentlemen's agreement" basis....Todd outlived this era, and was never able to understand, that younger men might not respect, or even understand his prior claim to all of northern Canada from Hudson Bay eastward. His correspondence file from the 1930s through the 1950s is filled with...copies of Todd's letters requesting reprints of faunal papers published in The Canadian Field Naturalist and elsewhere, and admonishing the authors that it would have been better had they made their notes available for Mr. Todd for incorporation into his "forthcoming" comprehensive work on Labrador birds. He even went so far as to guard possessively some of the specimen data from his northern expeditions.[37]

It is hardly surprising that Taverner, and other Canadian ornithologists, while extending every possible courtesy to the Carnegie expeditions, took a somewhat jaundiced view of these long-term, well organized efforts, the results of which were not even visible in print for a long time. While Todd was jealously guarding some of his specimen data, Canadian ornithologists made sure that they collected

specimens for their own museums, and that they published their results as soon as possible. Moreover, there was nothing they could do to stop American expeditions in Canada.[38] Similarly, because of the lack of career opportunities in the 1930s, they could not prevent talented young Canadian students, collectors, and ornithologists, from taking up employment in the U.S. In addition to Harrold, who left Canada to go to New York in 1929, Bert Lloyd, after accompanying Todd and his expedition to the north, became a permanent member of the Carnegie Museum staff. Arthur Twomey, a student of Rowan at the University of Alberta, went to the University of Illinois, where he received his Ph.D. in ornithology under S.C. Kendeigh. He subsequently became affiliated with the Carnegie Museum and participated in expeditions to the Hudson Bay area.

It is evident, that the later development of ornithology in Canada, combined with lack of financial support, made it impossible for Canadian institutions to compete with studies of distribution and taxonomy of Canadian birds conducted by American ornithologists. In fact, Canadian public institutions have "supplied only a small part of our knowledge of Canadian birds."[39] Most of the important investigations were carried out by individual ornithologists.

Taverner's lack of collecting opportunities during the 1931-1936 period had deleterious effects not only on the museum's collections per se, but also on his contribution to science. Being restricted to collecting on Canadian territory

for almost twenty years greatly limited the scientific potential of the museum's collection. Not being able to add to the northern material after a couple of successful field seasons, while foreign institutions conducted expeditions to the north, was even more discouraging to Taverner.

Taverner had been campaigning for obtaining extralimital material by direct collection, exchange or purchase, for a number of years. In 1929 he wrote to Collins that:

> if we are to do serious and lasting ornithological work in the museum, it is practically imperative that we have certain series of extralimital specimens for comparison with our own. This is particularly true of arctic work where so many of our own species are circumpolar.[40]

Five years later, during which the situation remained unchanged, he complained to Rowan:

> We need world, especially palearctic specimens badly enough but the rulers of our destinies seem to think that all a Canadian museum needs is Canadian material. It has not been so very long since they wanted them as they went into the Ark, two by two, male and female.[41]

The lack of complete series of Arctic and extralimital material was particularly irksome to Taverner in the early 1930s, because his services were requested to revise the galley proofs on Canadian birds for the forthcoming checklist of the birds of the world. This co-operative endeavour was started in the late 1920s by the American Ornithologists' Union, the British Ornithologists' Union and the International Ornithological Congress. Taverner was considered the Canadian

expert, but his participation was greatly hampered by the museum's policy of limiting its collection to Canadian material. Disgruntled by the situation in Canadian museums, Taverner bemoaned the position of Canadian systematists, when he wrote to Frank Farley:

> How can a Canadian bring any important assistance to a check-list of the American section of the birds of the world when all he knows is Canadian birds and has no opportunity to learn North American birds, much less those of the world. There is only one single collection of the world birds in Canada and that is a private one [that of J.H. Fleming in Toronto] who is and has been consistently overlooked and discouraged by his home town and its institutions. He should be the big gun in the Toronto museum [the Royal Ontario Museum], yet is hardly recognised there. All the recognition he ever received has been from the states and abroad. There is not a single systematist in the higher lines of zoology in the Royal Society of Canada. Botanists, geologists, entomologists and Priests galore....As a Canadian I do wish Canada would grow up and broaden out.[42]

The situation did not improve at all in the 1930s. In 1936 Deputy Minister of Mines, Dr. Charles Camsell did not allow a museum collecting expedition to the western United States, as requested by Taverner, because of the policy that "Canadian government naturalists should confine their efforts entirely to Canada."[43] To study the Canadian avifauna, but having to receive much of the pertinent information from American colleagues, was a prospect Taverner and other Canadian ornithologists did not relish. Camsell's opinion was that "our work lay in Canada and we had no business beyond our political lines," noted the exasperated Taverner, and asked

"With that kind of Deputy what can a museum do?"[44]

Before his retirement in 1942 Taverner only managed to "get" two more field seasons to the north, one in 1936 along the Hudson Bay Railway in northern Manitoba, and the other in 1937 investigating the avifauna between The Pas and Duck Mountain, Manitoba. "The object of the 1936 work was to begin a direct line of consecutive observations between...two strongly contrasted faunas."[45] These were the Upper Austral and Transition Zone. As he later explained in Birds of Canada (1938) the geographic divisions of Tropics, Temperate and Arctic zones in North America were separated into three roughly equivalent 'life' regions, the Tropic, the Austral, and the Boreal. These were "subdivided into life-zones each characterized by its own peculiar assemblage of plants and animals....The Austral region...is divided into three life-zones,"[46] the Lower Austral, the Upper Austral, and the Transition. Since the "ornithology of Churchill...at the edge of the Arctic Faunal Zone" had been relatively well explored, and "that of southern Manitoba south to the boundary where the Upper Austral influences intrude upon the Transition Life Zone has also been well developed," Taverner wished to study the intervening region, of which there was only "more or less casual information."[47] In the 1936 field season Taverner was accompanied by bird collector (and local expert) T.E. Randall of Edmonton, and biology student Ronald W. Smith of Wolfville, N.S.

The 1937 field season was the last Taverner ever conducted. Its "principal field activity...was the continuing the north to south ornithological cross section of Manitoba."[48] From the beginning of June to late August, Taverner together with collectors Angus H. Shortt and W. Watkins, established "the normal northern limits of range of a number of Transition species and the southern limits of northern ones."[49] In spite of Taverner's "Report" which proposed that "another season's work should carry this traverse down to the well known sections of the province and complete a connected line of faunal reconnaissance through the continental interior from the Arctic to the upper edge of the Austral faunas," no funds were available.[50] Another, similar project from Lower James Bay to southern Ontario was never accomplished by the National Museum. Instead, it was carried out by the Royal Ontario Museum.

During Taverner's last field season, at his suggestion, Professor V.C. Wynne-Edwards of McGill accompaned the 1937 Bowdoin-Macmillan Arctic Expedition to Frobisher Bay, "a locality from whence there has been no ornithological information since that procured by Ludwig Kumlien in 1877."[51] Unfavourable weather and ice conditions made this expedition less successful than envisaged, but "some important doubtful questions were settled in the negative [and] a few specimens secured."[52]

The museum's narrow policy and lack of finances not only precluded further field work, but prevented Taverner from attending the 1938 International Ornithological Congress in Rouen, France. Canada was represented by J.H. Fleming, as a private citizen. The National Museum of Canada did not see it fit to send a representative! Another major disappointment resulting from the museum's poorer than ever financial position during the Great Depression, was the cancellation of the publication of Taverner's Water and Game Bird Manual, which had been in preparation for over a decade.

A trip to the 1939 Berkeley meeting of the American Ornithologists' Union was authorized and expenses to the meeting paid only because Taverner emphasized that he wanted to use the opportunity to visit museums,

> going over collections, making personal contacts and...study ornithological conditions in the south where many of our birds winter and through where many of them pass in migration. This reconnaissance I propose to make at my own expense provided I can get my expenses to go to the meeting and am allowed time [my emphasis].[53]

Under these circumstances no reasonable objections could be raised even by Camsell, and the memorandum was approved. The securing of extralimital material by a government employee, at his own expense, was obviously acceptable! This demonstrated that the "Canadian only" policy was a narrow dictum, governed solely by financial considerations.

With Taverner's impending retirement the Museum authorities created a position of "Assistant Zoologist," to

help Taverner with the ornithological work of the Museum. At Director F.C.C. Lynch's request, Taverner recommended certain changes before the position was advertised, because, he wrote:

> it is the general intention to obtain, if possible, the services of such a candidate as would be qualified to assume more senior duties upon my retirement....It is to be noted that field preparation of specimens and systematic taxonomy are essential in Museum as against general biological work as usually required in University curricula for academic degrees. We want a Museum man rather than a mere laboratory microscopist.[54]

In his letter to Lynch, Taverner also specified all duties, such as collection, preparation, classification, correlation and cataloguing of specimens and a "complete and exact knowledge of Canadian ornithology...." He also recommended education equivalent "to graduation in science from a university of recognized standing, with specialization in biology; at least one year of experience in field exploration and zoological and systematic research...."[55]

IV

Taverner's successor at the Museum was Austin Loomer Rand (1905-1982), a native of Nova Scotia. As a young student Rand came under the influence of Robie W. Tufts, who persuaded him to make ornithology his career. In opposition to his father's wishes, Rand studied biology at Acadia University. He graduated with a B.Sc. in 1927, and entered the Cornell Laboratory of Ornithology as a graduate student. The

Laboratory, established in 1915, was one of the major centres of ornithological research and education in North America. Rand's early field work in Nova Scotia, which included bird-banding, combined with his biological training, stood him in good stead at Cornell. When in 1929 there was an opening for a collector to accompany the "Archbold Expedition" to Madagascar, Rand with Professor Arthur A. Allen's support received the job. He replaced C.G. Harrold, who died of meningitis before the start of the expedition.

Rand's report of the avifauna of Madagascar formed the basis of his Ph.D. thesis and was published by the American Museum of Natural History in 1932. During the following decade, he participated in three more major expeditions financed by Richard Archbold, and in 1941 helped establish the Archbold Biological Station in Florida. He soon became dissatisfied with the inadequate facilities of the Station, and was pleased to come to the National Museum of Canada as Taverner's assistant, and eventual replacement.

In many ways Rand had an easy time at the Museum. There was more money for field work and assistants and there were fewer restrictions. During World War Two new roads opened up in the North West, and provided access to new areas for faunal investigations. In the summer of 1943 Rand led an expedition along the southern part of the Alaska Highway. The following year, accompanied by W.H. Bryenton, he studied the birds and mammals in the Mackenzie Mountains. During the next

two years he pursued field work in southern Alberta, and southern Quebec, and also co-operated with the National Parks Branch in various faunal investigations.

In early 1946 several positions opened up in the Museum: there were two for "Zoologists -Grade 2" (Assistant Zoologist) and there were also positions for taxidermists. Rand contacted a number of university professors in zoology asking them to recommend students for the zoology position. The requirements were at least one year of post-graduate study and research experience. However, finding new zoologists proved a difficult task. In contrast to the previous decade, when a number of enthusiastic young university graduates were seeking positions in the National Museum, but had to be discouraged by Taverner, because of lack of opportunity, in the mid-1940s there were not enough zoology graduates available for positions opening in various organizations. Rand had high standards and was not prepared to take just anybody. He wrote to Ian McTaggart Cowan, of the Zoology Department at the University of British Columbia, "I hate to fill these positions unless I can get really good men, for once filled there will be no possibility of changing."[56] V.C. Wynne-Edwards, at McGill University, agreed with Rand and wrote, "Male zoologists are...in short supply. I suppose you have considered employing a woman. We have several graduates...capable of being useful museum assistants, though

of course girls are handicapped in field work."[57] Rand, apparently discussed this question with the Director, and replied, that "ultimately we will have women working in the museum " but, as the Director said, "in view of the field work that will probably be necessary, it would be inadvisable to make such an appointment as a zoologist."[58] Rand made one good find eventually, and hired W. Earl Godfrey for one of the zoology positions.

In late 1946, Rand became Acting Chief of the Biological Division. R.M. Anderson, Chief of the Biological Division retired in 1945 and Rand, hoping to become Curator of the Museum, was understandably disappointed, when F.J. Alcock, a geologist was chosen. Moreover, after five years at the Museum Rand began to find the parochial attitude of Canadian administrators and scientists more and more irksome; this parochialism, he wrote to J.R. Dymond, was the "single...thing about our educational products that impressed me, on returning after many years abroad."[59] Rand, having worked with large, world wide collections in the U.S., found the restrictive all Canada policy and lack of advancement at the National Museum hard to take. When the more cosmopolitain Field Museum of Natural History in Chicago was looking for a Curator in 1947, he applied and was promptly hired. There he had ample opportunity to spend almost all his time on research and remained at the Field Museum until his retirement in 1970.

Rand's successor, W. Earl Godfrey was born in

Wolfville, Nova Scotia in 1910. Like Gould and Rand before him, he was influenced by R.W. Tuft's enthusiasm and experience with Nova Scotia birds. As a highschool student Godfrey began to work as a collector. Later, he studied biology at Acadia University. After graduating with a B.Sc. in 1934, he went to Cleveland, Ohio, as instructor to Cyrus Eaton's son. In his spare time he began to frequent the Cleveland Museum of Natural History, where be became acquainted with Curator Harry Oberholser. He became an Associate of the Museum, and from 1938 to 1940 he attended graduate courses in ornithology at Case-Western University, where Francis H. Herrick was Professor of Ornithology.[60] Association with Herrick and fellow graduate students, like John W. Aldrich, provided Godfrey with excellent training in ecology, distribution, and higher taxonomy. His association with Oberholser was invaluable, because he acquired added expertise in museum work.

Godfrey's first field expedition took him to the Lake St. John region of Quebec in 1946. The following year he went to the Lake Mistassini and Lake Albanel areas of Quebec, east of James Bay, where in 1885 James M. Macoun and A.P. Low of the Geological Survey collected some birds. During the following years he went further afield, in 1948 to the Cypress Hills, Saskatchewan, in 1949 to the southern Yukon, and in 1950 to the Lesser Slave Lake and Peace River districts of

Alberta.

Godfrey's field work was undertaken with a view of elucidating the taxonomy of a number of Canadian birds, since, as he wrote to Alcock, "our knowledge of this important aspect of ornithology is in an extremely unsatisfactory state."[61] Godfrey also sent additional field parties to areas in southeastern Canada, because he explained, "the theory that geographic variation of birds species does not occur in Southeastern Canada and Northeastern U.S." was outmoded, and new collections from southern Nova Scotia and New Brunswick were needed for an "intelligent taxonomic interpretation of eastern Canadian birds."[62]

In the late 1940s Stewart D. MacDonald joined the Museum as taxidermist to Clyde Patch. From the late 1950s he had developed into a specialist of Arctic birds, spending many summers in the field studying their behaviour and life history. In the early 1950s Violet Humphries was hired as assistant to Godfrey. For the next three decades she worked on practically all aspects of museum ornithology, such as accessions, cataloguing bird files, and entering distributional data on maps. In view of the lack of other qualified personnel, her activities were confined to the Museum proper, and she did not participate in field expeditions.

V

During his three decades at the National Museum Taverner built up a sizeable bird collection. It was used for exhibitions, education, exchange, and research. Taverner's interest in subspecies, a favourite subject of early twentieth century systematists, is evident in both his correspondence with other ornithologists and his published papers on the subject. Unfortunately, his extremely busy schedule at the Museum prevented him from doing extensive taxonomic work. However, he accumulated a large amount of material for his varied scientific publications, his popular books and his distributional maps of Canadian birds. His scientific papers were published as Museum Bulletins, Summary Reports, and as articles in journals, such as The Auk, The Wilson Bulletin, The Condor, and The Canadian Field Naturalist. They encompassed such diverse aspects of ornithology as migration, distribution, systematics, life history, economic ornithology, and conservation. He considered his three books on the birds of Canada, published between 1919 and 1938, as popular accounts. Indeed, they were very popular. Several generation of young Canadians learned their ornithology from them. Many families interested in natural history owned one, as did every outpost of the Royal Canadian Mounted Police. His Birds of Western Canada (1926), was used as a textbook in American universities in Washington State and Oregon.

Soon after his initial survey of the Museum's

collection in 1911, Taverner began to map the occurrences and references to every bird recorded in Canada. A paper, entitled "Label Relief Map for Showing Distribution" was presented to a conference of the American Association of Museums and published in the Proceedings of the conference in 1914. During the following decades detailed distributional maps were established for all species of Canadian birds. Each reference was entered onto a file card, and a cross-reference system was established. Each bird species had its own large-scale map on which reliable bird records were marked with a coloured pencil. Arrows pointing up or down indicated birds reported on spring or fall migration. A circle indicated summer records, while a filled circle showed that actual breeding took place. There were various other codes for single records, dateless records, and winter occurrences.

Considering that Taverner did all aspects of mapping and cross-referencing himself, not to mention much of the collecting, in addition to his other duties as museum curator, the accomplishment is truly astounding. The distributional maps are a testimony to his knowledge, dedication and perseverance. Some of the time he worked under very difficult conditions: money was scarce, space limited, and assistance not available. Important reference works and extralimital specimens were not acquired as a result of short-sighted museum policy. However, the distributional maps, the

preparation of which prevented him from engaging in more extensive research, have endured. With periodic updating they are still used by his successors.

Taverner was a popular member of the American Ornithologists' Union, where he served on various committees. He was elected Fellow in 1917. Taverner, with the help of Hoyes Lloyd and Harrison F. Lewis of the Parks Branch, organized the first Canadian meeting of the A.O.U. in Ottawa, in 1926. The conference was a great success and American ornithologists greatly enjoyed the exhibiton of Allan Brooks' painting, the many interesting field excursions, and last but not least, the scientific sessions. There, for the first time, many of the papers were given by Canadian ornithologists. Taverner's contribution to Canadian ornithology was finally recognized by the Royal Society of Canada when in 1935 he was elected Fellow of that organization.

With the arrival of Austin Rand at the Museum there was a change of emphasis in museum work. He had wide interests, and his publications during his short Canadian stay included papers on distribution and taxonomy, based on his field expeditions and the Museum's collection, while others showed his interest in the ecological and evolutionary aspects of breeding biology and behaviour. Rand kept up correspondence with the network of Canadian ornithologists established by Taverner, but did not keep the distributional maps up-to-date.

One of W. Earl Godfrey's first tasks was to catch up with the backlog of nearly six years and enlarge the maps by adding new information from his own expeditions and from the reports of other ornithologists. Godfrey was interested in breeding populations of birds. By "employing vast amounts of up-to-date information, [together with] extrapolation where data are still not available,"[63] he mapped the breeding range of all species nesting in Canada. These range maps later formed a much acclaimed part of his Birds of Canada (1966).

Godfrey also continued to provide information and encouragement to a large number of Canadian ornithologists. Although old fashioned natural history surveys and studies still had to be carried out in various parts of Canada, there was a new approach in interpretation. With his interest in distribution, ecology and higher taxonomy; as seen in his landmark paper on the "Birds of the Cypress Hills..." (1950),[64] he brought ornithological research in the National Museum of Canada closely in line with investigations carried out in American natural history museums.

VI

In addition to the expeditions organized by the National Museum of Canada some of the smaller regional museums also carried out field work to provide specimens for exhibitions and for study collections. Pre-eminent were the

Provincial Museum of Saskatchewan, established in 1906, and the Royal Ontario Museum of Zoology (ROMZ) founded in 1913. By the early 1930s they were considered to be the best Canadian "provincial" museums by two separate authorities. F.M. Chapman and J.L. Peters in a review volume on American ornithology, and Sir Henry A. Miers and S.F. Markham, in their Report on the Museums of Canada (1932) based on a survey conducted under the auspices of the Carnegie Foundation of New York, reached the same conclusion.[65]

The "Regina Museum" began with a small collection of game birds, purchased for the 1906 Dominion Fair at Halifax, N.S. The ROMZ had its origins with the small biology collection of the University of Toronto in the late nineteenth century. Both of these museums conducted a number of field expeditions, but while the "Regina Museum" remained a regional museum, the ROMZ developed into one with world wide interests.

Field work at the "Regina Museum" began in 1913, soon after "the services of Mr. H.H. Mitchell were secured."[66] Horace Hadley Mitchell was born in England in 1868, and came to Canada as a young man. In Toronto he worked for a number of years at the Spanner taxidermy shop, and became its manager early in the twentieth century. After an unsuccessful application for the position of taxidermist at the Victoria Memorial Museum in 1910 (see Chapter 3), Mitchell was delighted to move to Saskatchewan as Provincial Naturalist and Taxidermist. A skilful and artistic taxidermist, Mitchell

preferred exhibiting habitat groups to single mounted specimens. Fred Bradshaw, Provincial Game Commissioner and museum administrator in Regina, also favoured this approach and strongly supported Mitchell's efforts in putting up new exhibits. The success of the first habitat groups, on the Yellow-headed Blackbird, Red-winged Blackbird, Northern Flicker, and one on several gulls nesting on the Prairies, was such that soon more specimens were needed particularly from the northern regions. Since Angus Buchanan expressed interest in exploring the northern parts of the province, the Department of Agriculture of the Province of Saskatchewan commissioned him to

> secure from the unexplored parts of Northern Saskatchewan natural history specimens and Indian curios for our museum....All specimens collected were handled in skilful fashion, well packed and delivered in excellent shape for mounting by our taxidermist. [67]

Other specimens were donated by naturalists, many of them ranchers in the southwestern parts of the Province.

The museum was housed in the Normal School building after 1916, but despite the crowded condition, policy required Mitchell to carry out field work during the summer. A detailed account of the various field expeditions between 1913 and 1931 can be found in the Annual Reports of the Department of Agriculture (Saskatchewan), and will not be repeated here. Briefly, during the 1913-1920 period Mitchell worked alone, both in the field and in the museum. In 1921 he had been

"permitted the services of an assistant" for the field season.[68] While the name of this person is never divulged, and is simply referred to as "my assistant" in the 1922-25 Annual Reports, a letter from Bradshaw to Taverner stated that "Mr. Mitchell will likely take up his last year's camping ground and in all probability will have his daughter assisting him."[69] Since women at the time were not allowed "into the field" in Canada, at least by government authorities, Mitchell may have felt it prudent to refer to his daughter Dorothy, a student at the University of Saskatchewan, as "my assistant".

Dorothy, having to finance her university education, was glad of the opportunity to earn some money. Since she was on summer vacation from the end of April to the beginning of September, she persuaded her father to consider hiring her as field assistant. For him to do so, she had to demonstrate to him that she was capable of preparing bird skins. She succeeded and began in the summer of 1921, and soon developed into "quite a skin maker."[70] For the next three years she spent her summer vacation in the field, as camp cook, collector and general field assistant, the first Canadian woman to work for any museum in this capacity.

In 1925 more funds were available. Dorothy had graduated from university, so Mitchell decided to "engage a lad with the necessary talent and enthusiasm to carry on the work of the museum in the years to come."[71] The "lad" was

Fred Bard, a yound bird bander, who became the museum's Director in 1947. With Bard's assistance Mitchell spent more time in the field and the two began expeditions to distant parts of the Province. After Bradshaw was appointed Director of the Museum in 1928, a banding program was started, which the naturalist and his young assistant carried out in addition to their collecting duties. At the same time a new educational program was initiated by Bradshaw, as was another, of far reaching importance. For the Whooping Crane Survey Bradshaw sent 1,500 circulars and questionnaires to correspondents from Alaska to South America, "with a view to securing information regarding the migration, occurrence, nesting and breeding grounds of the Whooping Crane."[72] This survey, and the banding work, albeit of local birds, was carried on after money became scarce in the early 1930s.

H.H. Mitchell retired in 1933, as did F. Bradshaw in 1935. Mitchell and Bradshaw succeeded in making the museum an important place for public education. Mitchell's habitat group exhibits were praised by visitors from other parts of Canada and from the U.S. The excellence of his work was testified to by Miers and Markham in the museum report. It is unfortunate that Mitchell's busy schedule, combined with the limited space in the museum, prevented him from doing much serious taxonomic or faunal work. He produced only one major publication, "A Catalogue of the Birds of Saskatchewan" which was published in the Canadian Field Naturalist in 1924. Their

work was continued by Bard, and the new Director Fred Dunk, until 1947.

The Royal Ontario Museum of Zoology whose history has recently been prepared by Lovat Dickson, began with a small collection in 1913. Four years later, Lester L. Snyder, a young American who had majored in museum technology at the University of Iowa, was engaged as assistant. Snyder was interested in the distribution and taxonomy of birds, and conducted province wide surveys of bird life under the auspices of the ROM. From 1923 to 1952, each summer a different area of Ontario was investigated. In 1935 Snyder became Curator of Birds and was appointed Associate Director of the Museum in 1949. Snyder's field expeditions were greatly enhanced by the addition to the museum's staff of assistant James L. Baillie, Jr. in 1922, and naturalist-illustrator Terence M. Shortt in 1931.[73]

Baillie, born in Ontario in 1904, became one of the foremost popularizers of bird study in Ontario. For several years he carried out the major part of Ontario field work, and being interested in faunistic studies published a number of papers, some of them jointly with Snyder, on that subject.

Shortt, born in Manitoba in 1911, attended the Winnipeg School of Art, and with his brother Angus collected extensively in Manitoba, Saskatchewan and Alberta. In the late 1920s Shortt joined the staff of the Bank of Montreal in

Winnipeg. There he became acquainted with C.L. Broley and B.W. Carthwright and these local ornithologists were immediately impressed with his artistic ability. In 1931 Shortt was hired by the ROMZ as assistant to Snyder in the "galleries." Although he was not as closely associated with Ontario faunal surveys as were L.L. Snyder, J.L. Baillie, and C.E. Hope, Shortt participated in seventeen expeditions between 1931 and 1950. These took him to various parts of Ontario, to Alaska (1936), to the Eastern Arctic (1938), to Moose Factory and Fort Albany (1942) and the western provinces (1944). In 1946, on a trip to Mexico, he collected for the Museum at his own expense.[74]

The Royal Ontario Museum's interest in world wide ornithology was initially largely due to J.H. Fleming, the noted Toronto collector and ornithologist, who became Honorary Curator of Birds at the ROMZ in 1927. Fleming's own considerable collection was "held in trust" for the museum until his death in 1940, at which time it became a part of the ROM's collection. One must add that the museum had from its inception a world wide collection of priceless china and antiquities, and this policy may have influenced the zoological department to extend its collections beyond the boundaries of Ontario.

The two regional museums contributed much to Canadian ornithology with their exhibits and study collections. They also popularized ornithology in their respective provinces,

and helped establish important nature sanctuaries. While only a few scientific publications resulted from the Saskatchewan Natural History Museum's ornithological activities, the ROM staff published many important works on local and regional ornithology. These were mostly faunistic and taxonomic studies, although during the 1930s, under the direction of J.R. Dymond, studies in population biology were conducted in the museum, mostly by graduate students at the University of Toronto. There were also studies on life history and behaviour of birds. Baillie's greatest contribution may have been his effect on a generation of young students, who learned their ornithology from him on field trips. Many of them pursued ornithology, or wildlife biology as a career in the second half of the twentieth century. Shortt not only illustrated many of the museum's publications, but also produced illustrations for various journals, published numerous ornithological papers, and two autobiographical books dealing with many of the museum's expeditions. Snyder, with the encouragement of J.R. Dymond, Director of the museum since 1934, developed a large network of Ontario naturalists who sent in information and specimens to the museum. Snyder was also active in conservation, and during his curatorship the collection of the museum increased from about 5,000 to 100,000 skins, eggs and nests.[75]

These provincial museums of natural history have

remained pre-eminent in the second half of the century, although others in New Brunswick, British Columbia, Manitoba and Alberta are now carrying out important bird studies. The Saskatchewan Museum of Natural History finally moved into its own building in 1955, where it continued its outstanding work in public education, exhibition, and conservation. In 1959 it served as host to the first western Canadian meeting of the A.O.U.

The Royal Ontario Museum had played host to the American Ornithologists' Union three times, in 1935, 1947 and 1967. Although it still serves a useful function in conservation and public education, there had been a major change in orientation since the late 1940s. Research projects since then have concentrated on modern distributional and systematic studies, using statistical methods, and investigations of the ecology and behaviour of birds.[76] It has become a major centre of avian biology in Canada.

Notes

1. Robert Ricklefs and Frank B. Gill, "Fifty years' of American Ornithology," in Bulletin of the British Ornithologists' Club 100 (1980): 118.
2. ROM, Fleming papers, Percy Taverner to J.H. Fleming, 13 May 1911.
3. Ibid.
4. Ibid.

5. NMNS, Uncatalogued papers of Percy A. Taverner (hereafter Taverner papers), Percy Taverner to John Macoun and R.W. Brock, 12 May 1911.

6. Ibid.

7. Ibid.

8. Ibid.

9. Ibid., 27 July 1911.

10. For an interesting discussion of the Canadian Arctic Expedition see R.J. Diubaldo, Stefansson and the Canadian Arctic (Montreal: McGill-Queen's Press, 1978).

11. P.A. Taverner, "Suggestions for Ornithological work in Canada, "Ottawa Naturalist 29 (1915-16) : 15.

12. Ibid.

13. Ibid., p. 18.

14. Ibid.

15. D.E. Allen, The Naturalist in Britain (London: Allen Lane, 1976). p. 187.

16. Whitmer Stone, "Ornithological Literature," F.M. Chapman and T.S. Palmer, eds. Fifty Years' Progress of American Ornithology, 1883-1933," (Lancaster: American Ornithologists' Union, 1933), p. 31 (hereafter Chapman and Palmer).

17. NMNS, Taverner papers, Percy Taverner to Robie Tufts, 29 February 1918.

18. NMNS, Taverner papers, Percy Taverner to W.J. Brown, 5 February 1919.

19. NMNS, Taverner papers, Percy Taverner to Henry Mousley, 30 September 1921.

20. NMNS, Taverner papers, Percy Taverner to Bradley Swales, 23 February 1922.

21. Ibid.

22. W.W. Stevens and G.W. Scotter, "Joseph Dewey Soper, 1893-1982," The Canadian Field Naturalist 97 (1983): 350.

23. NMNS, Taverner papers, Percy Taverner to William Rowan, 20 April 1923.

24. P.H. Kortright, The Ducks, Geese and Swans of North America (Washington: Wildlife Management Institute, 1967) p. 138.

25. NMNS, Taverner papers, Percy Taverner to William Rowan, 20 September 1929.

26. Ibid.; Dr. M.O. Malte was Dominion Botanist at the time.

27. NMNS, Taverner papers, Percy Taverner to H.H. Mitchell, 6 February 1930.

28. NMNS, Taverner papers, Percy Taverner to W.H. Collins, 19 February 1930.

29. Percy A. Taverner and George Miksch Sutton, "The Birds of Churchill, Manitoba," Annals of the Carnegie Museum 23 (1934): 4.

30. NMNS, Taverner papers, "Proposals for fieldwork," 5 March 1931.

31. NMNS, Taverner papers, Percy Taverner to William Rowan, 22 May 1931.

32. Ibid.

33. Twomey and Farley returned to Churchill in 1932 and 1933.

34. NMNS, Taverner papers, Percy Taverner to Arthur Twomney, 31 Ocrober 1931.

35. R.M. Anderson, "The Work of Bernhard Hantzsch in Arctic Ornithology." The Auk 45 (1928): 450-66.

36. W.E.C. Todd, Birds of the Labrador Peninsula and Adjacent Areas (Toronto: University of Toronto Press, 1963), p. 13.

37. K.C. Parkes, "In Memoriam: Walter Edmond Clyde Todd," The Auk 87 (1970): 643.

38. There were also the expeditions organized by the Oxford University Explorations' Club. Raymond Bray and T.H. Manning collected and observed birds in the Arctic in the 1930s. Bray died on one of the expeditions in 1938.

Manning continued visits to the Arctic, which resulted in collections and observations. He donated some of his collection to the National Museum.

39. NMNS, Taverner papers, Percy Taverner to Kenneth Racey, n.d., possibly 1931.

40. NMNS, Taverner papers, Percy Taverner to W.H. Collins, 6 December 1929.

41. NMNS, Taverner papers, Percy Taverner to William Rowan, 2 March 1934.

42. NMNS, Taverner papers, Percy Taverner to Frank Farley 29 March 1932.

43. Ibid., 29 March 1936.

44. Ibid.

45. NMNS, Taverner papers, Report, Ornithological Division for the Fiscal Year 1936.

46. P.A. Taverner, The Birds of Canada (Toronto: The Musson Book Company LTD, 1938), p. 7.

47. NMNS, Taverner papers, Report, 1936.

48. NMNS, Taverner papers, Report, Ornithological Division, 1937-38.

49. Ibid.

50. Ibid.

51. NMNS, Taverner papers, "Recent Activities of the Ornithological Division of the National Museum of Canada," 22 September 1937. Kumlien was a Swedish-born American collector.

52. Ibid.

53. NMNS, Taverner papers, Percy Taverner to W. Malcolm, 3 April 1939.

54. NMNS, Taverner papers, Percy Taverner to F.C.C. Lynch, 27 June 1941.

55. Ibid.

56. NMNS, Uncatalogued papers of A.L. Rand, Office Files,

(hereafter Rand papers), Austin Rand to Ian McTaggart Cowan, 10 May 1946.

57. Ibid., V.C. Wynne-Edwards to Austin Rand, 20 May 1946.

58. Ibid., Austin Rand to V.C. Wynne-Edwards, 22 May 1946.

59. Ibid., Austin Rand to J.R. Dymond, 29 January 1947.

60. W.E. Godfrey, personal communication to the author.

61. NMNS, Uncatalogued papers of W.E. Godfrey (hereafter Godfrey papers), W.E. Godfrey to F.J. Alcock, 7 November 1947.

62. Ibid.

63. W.E. Godfrey, personal communication to the author.

64. W.E. Godfrey, "Birds of the Cypress Hills and Flotten Lake Regions, Saskatchewan," Bulletin of the National Museum of Canada No. 120, Biological Series No. 40, 1950.

65. J.L. Peters, "Study Collections," in Chapman and Palmer, eds., pp. 113-141; F.M. Chapman, "Exhibition Collections," Ibid., pp. 143-157; H.A. Miers and S.F. Markham, Report on the Museums of Canada (Edinburgh: T. and A. Constable, 1932).

66. F. Bradshaw, Annual Report of the Game Commissioner. Department of Agriculture, Province of Saskatchewan 1927-28, p. 32. (hereafter Regina Museum Report).

67. F. Bradshaw, Regina Museum Report, 1914, pp. 33-34.

68. H.H. Mitchell, Regina Museum Report, 1922, p. 57.

69. NMNS, Taverner papers, Fred Bradshaw to Percy Taverner, 22 April 1921.

70. ROM, Fleming papers, H.H. Mitchell to J.F. Fleming, 20 September 1921.

71. H.H. Mitchell, Regina Museum Report 1925, p. 37.

72. F. Bradshaw, Regina Museum Report 1930, p. 11.

73. J.R. Dymond, History of the Royal Ontario Museum of Zoology Contributions of the ROMZ, No. 18 (Toronto: University of Toronto Press, 1940).

74. T.M. Shortt, personal communication to the author.

75. H. Ouellett and W. Earl Godfrey, "Ornithology in Canada in the 20th Century: a capsule overview," Bulletin of the British Ornithologists' Club 100 (1980): 116.

76. Ibid.

CHAPTER 5

FIELD AND EXPERIMENTAL STUDIES OF LIFE HISTORY AND BEHAVIOUR IN CANADA

I

> That a bird in the hand may be worth two in the bush may be a good motto for an anatomist or epicure, but for the observer of living animals a bird within reach of the hand and still in the bush is of far greater worth.[1]

In "Suggestions for Ornithological Work in Canada" (1915), P.A. Taverner recommended life-history studies as one of the fields with much scope for original research.[2] The systematic study of life history and behaviour (or habits) in North American was a late nineteenth century development. Nesting and courtship practices, feeding and other behaviour had been observed even by the early travellers of the new world, but most of them had little time for the extended observations practiced by such naturalists as Gilbert White, George Montague and Charles Darwin in Britain, and Christian L. Brehm and his son Alfred E. Brehm, and Bernard Altum in Germany. In France natural history and behaviour constituted only a minor tradition; most of the interest was concentrated instead on exotic birds, studied mostly from specimens.[3]

In surveying the world-wide development of life history studies in the early 1930s, American ornithologist Herbert Friedmann noted that in Europe "birds were known for centuries

before science, in America science inspired the discovery of birds and their habits."[4] In most other regions of the world systematic surveys of the avifauna remained the primary consideration of ornithologists. In North America, "life history data accumulated on the heels of systematic discoveries,"[5] and by the late nineteenth century several compilations of the 'habits' of birds were published by American ornithologists. S.F. Baird, together with co-workers T.M. Brewer and Robert Ridgway published books on North American land and water birds (1874, 1884). Charles Emile Bendire in his two-volume Life Histories of North American Birds (1892-1895) not only summarized existing information but added a wealth of original observations. His works constitute the "first exhaustive attempts to deal with habits entirely apart from taxonomy."[6] In the twentieth century Bendire's work has been carried on by Arthur Cleveland Bent and his co-workers. The series "Life histories of North American [birds]...", otherwise known as "Bent" has been published by the Smithsonian Institution.

By the end of the nineteenth century photography had developed sufficiently to be used to supplement the notebook during field work. The work of pioneer bird photographers Chester Reed, F.M. Chapman, Herbert K. Job, and Francis H. Herrick encouraged many life-history studies. The first important work resulting from this new development was

Herrick's Home Life of Wild Birds, published in 1901. Herrick studied birds from a blind throughout an entire reproductive cycle. This period included the spring arrival of birds to their nesting ground, selection of mate, mating, nest building, egg laying, incubation, care of young in the nest (feeding and sanitation) and care of young after leaving the nest. It also included fall migration. Other similar long-term studies followed during the first half of the century, in which many instances of courtship and nesting, feeding and other behaviour were recorded and analysed.

In Canada, where distributional studies lagged behind those of the U.S. there was considerable interest in some aspects of life history work. Isolated naturalists, many living in close proximity with nature, or having the opportunity to spend long periods outdoors, engaged in extended field observations. Studies by J.H. Fleming, Allan Brooks, Charles de Blois Green, William J. Brown, F. Napier Smith, Lewis McIver Terrill and others dealt with various aspects of the breeding and feeding—behaviour of birds. Others, such as P.A. Taverner, James A. Munro and Harrison F. Lewis, considered the economic aspects of life history studies. Most of the Canadian ornithologists who published papers and notes on their observations in The Auk, Ottawa Naturalist, Wilson Bulletin, Murrelet, and other journals, or in government publications, also provided data for the Bent "Life History" volumes.

Other ornithologists preferred to devote time to the long-term study of the life history of one or two species of birds. Their contributions appeared under their own name in "Bent." For instance Terrill, active in conservation, and in faunal and migration studies (see Chapter 6), and also an excellent nature photographer, authored the section on the Eastern Fox Sparrow (Passerella iliaca) in "Bent." Doris Huestis Speirs began her detailed life history investigation of the Evening Grosbeak (Hesperiphona vespertina) in the late 1930s. For more than a decade she travelled all over Ontario, studying all aspects of the life history of this species in the field. She was the first Canadian woman ornithologist to pursue extensive field work, and her letters, [redacted] daily journals of her observations, filled with detailed descriptions, are illustrated with her own drawings. In addition to her field observations she studied specimens and stomach contents of these birds in the Royal Ontario Museum. She also corresponded with other ornithologists concerning their observations of this species. In the spring of 1[redacted] she received a pair of live Evening Grosbeaks and began studying their behaviour in an aviary, comparing and contrasting their feeding and roosting behaviour with those of wild birds. Although she also observed the behaviour and life history of other birds, and with husband J.M. Speirs co-authored the life history of the Lincoln Sparrow (Melospiza lincolnii), she

became the acknowledged expert on the Evening Grosbeak.

II

The study of bird behaviour became an important topic for research in the late 1930s, and by early 1950s birds were discovered to be excellent subjects for the investigation of animal behaviour because of the "stereotyped and relatively inflexible nature of many of their responses."[7] Moreover, the study of animal behaviour came to be considered one of the most "basic of the biological sciences."[8] Early field studies of behaviour, as part of investigations of the life history of birds, were done by Edmond Selous, Elliot Howard and Julian Huxley in England, and A.A. Allen, F.H. Herrick and Althea Sherman in the U.S. A parallel tradition, the study of the behaviour of captive birds, was developed in Germany by Oscar and Magdalena W. Heinroth. They studied birds in the Berlin zoo and in 1910 were the first to present the idea that "voice and behaviour were clues to [taxonomic] relationship."[9] In the U.S., C.O. Whitman and Wallace Craig studied captive doves and pigeons (Columbidae) early in the twentieth century. In the 1920s, Konrad Lorenz, influenced by their studies, began to work with semi-tame Jackdaws (Corvus monedula) around his home in Austria. By the mid 1930s he had "proposed the 'releaser' concept to explain the initiation of instinctive behaviour patterns."[10] Lorenz's work was generally, though not universally accepted, but it did prompt many behaviour

studies on both sides of the Atlantic.[11]

Among the many Canadian ornithologists pursuing life history and behaviour studies during the 1900-1950 period, were some whose contributions put them in the forefront of ornithological research. Outstanding were Harrison F. Lewis (1893-1974), Louise de Kiriline Lawrence (b. 1894), William Henry Mousley (1865-1949), and Hance Roy Ivor (1880-1979). Because of their varied experimental studies on wild and semi-tame birds respectively, together with many other important contributions, Mousley and Ivor will be treated in more detail than Lewis and Lawrence. Lewis, for professional reasons, ceased to pursue long-term studies early in his career, and Lawrence began her career only towards the end of the period under discussion in this thesis.

Harrison Flint Lewis was the first Canadian scientist to go to Cornell University and obtain a Ph.D. in ornithology. Born on Long Island, N.Y., educated in New York State and in Nova Scotia, Lewis worked for the Department of Militia and Defense in Quebec City after World War One. Following up his early interest in ornithology, he studied in his spare time in the library and museum of Laval University, where he was ably guided by the Curator C.E. Dionne. In 1920 Lewis was appointed Migratory Bird Officer for Quebec and Ontario, in the Dominion Parks Branch, and with the exception of leaves of absence to pursue graduate studies at the

University of Toronto, and later at Cornell, he remained in the service of the Canadian government until his retirement in 1952.

In the late 1920s, at Cornell University, Lewis came under the direction of Arthur A. Allen, one of the pioneers of life history and behaviour studies in the U.S. He decided to study the natural history of the Double-crested Cormorant, (Phalacrocorax auritus), "to try to fill many of the gaps in our scientific knowledge of it...." Lewis conducted field investigations for several seasons, on wild living birds in nesting colonies on the north shore of the Gulf of St. Lawrence, and he also kept birds in captivity at Cornell "for observation and experiment."[12] Laboratory study included food content, study of bird skins, embryological material and parts preserved in alcohol. He also studied captive birds in zoological parks, banded fledglings at nesting sites and used the data from banding returns in Canada and the U.S. Graduating from Cornell in 1929, he published the Natural History of the Double-crested Cormorant (Phalacrocorax auritus auritus (Lesson)), during the same year. This monograph, published under the auspices of the Province of Quebec Society for the Protection of Birds, came to be recognized as a major work in the life history of economically important species of birds. Returning to government service, Lewis, a keen conservationist, published many short papers on a number of ornithological and conservation subjects. His official duties

as Migratory Bird Officer, and as Editor of the Canadian Field Naturalist, prevented further long term ornithological research. Nevertheless, his magnum opus was cited as an example of careful detailed studies "whose value for outstrips their original aims."[13]

Louise de Kiriline Lawrence began observing and banding birds during the early years of World War Two. Born in southern Sweden, Lawrence came to Canada in 1927. She had been interested in nature since childhood, but it was only after she settled down in northern Ontario in the mid-1930s, that she became slowly acquainted with the Canadian avifauna. When a friend lent her Taverner's Bird of Canada, Lawrence, was

> Entranced with the author's insight and writing, [and] wrote to him then Curator of Ornithology at the National Museum of Canada, Ottawa, expecting no answer. But it came and, although we never met, this contact developed into a meaningful friendship, that endured until his death and had great influehce on my thinking and work.[14]

Lawrence was not the only one who gained much from this burgeoning friendship. The aging Taverner, much depressed by the world situation, his impending retirement, and poor health, was delighted to have such an intelligent, enthusiastic, articulate new portégée. When Lawrence began to feel the desire to put her interest in birds "to some more useful purpose than just as a passe-temps," she wrote to Taverner in 1942, to ask "how, with what I have and what I can

do, can I learn to learn more? How can I do more, study better, and let it come to some use for all our knowledge?"[15] Taverner, just retired after more than thirty years of service in the National Museum wrote back, that "the thought that perhaps I have had some influence direct or indirect in your awakened interest in your birds and all nature is a very satisfying one." He was genuinely pleased that "I may have been of some real use to at least a few who needed it...you ask for something definite to do. Why not try bird-banding?"[16] Lawrence soon obtained a permit and numbered bands from Hoyes Lloyd at the National Parks Bureau in Ottawa. Living alone in a loghouse near North Bay while her husband was overseas during the war, Lawrence made a bird trap and began banding migrating birds, in the fall of 1942. With increasing experience in trapping and banding adult and nestling birds, Lawrence by early 1945 was "slipping from mere bird-catching and recording to a more purposeful bird-banding in which special things, such as plumages, physical condition...become things of special observation and note-taking."[17] Encouraging her development as an ornithologist were Doris and Murray Speirs, who were stationed at North Bay. "If you started my birding record, they have led me on to ever vaster fields," wrote Lawrence to Taverner. She added "living daily in one special region with opportunity to be in the field hourly from dawn to dusk the contact with the Speirs has...concentrated [my interest] into a regional study

centring around the banding and the birds in my own home woods, marshes and fields." She soon began mapping the region around her house to see "exactly where whose territory is and how far so and so goes for food or fight...." Lawrence also acquired a collector's permit, and visited the Royal Ontario Museum where she "was shown the rudimentary rules of birdskinning by Mr. [E.C.] Hope and with a little practice I should now be able...to make use of dead birds as models for my bird drawing experiments."[18] Within the next few years Lawrence abandoned bird drawing, to concentrate on life history studies of woodland birds, particularly vireos, warblers, jays and woodpeckers. Though her major work, a monograph on the Comparative Life History Study of Four Species of Woodpeckers was not published until 1967, it was part of the prestigious Ornithological Monograph series of the American Ornithologists' Union. Lawrence's early ornithological papers, in the Canadian Field Naturalist (1947, 1949), The Auk (1948) and the Wilson Bulletin (1949) quickly brought her to the attention of American ornithologists. In 1954 she became the first Canadian woman to be elected Member of the A.O.U. Ernst Mayr regards her as one of the best life history researchers in North America.[19]

In addition to her many scientific contributions, Lawrence's books and nature stories, published in Audubon, did a great deal to popularize ornithology. In 1969 she was

the recipient of the John Burroughs Medal, one of the most distinguished awards for nature writing.

III

William Henry Mousley, the best all-round naturalist-ornithologist of twentieth century Canada was born in England, the son of a prosperous railway contractor. He became interested in natural history at the age of six, and while a student in the south of England, and later as a civil engineer and agent for his father's company, he spent much of his spare time in natural history pursuits. He studied orchids, butterflies, waterfowl, and shorebirds. In 1910 Mousley decided to emigrate to Canada and to join his eldest son, who had settled on a farm near Hatley in the Eastern Townships of Quebec. There he soon discovered the exciting natural history of the region, a "wonderfully interesting part of the country...where one never knows what may turn up...."[20]

Soon after his arrival to Canada, Mousley began to study the flora and avifauna of the Hatley region. With characteristic thoroughness, he checked the ornithological literature for references on the birds of the Eastern Townships and found that "very little if anything has been published on the birds of this particular part of the country."[21] In 1914 he wrote to John Macoun that "I can find no references in your Catalogue south of Montreal, with the exception of Mr. Terrill's notes on the warblers of

Bury...."[22]

For six or seven years, following his arrival to Canada, Mousley attempted to find "congenial employment," but first the war years, and later ill health, contributed to his remaining a full-time naturalist. Beginning with the study of bird and plant distribution in the Hatley district, Mousley carried out various experimental studies. His first major contribution was a series of "Notes and Observations on the Birds of Hatley...." In these papers, all of which were published in The Auk, Mousley provided the first long-term study of a single area in the Eastern Townships, and as such his papers met with critical acclaim both in Canada and the U.S.

Mousley also carried out projects on the nesting behaviour of some shorebirds, and warblers and other passerines. He admitted that "waders and warblers" were his favourite birds, and that work on these had "prevented me from giving much attention to the Hawks and Owls, which two families do not interest me so much, perhaps partly because I am no climber."[23] For his extended studies on nesting behaviour of birds it was essential to take the nest and eggs of the birds studied. Mousley was well aware that this practice might elicit criticism from certain quarters. He collected, as part of his field studies, although did not enjoy doing this. In the introduction to his first

experimental paper "A study of subsequent nesting after the loss of the first," (1917) Mousley made it clear that he did not enjoy collecting for its own sake.

> ...it soon became evident that if my data were to be of any use not only would great care have to be exercised in the selection of the ground, such as small detached pieces of woodland, etc., where only one pair of birds of any particular species were domiciled, but I should perforce be obliged to put sentiment to one side for the time being, and take the sets of eggs one after the other as they were laid. Lucky the botanist who has none of these distressing things to contend with in the pursuit of his favourite study.[24]

In his private correpondence with other ornithologists, Mousley emphasized that one should "make a special point of teaching children to leave birds' eggs alone until such time as they were old enough to know whether by taking some they can forward science in any way."[25] In "Subsequent nesting...," based on research from 1911 to 1916, Mousley set out to answer questions concerning the effect of the loss of the first set of eggs and nest on the nesting behaviour of birds. The study was conducted on fourteen species of birds, mostly warblers, but also some flycatchers, sparrows, the Prairie Horned Lark (Eremophila alpestris), and the Downy Woodpecker (Picoides pubescens). Six seasons of intensive experimental work enabled Mousley to provide answers to the original questions which prompted the study: the number of sets of eggs a bird will lay after the loss of the first one; how long the building of the nest will take? are these in similar habitat and of similar construction? and do the eggs

resemble the original clutch in shape, markings and number? Since at the time Mousley was a good field man but poor photographer, the paper was illustrated with photos taken by the photographer of the Victoria Memorial Museum.

Mousley's early "home life" studies included observations on the Prairie Horned Lark, the Black-throated Blue Warbler (Dendroica cerulescens), and the Migrant Shrike (Lanius ludovicianus). He was never satisfied with the mere recording of observed facts. When noticing any deviation from the norm, he was always anxious to find out the "why" and the "how." His study of the shrike is a good example. Finding a pair of shrikes near Hatley, Mousley set out to locate their nest. After some trouble he found it in a fir tree, instead of the nearby apply tree or thorn bushes which provide the usual nesting site of this species. Mousley took the eggs

> more especially as I wanted to try and solve the problem as to why the birds had selected this abnormal site. Was it hereditary, or merely a case of environment? If the former, then the birds at their second venture ought by rights to select some equally high elevation.[26]

From his readings, and previous experience, Mousley knew that shrikes seldom or never nest in the same tree twice in a row. A later visit to the general area resulted in his finding another nest, in an apple tree 85 yards from the first one. In these the adults raised five young. Mousley concluded that the choice of the atypical nesting site was due to the unusual occurrence of a fir tree among the apples and

thorns, which at the time of the first nesting attempt provided better cover, an important requirement in choosing nesting sites, than the other bare trees. By the time of the second nesting attempt, sufficient cover was provided in the apple tree, therefore he concluded that the choice of the first nesting site, unusually high in a fir tree, was due to environmental factors and not to heredity.

During the 1910-1918 period Mousley collected data for what became his best known theoretical papers. These were derived partly from his attempts to find warblers' nests and eggs for his study of the life histories of North American warblers (which he compared to Old World warblers found in Europe) and partly from observations and comparisons of the nesting habits of the Spotted Sandpiper (Tringa macularia) with those of the Common Sandpiper of Europe (Tringa hypoleucos). Mousley was encouraged to publish the result of his research by his American friend, Dr. C.W. Townsend, who read the paper in front of the Boston based Nuttall Ornithological Club. There it met with approval, "the members expressing the opinion that it was an important contribution to our knowledge."[27] "The Singing tree, or How Near The Nest Do The Male Birds Sing?" was published in The Auk in 1919. A companion paper, conceived at the same time, entitled "Which Bird Selects the Nesting Locality" appeared two years later. The success of the "Singing Tree..." was immediate. Taverner

congratulated Mousley, as did many others. "One man," Mousley reported, went "so far as to say that it was easily the most interesting as well as the most original one in that month's Auk."[28] The paper presented Mousley's "system" for finding nests in appropriate habitat for certain species, and many ornithologists engaged in life history studies found the system useful. The study originated, in part, from the author's frustrated attempts to find warblers' nests, during the course of which he realized that females are rarely seen "until the nests are discovered. It is the males that are always in evidence," particularly when singing.[29] "If a male bird could be found singing constantly in the same tree or trees the nest would be generally found within twenty yards of the spot."[30] Mousley spent many hours in the field experimenting with this system, observing the behaviour of the males of twenty-five species, such as the direction faced by the singing male and the direction of his flight when leaving the singing tree. He also noted that in some species, such as the Spotted Sandpiper and the Horned Lark (which sings in the air) the observation post replaces the singing tree.

"Which Sex Selects The Nesting Locality," published in The Auk in 1921, presented some of the ideas found in the "Singing Tree..." but in more developed form. It is the male bird, Mousley concluded, which selects or establishes the general nesting site, contrary to the then prevailing notion that the "female is the principal actor in this selection

business."[31] The singing tree serves a dual purpose: first it guides the female to the singing male, and second "it also acts as a lookout post, from which the male can perceive any encroachment on his domain and at once resent it by immediately attacking the intruder."[32] The male's attachment is to a chosen ground, a territory, and not to his mate, and the male often returns to the same area year after year.[33]

Because it appeared just after the publication of Eliot Howard's Territory in Bird Life (1920), this paper created considerable interest. Witmer Stone, editor of The Auk, knew that Mousley's paper had been in preparation for some time, and that Mousley had not been influenced in any way by Howard's theory. Neither Howard nor Mousley knew of each other's research. Stone, in a footnote to Mousley's paper, stated that it was "received for publication before the appearance of Mr. Howard's Territory in Bird Life, and it is interesting to see how Mr. Mousley has independently evolved the same theory that is so fully set forth in that volume."[34] Other ornithologists, such as Ernst Mayr and Margaret Morse Nice later considered Mousley as one of the forerunners of the "Territory theory."[35] Herbert Friedmann argued that:

> The publication of Mousley's and Howard's territorial studies dove-tailed in beautifully, at a most fortunate time, with the growing tendency to break away from the purely descriptive presentation of ethological data....the newer approach is to use these descriptive data in an analytical study, to see how each part of the cycle modifies, inhibits, accelerates, or prepares the way for the other

parts.[36]

Mousley was certainly among the first to ask the questions "why and "how," instead of the "what" "when" and "where" of an older generation of ornithologists.

A family visit to England in 1921 provided Mousley with the opportunity to meet Eliot Howard. "He is a delightful host and...we talked a good deal about "Headquarters" [Howard's term] and "Singing Trees," etc.," wrote Mousley to Taverner in Ottawa.[37] Taverner, who had reviewed Howard's book in the Canadian Field Naturalist and was familiar with Mousley's paper, commented, "you have a great deal of confirmatory evidence. Hope, however, that you do not make up your mind to remain permanently in England. We need you here."[38]

Taverner need not have worried, because Mousley returned to Hatley and resumed his ornithological (and natural history) studies. By the end of 1922 he was deeply involved in working on two papers, "Further notes on the Birds of Hatley, 1921-22," and a "Study of the Home Life of the Northern Parula and other warblers, Hatley, 1921-22." The home life studies came to absorb him more than in the previous decade. He confided to Taverner that "I think my home life studies should prove interesting, especially as we have nothing of the kind as far as I am aware, at least not as I shall present mine."[39]

Mousley started from Frank M. Chapman's 1907 statement

that warblers are "our most beautiful, most abundant and least known birds."[40] Fifteen years later it was still difficult to find "a really intimate study of the home life of any warbler."[41] Mousley stressed the need for at least half a dozen studies on each species of warbler to gain an adequate idea of their life history, but warned that these studies can be difficult, tiring, and "any laxity on the part of the observer may result in important detail being missed...."[42] He also recognized that birds belonging to the same species do not necessarily act exactly alike; therefore "it requires several studies before one can form an accurate idea of their behaviour."[43] The results of his warbler studies were summarized in a table which included such data as the number of observation hours, how frequently each parent fed the young, the number of young brooded by the female and male and the number of times the fecal sac was removed by the female and male.

His conclusions present a wealth of information on the nesting behaviour of North American warblers. It was fortunate that Mousley was temperamentally suited for the type of research needed for life history and behaviour studies, and that he had the opportunity to pursue this type of research. His patience and self-discipline in the often mosquito-infested woods and swamps were exemplary. His determination to carry out his studies in spite of unpleasant experiences,

is made clear in a 1923 letter to Taverner:

> I had an awful experience trying to find the nest and egg of the Nor[thern] Waterthrush in one of the worst spots imaginable, a tangled up kind of swamp with plenty of water and old root and stumps. After locating a single male and hunting around his singing tree I, at last, had the satisfaction of seeing the female gathering building material but follow her I could not as the infernal nature of the ground made going a very slow process and in my hurry I shipped in two boots full of water and fell all of a heap. Three hours of this kind of work about played me out but I am going again as this bird is about the hardest nut to crack amongst the warblers.[44]

In 1924, for family reasons, Mousley had to give up living in his beloved Hatley, and moved to Montreal. While adjusting from country to city life was difficult for a while, the move enabled Mousley to meet with members of the Province of Quebec Society for the Protection of Birds, established in 1917, and to meet more often with local ornithologists Terrill, Brown and Smith. He also made many new friends. Soon Mousley plunged into fieldwork in the Montreal region. In fact the following two decades were no less productive than the Hatley ones, as several branches of inquiry were open to a perceptive naturalist of Mousley's experience and stature. There was the study of the flora and fauna of Montreal and its surrounding regions. He tried photography again, and soon used his own photos to illustrate his papers, and the talks he gave to the "Bird Society" (the PQSPB) and to schoolchildren. Within a few years his bird photos were good enough to exhibit.

In Montreal Mousley also found "congenial" employment

in the Emma Shearer Wood Library of Ornithology at McGill University. From 1927 he worked in the library, cataloguing books, journals and illustrations, and doing research on the book and journal collection. One of his most acclaimed publications resulted from his discovery of the oldest (1805) drawing of the upper mandible of the Woodcock's bill (Scolopax sp.). "A historial review of the habits and anatomy of the woodcock, compiled from the earliest drawings and accounts to those of the present day," was published as a special issue of the Canadian Field Naturalist in 1935. The publication was financed in part by the Province of Quebec Society for the Protection of Birds.

At McGill Mousley came into contact with Professor V.C. Wynne-Edwards of the Zoology Department. The two were official delegates of McGill to the 1932 Quebec City meeting of the American Ornithologists' Union. He also had ample opportunity to meet with visiting ornithologists. While both head librarian Gerhardt Lomer, and Dr. Casey A. Wood, founder of the library, knew that "the slight remuneration which Mr. Mousley will get is by no means in proportion to the value of the work he is doing,"[45] Mousley enjoyed his work at McGill. He also had many compensations for the low salary he received, such as being able to take time out for field work.

Even after settling in Montreal Mousley continued to add to the faunistic studies of birds of the Hatley region,

and in 1928 he started an annotated list of the "Birds, Orchids, Ferns and Butterflies of the Province of Quebec," based mostly on his studies of the Montreal region. He also continued his life history studies. Some, including one on the Northern Parula (Parula americana), he carried out on his visits to Hatley. Others, including the American Goldfinch (Carduelis tristis), Virginia Rail (Rallus limicola), Sora Rail (Porzana carolina) Short-billed Marsh Wren (Cistothorus platensis), Black duck (Anas rubripes), and Whip-poor-will (Carprimulgus vociferus) were on field work in the Montreal district. By the mid-1930s Mousley had done intensive field work on about twenty species of birds for his home life studies. One of his long term research projects was on the Spotted Sandpiper. At Hatley he made a comparative study of the nesting behaviour of this bird and the European Common Sandpiper, and derived some of his ideas on territorial behaviour from these observations. It took nearly twenty years, however, before Mousley was able to conduct an experimental study on the nesting of the "Spotty." In a 1937 paper, entitled "Nesting habits of the Spotted Sandpiper," Mousley explored three aspects of nesting behaviour of this bird. First, the length of the incubation period, about which differences existed in the ornithological literature. He established this at 20-21 days. Secondly, which parent cared for the offspring, which he demonstrated to be the male. Thirdly, the injury-feigning habit of this species, the study

of which was prompted by a much praised, but somewhat controversial paper by Dr. Herbert Friedmann of the U.S. National Museum.[46] Further experiments on this species, and on the Wilson Snipe (Gallinago gallinago) led Mousley to conclude that injury-feigning occurs only at critical periods of the breeding cycle, just after the young birds hatched and when they are ready to leave the nest.

Mousley published one hundred and thirty-one scientific papers during a thirty year period in Canada. The last one, on the Eastern Kingbird, (Tyrannus tyrannus) appeared in the Annual Report of the Provencher Society of Natural History in 1946, when Mousley was eighty-one years old. His scientific contributions, however, cannot be assessed solely on the basis of his ornithological work. He was also a well known botanist, a friend of Frere Marie-Victorin of Montreal, and published many papers in botanical journals in England, Canada and the United States. His studies on butterflies were published in the Canadian Entomologist and in several British journals.

Henry Mousley was a true naturalist in the nineteenth century tradition; he had wide interest and knowledge of several branches of natural history. Living during a period of transition in ornithological research, in spite of the handicap of ill health, Mousley became a researcher in the twentieth century style. He was not satisfied to accept the

views of other ornithologists without checking results and experimenting himself. He was familiar with the ornithological literature past and present, and was well able to evaluate the work of his colleagues. He was often stimulated by an interesting study, and knew which areas were worth investigating. It is surprising, therefore that although he knew about the technique of bird-banding which became a tool for life history studies in the early 1920s, and his friends in the Montreal area had banding permits he never used this technique for his own life history studies. He took up another popular technique, bird photography, when nearly 60 years of age, and became successful with it. With great patience he would spend many hours waiting to get the right photographs, many of which he used to illustrate various points raised in his studies. The artistic quality of his pictures was admired at many ornithological meeting during the 1926-46 period. In 1945 one hundred of his photographs were exhibited at the Montreal Art Gallery! The following year two-hundred of his pictures were on exhibit at the Provincial Museum in Quebec. This exhibition of the work of the 81 year old Mousley was organized by the Provencher Society of Natural History, and was highly successful.

Perhaps the following quote illustrates best what motivated Henry Mousley:

> To my mind, the charm in studying bird and plant life in the open is that we learn to what extent if any, deviation takes place from general principles laid

down in our textbooks, governing the conduct of most birds and plants. How few, alas, know anything definite regarding the deviations either one way or the other, matters that can be learned only by long and patient study in the field.[47]

IV

In contrast to Mousley, whose experimental work was carried out exclusively in the field, H. Roy Ivor studied the comparative behaviour of semi-captive and wild birds in and around his aviary in Ontario. In Canada, the behavioural study of birds in captivity was an unusual method in the first half of the twentieth century. William Rowan, professor of zoology at the University of Alberta, studied the migratory stimulus in captive birds in his aviary in Edmonton. His research will be discussed in Chapter 6. Laboratory experiments on animals by university trained scientists were considered acceptable both by other scientists and some administrators funding research. The efforts of an unaffiliated, self-trained ornithologist, such as the eccentric Ivor, who had the originality to experiment with semi-tame birds, were met with scepticism by scientists at the Royal Ontario Museum.

Hance Roy Ivor, the son of a banker, was born in Ontario, and spent his childhood near Moose Jaw, Saskatchewan. It was there that he developed an early interest in birds and at the age of ten was the first to discover the nest and eggs of Richardson's Merlin (Falco columbarius), a very pale

subspecies of the Merlin found in parts of the Prairie Provinces. This event did not turn him into an egg collector, a favourite pastime with many boys, but instead it gave him a life-long interest in birds. After his return to Toronto in 1897, Roy Ivor went into the stone and marble business, and "retired" to his forty acres of land near Mississauga in the late 1920s. On this land, which he soon had turned into a bird sanctuary, Ivor rediscovered nature.

Originally Ivor built a small aviary to house injured birds. Later he gradually extended the aviary, and the more he observed birds in and around the spacious enclosure, the more he became interested in studying various aspects of their behaviour. When, in the mid 1930s, he obtained four albino American Robins (Turdus migratorius), the offspring of normally coloured birds, he decided to equip them with coloured bands and to study not only their behaviour, but also that of their offspring (if any), for information on the heredity of albinism. In late 1937, to obtain assistance for this project, Ivor wrote to F.H.H. Williamson, Commissioner of National Parks, asking for a "two-compartment aviary for four robins to study albinism," because he wanted a separate study area for these birds.[48] The letter was forwarded to Taverner at the National Museum, who answered:

> I regret that this museum has no funds at all for carrying out such experimental work as you suggest, nor do I know where - in spite of the undoubted genetic interest there would be in breeding your birds

> under controlled conditions - you could get assistance for it.[49]

Ivor had turned to the National Parks Branch as a last resort. Earlier he had sought assistance from the Royal Ontario Museum, and even approached Lee S. Crandall, zoologist at the New York Zoological gardens, but to no avail. While waiting for his albino robins to nest (and there were only two attempts in nine years) Ivor studied many other species. He compared the behaviour of hand reared birds to that of wild birds in his sanctuary. He also studied the "ailments of birds in captivity," and tested a "universal food for captive birds for the Laboratory of Comparative Pathology of the Philadelphia Zoological Society."[50] Ivor foresaw the importance of breeding wild birds in captivity, not only for research, but for the preservation of endangered species. He maintained that "had sufficient been known of the feeding and breeding of the Passenger Pigeon, these birds could have been saved from extinction."[51] (This idea was later applied by the U.S. Fish and Wildlife Service for the captive breeding of the endangered Whooping Crane). Unfortunately, neither the National Museum nor the Royal Ontario Museum had the means to help Ivor. Even his suggestion, that the Royal Ontario Museum could establish a field station at his sanctuary, at very little cost, met with refusal.

While institutions of ornithological work were not prepared to help Ivor, many individual ornithologists did.

Outstanding among them were American ornithologists Arthur A. Allen, Margaret Morse Nice, and Amelia Laskey, and Canadian ornithologists Doris H. and J. Murray Speirs who were among his most consistent and important supporters.

During his years of observations of bird behaviour, Ivor noted many isolated instances of birds picking up ants in their beaks, and rubbing them on their feathers. In late 1938 he decided to experiment, and taking a shovelful of earth from an anthill added it to his aviary. Many species of birds engaged in "anting" in such an "enthusiastic" fashion, that Ivor communicated his finding to Doris Speirs.[52] She, in turn, sent him a recent article, by W.L. McAtee, which had just appeared in The Auk. In this McAtee summarized the few published notes in the literature on this unusual behaviour of birds, and quoted the definition of anting proposed by German ornithologist Erwin Stresemann. This referred to "not only 'bathing' in ant nests and swarms, dressing the plumage with crushed ants, and placing ants among the feathers, but all apparent substitutes for these actions."[53] Since only few North American observations on anting had appeared in print, it became apparent to Ivor that this was a novel and fruitful line of study. He decided to write to The Auk "in regard to my experiences, which in some ways were a little different from those published."[54] The resultant paper was published in 1941. Because his observations were made on captive and semi-captive birds, Ivor began his paper by defining semi-

captivity:

> The use of the word 'semi-captivity' in relation to songbirds seems to be little understood by bird students or at least it seems unfamiliar or far-fetched. By semi-captivity I mean that any pair of birds which nest in the aviary are given day-time liberty during the period of egg laying and incubation and full-time liberty - unless predators are known to be nesting within hunting distance - during the time of rearing the young and until they are weaned or ready for weaning.[55]

He added that "no time have I ever seen any of these birds 'anting' while at liberty. Nor have I seen them going through this peculiar performance in the aviary except when a shovelful of earth from an anthill was put in." Ivor reported this behaviour for sixteen species of birds not mentioned by McAtee in his paper.

Following his initial observations, Ivor carried out a "series of sixteen experiments designed to discover the exact procedure during anting," using seventy-three birds of thirty-one species...[57] Sixty-eight of the birds were native, three were from Europe and two from Asia. As with his initial experiment, Ivor scattered a shovelful of earth containing hundreds of ants onto the floor of the aviary, and then observed the reaction of birds from varying distances from sixteen inches to fifteen feet. Since more than half of the observed birds were hand reared by Ivor, they allowed close observation without using a blind. Birds anted for half an hour at a time, and were so involved in this behaviour than even wild birds ignored Ivor's presence. Since many of the

bird movements were too rapid for the human eye to follow, Ivor had coloured motion pictures made and intended to have some still photos taken.[58] Ivor found that there "seemed to be no fundamental differences in the specific actions of families, species or individuals, the only variation being in the position [the birds assumed while anting]."[59] He further noted that "enthusiasm for anting" varied with the seasons, with periods of highest activity occurring from mid-April to the end of July.[60] Ivor's article, in 1943, was the first in a series of communications on anting in The Auk. "There seems to be a field here for more careful investigations to a phase of bird behaviour which has never been investigated before"[61] wrote Ivor to one of his most vehement critics, Toronto ornithologist L.L. Snyder of the Royal Ontario Museum.

The success of the anting papers at least elicited some recognition from Snyder, with whom Ivor had been at odds for a number of years concerning the merits of research on semi-tame, or captive, birds as opposed to field studies on wild birds. Snyder, trained in museum technology, was interested in building up the museum's collection, and in conducting faunal studies. To a lesser extent he was also interested in breeding biology, life history and population studies, and in conservation. He had very little time, or possibly inclination, for extended observations of wild birds. Moreover, he had no background in experimental research and

was sceptical of Ivor's studies of bird behaviour in an aviary. Ivor attempted to persuade Snyder that "considerable knowledge may be gained from studies under aviary conditions, which may not be gained from birds in any other state."[62] However, it took five years for Snyder to take Ivor seriously enough to supply him with references, agree to advise him on his manuscript and offer suggestions.

His studies on anting also brought Ivor into closer contact with many American ornithologists, and some from England and Australia. "A chap in England" working on a bird book, sent Ivor his chapter on anting for review and criticism; Alec H. Chisholm, who first reported anting in Australia in 1935 in Bird Wonders of Australia and later published many papers on the subject, wrote to him about their mutual interest.[63] Although Ivor would not speculate on the biological significance of anting, his early studies are still cited in modern papers on this, still poorly understood aspect of avian behaviour.

While he is best remembered for his pioneering research on anting, Ivor published other important papers. In 1944 he published "Bird study and semi-captive birds. The Rose-breasted Grosbeak," in the Wilson Bulletin. In this work he emphasized that "fifteen years of study of a number of species of songbirds in a semi-captive state and comparison of their behaviour with that of the same species in the wild, is an important and dependable method of investigating specific

patterns of innate behaviour."[64] Subject headings in the paper include those used in conventional field studies of life history by other investigators: song, territorial behaviour, mating, nest construction, incubation and brooding, egg and nestling, food habits, sanitation, and molt.

This paper was also well received by other ornithologists. A. Laskey wrote:

> It certainly should convince any skeptics on the value of data from birds raised in semi-captivity...I hope you have only started publishing results from your great storehouse of information on habits of many species you have raised and which you have recorded in your diary. You have enough for a lengthy book and with your field of knowledge of birds for comparison the data are invaluable.

Arthur A. Allen, who encouraged his own students at Cornell to study both wild and captive birds, considered Ivor's method the "only way" to study bird behaviour.[66]

That, in spite of initial scepticism on the part of some Canadian ornithologists, Ivor's methods were valid, has since been proven by many ornithologists. In 1962, William C. Dilger, published a paper on the "Methods and Objectives of Ethology," in which he stated that ideally "animals should be studied both in captivity and in the wild for best results."[67] He also stressed that the criticism that "behavior of captive birds is likely to be abnormal," the objection Ivor had to put up with for many years, was only valid if their natural conditions in the wild cannot be duplicated in the aviary. "One of the advantage of working with birds is that it is

usually comparatively simple to furnish them with all the items necessary for normal behaviour."[68] Ivor, from his many years' of observations of wild birds knew which trees and other plants were necessary for nesting, and included them in his aviary. For the nesting of the Rose-breasted Grosbeak he supplied his birds with large quantities of

> dead hemlock twigs of varying degrees of fineness for building and lining the nest....The female immediately began to examine these twigs with great care....When a suitable twig was selected it was taken to the nest site [in the aviary] and carefully placed in position.[69]

The females nesting in the aviary apparently "lost nothing of their building ability or the knowledge of the exact quality in a twig which is important."[70] Ivor had to supply fresh twigs a number of times before the females were able to finish their nests. Ivor's knowledge of the habitat requirements of birds he studied was so exact, that a careful inspection of the aviary nest and its comparison with those built in the wild showed that there was no difference in any way among the nests built inside or outside the aviary.

On the basis of this study, together with experience gained with sixty species of North American songbirds studied under controlled conditions, Ivor concluded that "the patterns of innate behaviour of a bird kept in semi-captivity may remain fundamentally unchanged." He added that the conclusion "does not necessarily apply to all species of birds and that it is only birds kept in a proper environment that will yield

valuable results in behavioural studies." In contrast, birds "kept caged under completely unnatural conditions will...behave unnaturally."[70] Ivor's ideas, most importantly the concept that aviary conditions may modify but not fundamentally change "natural behaviour," were echoed by Dilger nearly twenty years later, when he wrote "the form of behavior does not ordinarily change in captivity... but frequencies of particular behavior may be increased or decreased...By and large, form of behavior can be depended upon to be normal."[71] In current behaviour research there are two major approaches: relatively short term studies on hand reared birds, and relatively long term ones on both laboratory (i.e. aviary and field studies.[73] Ivor used both approaches.

Ivor continued his studies on nesting, bird song, and other facets of behaviour until he was in his nineties. Two of his papers, on "Birds' Fear of Men" and "Hatching of Eggs of Hand-reared Wood Thrushes" were published in The Auk in 1944 and 1952 respectively. Other, more popular studies were published in Nature Magazine, and the National Geographic Magazine. A long monograph on bird behaviour, submitted to various publishers after World War Two, was never published. I Live With Birds, a semi-popular account of his experiences with his aviary birds, published in 1968, became a great success.

Ivor was a pioneer in Canadian behaviour studies.

Since his work, the value of research in captive and semi-tame birds as opposed to wild birds, has become an accepted method in biology.

V

Mousley and Ivor are outstanding examples of the contribution non-professional scientists have made to biology. Their close observations of birds in a limited geographic area, their painstaking research over long periods of time allowed them to pursue studies that most academic or museum scientists could not find time for. Together with other Canadian ornithologists, Saunders, Brooks, Munro, Taverner, Pearse, Green, Terrill, Fleming, Speirs, Lawrence, Lewis and others, working on various aspects on the life history and behaviour of birds during the first half of the present century, their results contributed to the increasing storehouse of information on bird behaviour in general and North American birds in particular. Their experimental work speeded the transformation of ornithology from natural history to avian biology.

Notes

1. Francis H. Herrick, The Home Life of Wild Birds (New York: G.P. Putnam's Sons, 1901), p. xvii.
2. The Ottawa Naturalist 29 (1915-16): 14, 16-18.
3. Stresemann, Ornithology, pp. 339-350; Farber, The Emergence of Ornithology, pp. 93-99.

4. H. Friedmann, "Life Histories," in Chapman and Palmer, p. 101.

5. Ibid.

6. Ibid., p. 102.

7. J.T. Emlen, "The Study of Behaviour of Birds," in A. Wolfson ed., Recent Studies in Avian Biology (Urbana: University of Illinois Press, 1955), p. 106.

8. Ibid., p. 105.

9. G.C. Sibley, "Ornithology," in A Century of Progress in the Natural Sciences (San Francisco: California Academy of Sciences, 1955), p. 642.

10. Ibid., p. 643.

11. A.L. Rand disputed some of Lorenz's conclusions concerning the stimulus for sanitation in birds' nest in The Auk in 1941 and 1942.

12. H.F. Lewis, The Natural History of the Double-crested Cormorant (Phalacrocorax auritus auritus (Lesson)), (Ottawa: Ru-Mi-Lou Book, 1929), p. 1.

13. Friedmann, Ibid., p. 105.

14. Louise de Kiriline Lawrence, Pimisi Bay, Ontario, Private papers. Louise Lawrence to Roger Clapp, 11 March 1982.

15. NMNS, Taverner papers, Louise Lawrence to Percy Taverner, 16 June 1942.

16. Ibid., Percy Taverner to Louise Lawrence, 30 June 1942.

17. Ibid., Louise Lawrence to Percy Taverner, 24 February 1945.

18. Ibid.

19. Ernest Mayr, "Epilogue: Materials for a History of American Ornithology," in Stresemann, Ornithology, p. 377.

20. NMNS, Taverner papers, Henry Mousley to Percy Taverner, 23 April 1923. For a more detailed treatment of Mousley's life and work see my "Henry Mousley and the Ornithology of Hatley and Montreal, 1910-1946," Tchebec

11 (1981): 113-134.

21. Henry Mousley, "The Birds of Hatley, Quebec," The Auk 33 (1916): 59.

22. NMNS, Taverner papers, Henry Mousley to John Macoun, 11 November 1914. Another publication, that of R.G. Price on Sherbrooke birds was published in The Ottawa Naturalist 24 (1910): 55-57, but seemed to have escaped the notice of both Mousley and Taverner until 1920.

23. NMNS, Taverner papers, Henry Mousley to Percy Taverner, 8 February 1915.

24. The Auk 34 (1917): 382.

25. NMNS, Uncatalogued papers of Lewis McIver Terrill (hereafter Terrill papers), Henry Mousley to Lewis Terrill, 29 February 1917.

26. Henry Mousley, "The Breeding of the Migrant Shrike at Hatley, Quebec, 1916," The Auk 25 (1918): 33.

27. NMNS, Terrill papers, Henry Mousley to Lewis Terrill, 26 February 1918.

28. NMNS, Taverner papers, Henry Mousley to Percy Taverner, 29 July 1919.

29. Henry Mousley, " 'The Singing Tree,' or How Near The Nest Do The Male Birds Sing?" The Auk 36 (1919): 340.

30. Ibid., p. 341.

31. Henry Mousley, "Which Sex Selects The Nesting Locality." The Auk 38 (1921): 321.

32. Ibid., p. 328.

33. Ibid., p. 324.

34. Editor's footnote, Ibid., p. 321.

35. M.M. Nice, "The Theory of Territoriality and its Development" in Chapman and Palmer, pp. 89-90; Ernst Mayr, "Bernard Altum and the Territory Theory," in Proceedings of the New York Linnaean Society 45-46 (1935): 24.

36. H. Friedmann, in Chapman and Palmer, p. 105.

37. NMNS, Taverner papers, Henry Mousley to Percy Taverner, 21 November 1921.

38. Ibid., Percy Taverner to Henry Mousley, 6 January 1922.

39. Ibid., Henry Mousley to Percy Taverner, 24 November 1922.

40. Henry Mousley, "Study of the Home Life of the Northern Parula," The Auk 41 (1924): 263.

41. Ibid.

42. Ibid., p. 264.

43. Ibid.

44. NMNS. Taverner papers, Henry Mousley to Percy Taverner, 16 June 1923.

45. McGill University Archives, RG 40, Uncatalogued papers of C.A. Wood (hereafter Wood papers), Gerhard Lomer to Casey Wood, 9 March 1934.

46. H. Friedmann, "The Instinctive Emotional Life of Birds," Psychoanalitic Review 21 (1934): 242-71, 381-407.

47. Henry Mousley, "Notes on the Birds, Orchids, Ferns and Butterflies of the Province of Quebec, 1928," The Canadian Field Naturalist 43 (1929): 95.

48. NMNS, Taverner papers, Roy Ivor to H.H. Williamson, 28 December 1937.

49. Ibid., Percy Taverner to Roy Ivor, 12 February 1938.

50. ROM, RG 59, Uncatalogued papers of J.R. Dymond (hereafter Dymond papers), Roy Ivor to J.R. Dymond, 20 October 1936.

51. Ibid.

52. Doris Huestis Speirs, Pickering, Ontario. Private papers. (hereafter Speirs papers), Roy Ivor to Doris Speirs, 3 October 1938.

53. W.L. McAtee, " 'Anting' by Birds," The Auk 55 (1938): 98.

54. Speirs papers, Roy Ivor to Doris Speirs, 28 December 1938.

55. H.R. Ivor, "Observations on 'Anting' by Birds," The Auk

58 (1941) 415.

56. Ibid.

57. H.R. Ivor, "Further Studies on 'Anting' by Birds," The Auk 60 (1943): 51.

58. ROM, SC 50, Uncatalogued papers of L.L. Snyder (hereafter Snyder papers), Roy Ivor to Lester Snyder, 11 February 1943.

59. Ivor, "Further studies...." p. 53.

60. Ibid., p. 54.

61. ROM, Snyder papers, Roy Ivor to Lester Snyder, 11 February 1943.

62. Ibid. Roy Ivor to Lester Snyder, 2 September 1936.

63. Speirs papers, Roy Ivor to Doris Speirs, 14 January 1946.

64. Wilson Bulletin 56 (1944): 91.

65. Cumberland Museum and Science Center, Nashville, Tennessee, Uncatalogued papers of Amelia Laskey (hereafter CMSC, Laskey papers), Amelia Laskey to Roy Ivor, 4 August 1944.

66. Speirs papers, Roy Ivor to Doris Speirs, 14 January 1946.

67. Living Bird 1 (1962): 86.

68. Ibid., p. 87

69. H.R. Ivor, "Bird Study and Semi-captive Birds. The Rose-breasted Grosbeak," Wilson Bulletin 56 (1944): 94.

70. Ibid.

71. Ibid., p. 102

72. Dilger, Ibid., p. 87.

73. Susan M. Smith, "The Ontogeny of Avian Behavior," in D.S. Farner and J.R. King, eds., Avian Biology Vol. 7. (New York: Academic Press, 1983), p. 85.

CHAPTER 6

CANADIAN ATTEMPTS TO SOLVE THE "RIDDLE OF MIGRATION"

I

The annual return of large numbers of different birds to their nesting grounds and their mysterious disappearance during the winter, has fascinated people all over the world for thousands of years. Bird-migration, an observable, large-scale event, has precipitated speculative theories since the time of Aristotle; some of them, such as the fantastic notion that swallows hibernate in muddy lake bottoms during the winter months, persisted well into the eighteenth century. Naturalists in the Old World and the Americas have recorded obvious features of migration, such as the dependable spring arrival dates of certain species of birds in a single area at about the same date every year. When and where which birds arrived could be observed and reported, whereas why and how they migrated could only be subjects for speculation.[1]

Because of the conspicuous nature of migration practically everyone who was interested in birds and kept notes contributed to some extent to its study. In Canada early naturalists and settlers noted the appearance and disappearance of swallows, waterfowl, the Passenger Pigeon, and many other species. Their letters, diaries and

publications are important sources of information. These widely dispersed, spontaneous observations became part of a continent-wide, organized study in the 1880s. Suggestions for such projects originated in Britain, where J.D. Salmon, a contributor to the Magazine of Natural History, recommended as early as 1834, that naturalists living near the seacoast observe the passage of birds.[2] It was not until the late 1870s, however, that the British Association for the Advancement of Science appointed a committee to organize and control migration studies on the British Isles. Participants in the migration watch collected a great amount of factual information which illustrated the various migration patterns of those species which frequented Britain. However, no attempt was made to formulate theories concerning these movements.[3]

In North America, W.W. Cooke began a systematic study of bird migration in the Mississippi Valley in 1882. The following year the American Ornithologists' Union formed a Committee on Migration of Birds. Chaired by Dr. C.H. Merriam, the committee sent hundreds of letters (eight hundred written by Merriam alone) to American and Canadian newspaper editors. A circular, explaining the committee's objectives, i.e. co-ordinating large-scale migration studies in North America, was sent along with the letters, and to those who requested them following the newspaper announcements. Eventually more than one thousand observers became involved in this scheme,

including three hundred lighthouse and lightship keepers. The North American continent was divided into thirteen districts, each with its own superintendent who publicized the study and collected information from observers. Canada was originally partitioned into five sections, Newfoundland, Eastern Canada, Manitoba, Northwest Territories and B.C. In 1885 Eastern Canada was further divided into the Maritime Region and Canada West. The work of this committee was taken over by the U.S. Government in 1886, when it established the Division of Economic Ornithology and Mammalogy in the Department of Agriculture. Observers thereafter sent their data to this organization, which in 1905 became the U.S. Biological Survey.

All active Canadian ornithologists of the nineteenth and twentieth centuries contributed to the study of migration. They published papers and books, in addition to sending observations to Merriam, and later W.W. Cooke, who took over the government's migration work early in the century. Untrained observers, many recruited by the regional superintendents, were mostly satisfied by noting arrival dates or collecting specimens. They had few study aids, deemed necessary by modern day field ornithologists, and it is no wonder that in the absence of bird books, binoculars, and other observers, many of their sightings were of questionable accuracy. In exceptional cases observers were trained by

visiting ornithologists, who taught them field marks, nomenclature and methods of preparing bird skins. The Bouteillier family of Sable Island, Nova Scotia, is an interesting example of this category of observers. In 1894 American ornithologist Jonathan Dwight Jr. visited the island, and impressed with its ornithological richess taught the five children of Superintendent R.J. Bouteillier to make birdskins.[4] Their list of Sable Island birds was included in John Macoun's Catalogue of Canadian Birds. A series of papers, authored by Richard and James B. Bouteillier, was published in the Ottawa Naturalist between 1901 and 1908.

Many of the western settlers and ranchers also became fascinated by the periodic migration of birds around their homesteads. From the time of E.T. Seton's first observations of the birds of Manitoba in the late 1880s, many people contributed migration reports to the A.O.U., the Biological Survey and later to the National Museum of Canada. These untrained naturalists became part of the large network of organized observers, and some of them submitted observations for several decades. Outstanding were the Wemyss sisters, who emigrated from Scotland to Manitoba in 1880, and later moved to Saskatchewan. Margaret M. Wemyss began making migration reports to the U.S. Department of Agriculture in 1892 under the nom de plume of Maitland M. Wemyss. Four years later she started submitting them under her own name. Her sister C. Esther Wemyss began sending reports from various areas of

Saskatchewan a few years later. In 1941 the U.S. Fish and Wildlife Service honored members of the family for half a century of continuous contributions.[5] George Lang was another long-term western observer, who began making reports in 1903. Later he was among the first to use bird-banding in Saskatchewan. Elsie Cassels settled in present day Alberta in 1889, and for fifty years kept a diary on migratory habits of birds. She also published several notes in the Canadian Field Naturalist. According to Taverner she was a good observer, "very painstaking" and he wrote to Rowan that her "opinion carries weight."[6]

Norman Criddle of Aweme, Manitoba, also sent reports for several decades. His "Calendar of Bird Migration," based on a quarter century of continuous observation, was published in The Auk in 1922. Lang, Cassels, and Criddle, although self-trained, were naturalists who were not satisfied to be mere contributors to inquiries organized by American or Canadian institutions, but took the opportunity to develop into capable field ornithologists publishing their own observations.

The "mystery" of migration interested practically all Canadian ornithologists in the late nineteenth century. Vennor, Chamberlain, McIlwraith, Seton, Saunders, Wintle, Dionne and others, discussed migration in their books, and published papers on their observations in Canadian and

American journals, such as the Canadian Record of Science, the Nuttall Bulletin, and The Auk. In the early twentieth century the number of papers on migration increased greatly. Fleming, Taverner, Lloyd, Lewis, Brooks, Munro, Mousley, Terrill and Tufts were among the better known of a much larger group of Canadians publishing papers on migration.

Taverner, whose interest in migration was both theoretical and practical (as we shall see in the section on banding) published "A Discussion of the Origin of Migration" in 1904. In this paper he reviewed a number of migration theories which stressed climatological and geological changes and their influences on the separation of breeding and wintering localities. Among these were the differing viewpoints of R.A. Wallace, W.K. Brooks, Charles Dixon, J.A. Allen and Alfred Newton. These suggested various origins of migration, such as spring dispersal for locating suitable nesting sites, abundance of food, exploitation of food for nestlings in temperate regions of the world, and the migrations to the tropics during periods of decline and absence of food supply. Taverner agreed with the theory of exploitation of food supply, concluding that,

> migrations, in their earliest stages, must have originated in a conscious seeking for food....In course of time, the movement became habitual, and generations of repetitions rendered it instinctive. Instinct...would be favored through natural selection; and as the birds acquired the peculiar powers necessary to migrate, migrations assumed all the various phenomena they exhibit today.[7]

Papers on migration were not restricted to scientific journals; popular articles shed light, at least partially, on the "mystery" of migration. The same was true of newspaper columns by such ornithologists as A.G. Lawrence of Winnipeg and Lewis McIver Terrill of Montreal. In 1921 Lawrence began a column called "Chickadee Notes" in the Winnipeg Free Press. He wrote over one thousand seven hundred columns which dealt with the observations of most Manitoba ornithologists, and he served as an important clearing-house for these widespread observers. Lawrence also contributed descriptions and photos to A.C. Bent's Life Histories of North American Birds.

The well-known Quebec ornithologist Lewis McIver Terrill is a good example of those who contributed to migration studies on several levels.[8] Born in Montreal in 1878, he was educated at Westmount Academy and the High School of Montreal. While still a high school student, he became acquainted with Sir William Dawson, Principal of McGill University, a famous paleontologist and geologist who taught natural history at McGill and encouraged several generations of young Montrealers to develop their interest in this subject. Terrill frequently visited the aging scientist in the Peter Redpath Museum, and Dawson was impressed with the young student's keen interest in nature. Encouraged by Dawson, Terrill began his natural history investigations by collecting birds, nests and eggs, and by making a herbarium. He also kept copious notes of his observations.

Although Terrill began to study the migration and distribution of birds in the 1890s, he did not send migration reports to the Biological Survey until 1910. His first report of spring arrival dates was much appreciated by W.W. Cooke, because reports ceased from the Montreal area after the publication of Wintle's Birds of Montreal in 1896. Terrill also sent data and descriptions to Bent and published papers in the Ottawa Naturalist, The Auk, and The Wilson Bulletin. When the Province of Quebec Society for the Protection of Birds was founded in 1917, Terrill was elected as the new society's first President; in this capacity he gave hundreds of talks to schoolchildren. His lecture on bird migration was published in the Teacher's Magazine of the Provincial Association of Protestant Teachers, Quebec, and other papers on migration were periodically printed in the Staff Magazine of the Bank of Montreal, where Terrill was employed from 1922 to 1942. Although Terrill's interest in ornithology included life-history, systematics and evolution, migration, a spectacular and relatively easily observable phenomenon, figured prominently in many of his talks and newspaper articles. Terrill's column, entitled "Outdoor Calendar," began to be published in the Montreal Star in 1925. Although these articles were aimed at popular audiences, they were well received by American ornithologists. Alexander Wetmore of the Smithsonian Institution considered them much above the usual

standard of such articles, and commended Terrill on "the accuracy of the statements made...."[92]

Terrill published dozens of papers on all aspects of ornithology in prestigious ornithological journals, and was generally highly regarded as expert on the birds of Quebec. He was also a well known conservationist and popularizer. His interest in migration prompted him to send data to the Biological Survey, detailed descriptions and contributions to Bent, to give many talks, and write articles. Despite all his other contributions, Terrill considered the "Migration Reports" of the PQSPB Annual Reports as his best efforts. The "Migration Reports" were actually initiated by Professor V.C. Wynne-Edwards, who in the early 1930s felt that if he, Terrill, Mousley and Napier Smith would combine their observation of migrating birds in the greater Montreal area, a useful migration column could be constructed. Terrill edited these reports from 1936 until his retirement in 1952. The "Migration Reports" are now an important part of Tchebec, the journal of the Province of Quebec Society for the Protection of Birds.

II

Marking birds with some easily recognizable object, whether collar, silver thread, or legbands, has been tried by various European and American ornithologists since the seventeenth century, but systematic banding of birds did not

begin until the twentieth century. In 1901 a bird observatory was founded at Rossiten, Germany, where banding operations started in 1903, although in 1899, Hans Christian Mortensen, a Danish schoolmaster banded a few Starlings (Sturnus vulgaris). Other European countries (Hungary, France, England) soon followed suit, banding long-distance migrants, such as the conspicuous White Stork (Ciconia ciconia).[10]

North American bird-banding commenced about the same time as the first European efforts. Dr. Paul Bartsch, a biologist at the Smithsonian Institution, banded twenty-three Black-crowned Night-Herons (Nycticorax nycticorax) in 1902. Leon J. Cole's paper, suggesting tagging for migration study, was published in the Bulletin of the Michigan Ornithological Club in 1903.[11] Centralized distribution and record-keeping of bird-bands for migration studies was the brainchild of Percy A. Taverner. In 1904 Taverner, already interested in the distribution and migration of birds in the Great Lakes region, seized upon the idea of tagging, and began to formulate a large-scale, continent-wide "tagging" scheme. As an experiment he mailed a letter addressed simply "Auk, New York," which in due time was delivered to Dr. Jonathan Dwight, business manager of The Auk, the journal of the American Ornithologists' Union. Encouraged by this, Taverner made a number of light-weight aluminum "tags" or bands, which he numbered and inscribed "NOTIFY AUK. N.Y." by hand. He also

put an announcement in The Auk, which read as follows:

> With a view of obtaining positive evidence of the return of birds to the place of their births, or otherwise, Mr. P.A. Taverner...proposes to attach small aluminum bands to the tarsus of young birds, in the hope that some of the birds thus tagged may afterward fall into the hands of ornithologists and be reported. The tag, for the sake of brevity of address, will be inscribed "Notify the Auk, N.Y." to which such discoveries should be reported for publication.[12]

Taverner also constructed a brick trap "for catching ground haunting birds." This simple trap needed only four bricks, and "3 twigs, stick or matches." In a letter circulated to members of the Great Lakes Ornithological Club, Taverner explained how to operate these traps:

> Two or three brick traps...set in the bush would be certain during the migration season to capture a good many birds-white throated and song and chipping sparrows are easily taken this way. Being right at home they could be set a night and looked at before leaving for office in the morning, at noon and again in the evening."[13]

Furthermore, Taverner suggested that should ornithologists tag only nestlings and not adults, the total birds marked during each season would be considerable. He also predicted that certain birds would be recaptured, because birds are likely to frequent the same locality on migration.

Bird-band number one was used by J.H. Fleming of Toronto. Others, including Saunders, Klugh and a number of interested American ornithologists, received over four hundred handmade bands during the 1905-08 period. The youngest bird-bander, Charles Kirkpatrick, a schoolboy in Iowa, banded

several birds, one of which was found hundreds of miles from the place of banding, constituting the first long-distance banding "return" in North America.

Making bands by hand was a time consuming and expensive process, which Taverner eventually had to give up. When the newly established New Haven Bird Banding Association showed interest in large-scale banding, Taverner turned over all the remaining material to them in 1909. At about the same time the American Bird Banding Association was founded, and studies involving bird-banding caught the interest of ornithologists in many parts of the continent. According to Taverner, bird banding in Canada "was not taken seriously until the United States Fish and Wildlife Service [successor of the Biological Survey] took over the task [of systematic distribution of bands] and made it national and international in scope."[14] In 1923, the Dominion Parks Branch became the centre which issued permits and bands and collected reports in Canada.

Since there were no Canadian bird-banding associations, Canadian banders belonged to American regional ones, or to the larger American Bird Banding Association. Those in the Maritimes and Quebec were members of the Northeastern Bird Banding Association, Ontario banders joined the Eastern Bird Banding Association, banders from the Prairie Provinces belonged to the Inland Bird Banding Association, and those from B.C. to the Western Bird Banding Association.[15] Among the early Canadian enthusiasts of this method were Robie

Tufts, Nova Scotia, Ralph de Lury, Harrison F. Lewis, R. Owen Merriman, Ontario, Lewis Terrill and Emily Luke, Quebec, J.A. Munro, Manitoba, Reuben and Bert Lloyd, and George Lang, Saskatchewan, Frank Farley and William Rowan, Alberta, and G.D. Sprot and Theed Pearse, B.C.

One Canadian bander who did not wait for the establishment of banding associations was "Wild Goose" Jack Miner, who established a duck and goose sanctuary near Kingsville, Ontario in 1904. He began banding waterfowl in 1909, and during the next thirty years banded over 20,000 Canada Geese, (Branta canadensis). Miner was an ardent, although somewhat misguided conservationist, whose interest in birds was non-scientific. However, both his banding activities and his sanctuary were important in popularizing waterfowl conservation.[16]

Much early Canadian banding concentrated on waterfowl. In addition to Miner, there were more scientifically inclined conservationists and ornithologists, such as Lewis, J.A. Munro, and Frank Farley, who banded ducks, cormorants and gulls. Theed Pearse in B.C. did his banding among colonies of Glaucous-winged Gulls (Larus glaucescens). His work provided information on migration, and also on the important but not well understood topic of plumage sequence.[17]

The Chimney Swift (Chaetura pelagica) is one of many species whose migration history had been elucidated by bird

banding. This abundant small migrant roosts and nests in large chimneys in the eastern U.S. and parts of eastern Canada, from south-central Saskatchewan to Nova Scotia, but its wintering ground remained unknown until the middle of the twentieth century. Banding of swifts in Canada was initiated by R. Owen Merriman at Queen's University in 1928. During the following six years Merriman and his helpers banded 6679 swifts mostly during spring migration. This effort is noteworthy, particularly because of the man who organized and carried out the banding. Merriman was born in Hamilton in 1895. Though a serious fall in infancy left him permanently disabled and confined to a wheelchair, it did not stop Merriman from receiving an education and engaging in field work. Educated privately in Hamilton, Merriman spent much of his childhood observing nature. He was one of the organizers of the Hamilton Bird Protection Association, and was instrumental in establishing the Dundas Marsh Sanctuary in the mid-1920s. In 1919 Merriman, then an economics student at Queen's, joined the American Bird Banding Association. Graduating with a B.A. in 1922, he entered graduate school at Queen's and received an M.A. three years later. He remained at Queen's as tutor in economics and administrator in the Commerce and Banking Departments. Merriman had many friends in and out of the university. With the help of these, including many Queen's students, he began banding swifts in June 1928. Using the large chimneys of Nicol and Fleming

halls, the first banding session resulted in 271 banded birds. Because swifts rarely roost in large flocks around Kingston in the fall, only two attempts were made at fall banding. One of the birds banded in September 1928 was recovered twelve days later at Charleston, W. Virginia, and subsequently at Kingston in May 1929.[19]

After Merriman's sudden death in 1934, the Biology Department of the university assumed responsibility for the banding scheme and became the third Canadian university to have a banding station as part of its educational program. The others were at the University of Alberta, where Professor William Rowan had banded birds since 1924, and at McGill University, where Professor Wynne-Edwards began banding passerine birds on Mount Royal in 1930.[19]

Banding birds for migration studies became so popular in the U.S. in the 1920s that some ornithologists felt that there was a danger of the method becoming an end in itself and not a means for the study of biological problems. William Rowan, for instance, deplored banding "for fun" or "picnic banding". In "The Scientific Aspects of Bird Banding," published in the Bulletin of NEBBA in 1928, Rowan stressed the need for continuity in banding and pointed out that only long term studies yield important scientific information. Moreover, he maintained that banding was important for migration study, because it was the "link that brings banders

and laboratory men into touch with each other." He also argued that "no matter how able or well-informed in biological theory a scientist may be, unless he is familiar with the field aspects of migration the subject to him is a closed book."[20]

Because of Rowan's innovative migration studies, and the importance of his research to the history of ornithology, his contributions will be dealt with at length in the following sections.

III

William Rowan was born in Switzerland in 1891, the son of a Danish mother and Irish father. He was educated on the continent until the turn of the century, and afterwards studied in England. In 1908 he came to Canada, and worked as a ranch hand for three years. While living in Manitoba he met A.G. (Alex) Lawrence, an enthusiastic and knowledgable field ornithologist, who introduced him to Canadian birds. Returning to England to study zoology, Rowan entered University College, London in 1912, but in 1914 his studies were interrupted when he enlisted in the London Scottish Regiment. After being wounded he was discharged in 1916, and a year later graduated with a B.Sc. in zoology. While recuperating from his wounds received in the war, Rowan first observed large-scale migratory movements of birds. The sight, he explained thirty years later, "impressed me so deeply that

I decided there and then, with the innocent optimism of youth, to attempt an experimental analysis of some of its factors."[21]

Rowan returned to Canada in 1919 and became a lecturer in zoology at the University of Manitoba. He renewed his acquaintance with Alex Lawrence and with his help began to familiarize himself with the avifauna of Manitoba. He also contacted P.A. Taverner to obtain information on ornithological journals and a bibliography of Canadian ornithology. He wrote to Taverner:

> I...accepted the appointment here especially to do work for the next few years or probably for the rest of my life, on the birds of Canada, for which my previous stays here have aroused a tremendous enthusiasm....I propose confining my activities for the first few years to this province.[22]

However, Rowan only stayed in Manitoba for one year. An offer of the opportunity to build up the zoology department attracted him to the expanding University of Alberta. Although in the fall of 1920 he was "training medical students as Associate Professor in the dept. of Biology,"[23] he was offered the Chair of Zoology as of 1921. In a letter to J.H. Fleming, one of his new correspondents, Rowan explained:

> [The] field of ornithology is so vast out here that it is bewildering to contemplate. It will no doubt be years before the University can achieve anything in the bird line owing to the usual handicap of funds. I do not know how the Zoo department will appreciate being run by a bird maniac. That remains to be seen. Birds will, however, have their fair share of attention![24]

The attractive research and career opportunities were

obviously not lost on Rowan, who at the age of thirty was given the seemingly outstanding opportunity of forming a new department, at a relatively new university. However, lack of money and administrative difficulties delayed the actual expansion of the department, and for the first few years, Rowan was the zoology department. These problems did not prevent him from studying the Alberta avifauna and spending every spare moment in the field.

The avifauna of the Edmonton region, particulary of nearby Beaverhills Lake, a staging (stopover) area for migrating waterfowl and shorebirds, reinforced Rowan's early interest in large-scale migratory movements of birds. He began to do field studies on migrating shorebirds, particularly those species which also occur in Britain. He also began to send migration data to the Biological Survey and data and descriptions to A.C. Bent for his forthcoming Life Histories of North American Shorebirds (1927, 1929). These contributions to ornithology did not satisfy Rowan. "The reason I am particularly interested in migration here," he wrote to Taverner in 1922, "is that the Biological Survey are (sic) very short of Alberta material." He added "I am also interested in certain aspects of migration and while I have to trace the movements of the birds here it is only a step towards the ascertaining of principles to be derived from facts."[25]

Having lost several years because of ranching and the

war, Rowan felt that he was still at the beginning of his career. He hoped to establish his reputation with a paper on the migration of plovers, which would be his "first contribution of any importance to ornithology." He also asked Taverner's advice concerning which journal would have the largest circulation or which would provide the best medium for publication for his forthcoming paper.[26] "Migration of the Golden and Black-bellied Plovers," published in the Condor in 1923, was well received by ornithologists. Rowan continued to collect information on the migratory routes of plovers and became particularly interested in the possibility that adult and young Lesser Golden Plovers (Pluvialis dominica) follow different migration routes in the fall. He set out to prove, therefore "or to disprove that the young have an entirely different migration route," based on his own observations and on data culled from major ornithological collections. Rowan maintained that this information supported his original argument that "old birds go south by some route on which they escape general observation." He felt that such a theory may be "revolutionary, and if it turns out to be more fact than fiction, it will be of more theoretical value to the topic of migration than any other observation made up to the present time."[27]

Rowan was a good field naturalist with a thorough grounding in modern biology - a rare combination in Canadian

ornithology in the 1920s. Impressed by the regularity of the spring and fall migration of certain species of birds, he sought to prove experimentally that these migrations, at least in some species, receive an external stimulus, "an environmental timing mechanism" of periodic nature.[28] Through his field studies of migrating shorebirds, some of which he collected and examined, and by the examination of museum specimens, Rowan observed with great interest the advanced development of the gonads in spring migrants at the time of their arrival in the Edmonton region. In an address to the Royal Society of Canada in 1946 Rowan explained:

> In view of theories then current with reference to interestitial cells, sex hormones, and sex behaviour, one only had to suppose that the migratory journey was itself a particular phase of sexual behaviour, as much dependent on the development of the gonads as the characteristic spring antics in which most birds indulge, to establish a practical working hypothesis for an experimental start. If one could artificially stimulate the gonads to spring activity in the fall, one might thereby induce the owners, when released to go north, instead of south in the autumn.[29]

Rowan isolated the one unvarying factor in the bird's environment, which could provide the external stimulus responsible for migration. In contrast with previous hypotheses and theories, which thought that temperature or barometric pressure were the most likely stimuli, Rowan decided that daylength, which changes at the same rate every year, was the only unvarying environmental factor. At the time Rowan was formulating his hypothesis, he read a paper by the Reverend Gustave Eifrig, entitled "Is Photoperiodism a

Factor in Migration?" which was published in The Auk in 1924. Eifrig doubted that spring migrant birds were influenced by physiological stimuli, such as the enlargement of gonads. This paper prompted Rowan to attempt to refute Eifrig's theory and at the same time to test his own hypothesis that spring migratory readiness can be experimentally induced by artificially lengthened daylight in autumn.

For his experiments Rowan needed aviaries to house large numbers of captive birds. Because of perpetual shortage of funds at the University of Alberta, Rowan had to rely on used material, such as mosquito netting and packing cases, to build two aviaries. These he put in his garden, away from any source of heat, where they provided housing for Slate-coloured (now Dark-eyed) Junco (Junco hyemalis), an abundant small migrant in the Edmonton region. This wide-spread species is confined to North America, wintering in the southern United States. The aviary used for experimental birds was lit with two fifty-watt lightbulbs, while the other, which housed control birds, received no artificial illumination. Starting in October 1924 experimental birds received daily increments of five additional minutes of artificial light after sunset. Periodically experimental birds were killed and their gonads were examined. Rowan found that although the size of gonads decreased for the first few weeks, after the middle of November they began to increase, and grew in size until the

end of December, when they were found to be actually larger than those of the first spring migrants to reach Edmonton.

A few days after the first set of experiments Rowan wrote to Taverner in a jubilant mood:

> I have succeeded in experimentally inducing Juncos to develop spring fever at Christmas in large aviaries in the garden with temperatures running down to 52 below zero. They were singing all day long and all that sort of thing and on dissection proved to have large spring testicles. I unfortunately started trapping after the females had gone south, and only got one belated sample in about 70 birds trapped. I kept her till the end, when she had well developed ovaries in about the same condition as they have them normally in the spring.[30]

Rowan described the gist of this experiment in "Relation of Light in Bird Migration and Developmental Changes," published in Nature in January 1925. He stressed that "It would...appear that whatever effect daily increases of illumination may or may not have on migration, they are conducive to developmental changes in the sexual organs."[31] Another longer paper on the subject started in haste when he read Eifrig's paper, was to include the experimental evidence. A letter accompanying the Nature article told Taverner that Rowan's "main theme" would be published in a lengthy paper. He added:

> I believe this bit of work of mine is the first attempt in history to prove any of the migration theories experimentally....If I had the cash next fall I believe that I could prove that together with the change in the gonads develops the desire to migrate. I am now doing detailed histological work on my material to try and prove or disprove the existence of a testicular hormone, that might be connected with the migratory impulse...[32]

This second article, "On Photoperiodism, Reproductive Periodicity, and the Annual Migration of Birds and Certain Fishes," was published by the Boston Society of Natural History in 1926. It included experimental evidence from 1924, and the 1925-26 fall and winter season. In these latter experiments Rowan not only subjected juncos to increasing amounts of artificial daylight, but also released some banded experimental and control birds to observe their behaviour. He facetiously wrote to Taverner, "My juncos are flourishing. I have now reached the stage that I can let out a batch and say "Go north," and off they go, within two hours after release. Or I can say "Go south" and off they go...." However, Rowan had to admit that he could not establish which direction the birds have followed, only that they "have gone off somewhere."[33] In contrast, control birds did not fly off but returned, without exception, to the aviary. Proud of his achievement Rowan boasted:

> Considering that every ornithologist and biologist of repute and many world famous physiologists as well have theorized on the topic of migration and have proved nothing, I have every reason to be tickled at the results of these experiments, for they have not only backed to the hilt a new theory of migration, worked out on collected fact, but have produced the first experimental evidence, ever produced as far as I know, in connection with migration.[34]

The first experimental evidence led Rowan to conclude in his paper, that "Two things have been definitely established (1) that the gonads can be artificially stimulated to premature

recrudescence by giving daily increases of light regardless of temperature, barometric pressure, etc.; (2) that birds whose gonads are at their winter minimum, will not migrate."[35] Rowan admitted, however, that proof was lacking that the particular condition of the gonads caused migration, and proposed further tests on other ductless glands.

Rowan's correspondence with Taverner, his long-distance mentor, explored the different migratory situation of birds that spend their entire life north or south of the equator, and those that are equatorial or transequatorial migrants (i.e. winter on the equator or cross it from the northern to the southern hemisphere for the winter). Taverner's comments on these different situations caused Rowan to insert a section in his 1926 paper discussing these categories of migrants. In this he stated that the immediate stimulus causing migration may not be identical for all birds, and that for equatorial and transequatorial migrants in addition to daylight (an environmental factor) an internal physiological rhythm is involved. Rowan suggested that this physiological rhythm is supplied by the gonads, "which exhibit a periodicity as striking as the migrations themselves, and...the degeneration and recrudescence of the organs coincide with the migratory periods."[36] In conclusion, Rowan reiterated that annual bird migrations depend on two factors, one internal "supplied by the reproductive organs when in a particular state of development and physiological activity," and the other an

environmental controlling factor, "provided by the varying daylengths."[37]

Rowan's paper created considerable interest among scientists on both sides of the Atlantic. The inherent research potential of his experiments was instrumental in securing him a research grant of £ 26 from the Royal Society of London. In August 1926 Rowan informed Taverner, "I have received the Royal Society (England) grant for research on migration and have a very fine aviary up now."[38] The new aviary was used to house experimentals, while the original aviaries were retained for control birds.

The 1926-27 experiments were conducted as follows: During the months of decreasing daylight one group of juncos, the controls, were left in normal daylight conditions; experimental birds were subjected to increasing amounts of artificial light during that period. In mid-winter two groups of experimental birds, whose gonads had been artificially increased during the fall, were deprived of light by the use of shutters on the aviary. One group was gradually deprived of light, the other was subjected to a sudden decrease in the amount of daylight from fifteen hours to nine hours per day. Gonads of birds belonging to both groups decreased considerably. However, the size of the gonads did not reach the "winter minimum" found in control birds.

Two other groups of juncos were taken indoors to

aviaries in the laboratory. Both were exposed to the same amount of very dim artificial light after sunset, but one group was allowed to roost in peace, while the other was given compulsory exercise at dusk. By gradually lengthened exercise periods, Rowan induced a noticeable increase in the size of the gonads, comparable to that achieved by the previous experiments which had used artificial light only. Rowan concluded that the important factor in the recrudescence of the gonads was not simply the direct action of light itself, but the "activity in which the light induced the birds to engage." The histological examination of the testes, ovaries, thyroids, parathyroids, and suprarenals, which Rowan began after his first set of experiments, proved that artificial recrudescence in the fall involved not only the enlargement of testes, but also induced sperm formation. Rowan's general conclusion was that in the junco, and possibly some other species, the increase and decrease of amounts of light per day influences the recrudescence or retrogression of gonads both in size and internal developments. Moreover, both changes are "accompanied by a marked increase in interstitial tissue within the gonads, and this tissue, through production of appropriate hormones, arouses the impulse to migrate."[39]

"Experiments in Bird Migration, I. Manipulation of the Reproductive Cycle: Seasonal Histological Changes in the Gonads," was published in the Proceedings of the Boston Society of Natural History in 1929. The paper was based on

Rowan's doctoral thesis at University College, London, though the experiments had been done at the University of Alberta. The summers of 1927 and 1928 were spent in London, since Rowan felt that he could "progress no further without a good library - a real one!"[40] Rowan originally intended to do his doctoral dissertation "on the early development of the Eared Grebe [Podiceps nigricollis] an embryological study that promises to be of exceptional interest."[41] But his research on bird migration had attracted such interest at University College, London, where he received his "former Prof's advice on the work,"[42] that Rowan abandoned the idea of pursuing research on the development of the Eared Grebe and concentrated on the histological work of his migration research. In February 1928 he wrote to Taverner that he was finishing his dissertation, and added:

> I think I am probably on the verge of unearthing an entirely new physiological principle as well as digging out some of the fundamental facts of migration. But I have more experiments planned now that I can carry out in a couple of years. However, it's very intriguing and promises some real good stuff."[43]

By the end of the year he heard unofficially that he had been awarded "the London D.Sc. So the effort has been worth while and it has been some effort," wrote the pleased Rowan to his friend Taverner.[44]

IV

Rowan's migration research and the completion of his doctoral dissertation were carried out under considerable difficulties. The University of Alberta lacked a good scientific library, research facilities were less than adequate, and there was no money for fundamental research. Generally speaking, money for all but practical research was always scarce in Canada. Canadian science was "guided by an entrepreneurial scientific ideology,"[45] brought to Canada by Scottish settlers, and this ideology lasted well into the twentieth century. Moreover, the main institutions of scientific research in Canada, the government agencies, "were dedicated almost entirely to practical science until after World War II...."[46] All scientific departments of the federal government had been established with practical aims in mind. The Geological Survey, the Experimental Farms, and The Biological Board pursued applied research, to "put science and industry together for the benefit of the people of Canada."[47] Although some members of the Council believed that, up to the founding of the NRC, university scientists in Canada who achieved distinction as research scientists did so "in face of incredible difficulties and discouragement,"[48] pure research was also a secondary consideration of the NRC. Canadian scientists interested in fundamental research continued to encounter discouragement, difficulty, and indifference to their aims.

Among the most vocal advocates of applied research was Henry Marshall Tory, founding President of the University of Alberta. Tory became President of the NRC in 1924. A firm believer in the usefulness of science, Tory "tended to favour the practical short-term problems that would make a noise; among the long-term projects, he favoured those with a staggering pay-off, preferably in tens of millions of dollars."[49] Tory's attitude exemplified the prevailing Canadian one, and he was in a powerful position where he could influence and promote applied research. Theoretical achievement was low on Tory's list of priorities.[50] It is hardly suprising, therefore, that Tory did not support Rowan's research into the physiological basis of migration.

Further diminishing Rowan's chances for obtaining Canadian research grants was his personal relationship with Tory. Both men were volatile, stubborn, and intolerant of opposing views. They clashed from the beginning of their relationship. Tory, with fixed ideas of what constituted zoological research, thought investigations should be carried out only in a laboratory. Rowan, as we have seen, favoured a combination of field work and laboratory experimentation in his research. The aviary in his garden was his outside laboratory. However, for Tory, Rowan was simply "playing" with birds. In a letter written to Sir Arthur Currie, Principal of McGill University, Tory expressed his low opinion

of Rowan, and spoke disparagingly of the scientist who "would not stick" to the laboratory, "but went out...on his various bird missions."[51] He confided to Currie, that during his last few years in Alberta (or during the period when Rowan was conducting his research on juncos), he gave "very little attention to Rowan due to the fact that only elementary work was done in the department...."[52] Moreover, Tory was convinced that Rowan had reached his limit, both at the University of Alberta, and as a research scientist. Rowan's promotion to full professorship in 1930, his election to the Royal Society of Canada in 1934, and his international fame showed the limitations of Tory's perspective. However, in the meantime the NRC president was in a position to prevent Rowan from acquiring research funds.

Rowan made his first grant application to the NRC in 1930. He submitted a detailed proposal for extending his migration research to the study of reverse migration in the American Crow (Corvus brachyrhynchos), requesting $1,905.00 to cover materials, travelling expenses, and salary for field assistants. He wrote that the experiments will "require nine months for completion, and will be carried out in the Zoological Laboratory of the University of Alberta, which is adequately equipped for all the usual types of zoological research work."[53] In spite of emphasis on laboratory work, his previous record of grants from outside Canada, and the fact that several other universities were "actively repeating

the experiments in part or in whole,"[54] the application was refused. Details of the committee's discussions are not available. The Proceedings of the NRC simply state that the committee "agreed to recommend that his application be not granted."[55] Rowan was eventually funded by the NRC, but only after Tory's retirement. In 1938 he received a $ 400 grant to study the effect of increased day length on the breeding season of the mink. This time, after "considerable discussion of the possible economic and scientific value of this work, it was agreed that Dr. Rowan be granted the sum requested."[56]

With no chances for funding for his research in Canada, Rowan turned to British and American sources; fortunately, a number of foreign institutions and even some wealthy American naturalists perceived the scientific potential of his research. After the initial grant of £ 26, received from the Royal Society of London in 1926, Rowan secured a series of grants for his migration research. The Royal Society granted him £ 45 in 1927, and £ 35 in 1932. The Bache Fund of Johns Hopkins University gave him $ 500 in 1928, and the Elizabeth Thompson Fund of Harvard University provided him with $ 400 in 1929 and 1931. The U.S. National Research Council granted him $ 1,000 in 1931. In 1937, Rowan turned to the Royal Society of London again and was granted £ 40 for travelling expenses, to be used to meet European scientists involved in migration research.

V

Because of difficulties in retrieving banded and released juncos, Rowan considered other species as subjects for his 1929 experiments. Juncos are only sixteen centimeters long, and are protected by the Migratory Bird Convention Act.[57] Such small birds could easily disappear in the large tract of muskeg north and northwest of Edmonton. Moreover, Rowan could not expect the population at large to shoot such birds and return specimens to the University of Alberta for examination. Added to Rowan's difficulties was the near loss of his banding permit, apparently caused by the protest of some "concerned citizens" who objected to his using juncos for experimental purposes.[58] It was only with Taverner's intervention in 1929 that Rowan's banding permit was renewed by the Dominion Parks Bureau, and Rowan eventually decided to use the American Crow for his experiments. Crows are well-known, heartily disliked by farmers because of a certain amount of damage done to crops, and they are not protected by law. Trapping crows proved to be extremely difficult, however. In contrast to juncos, which were easy to trap and handle, the Crow, an intelligent species of birds, defied most of Rowan's attempts.[59]

In spite of initial difficulties, resulting in a low number of experimental birds, Rowan decided to proceed with

this study. Crow experiments were similar to those performed on juncos during the 1924-28 period. The birds were subjected to increasing amounts of artifical light in the fall. In order to establish whether the artificial recrudescence of gonads would induce reversed migration (i.e. that birds would migrate north, instead of south in the fall) Rowan banded and released experimental crows near Edmonton early in November. Because of the geographic location of Edmonton, most of the released crows disappeared into the northern muskeg, and very few bands on birds were found and returned. He decided, therefore, that for future experiments a much larger number of birds would be needed and that they should be released near the centre of the inhabited part of Alberta. Rowan conducted no further experiments in 1930, because he had no funds for research, and also because he was in the process of writing a book on migration in addition to a number of scientific papers on the same subject.

For the 1931 season Rowan planned experiments involving about one thousand crows. His quest for this well-known bird was publicized in various newspapers in Alberta. He also talked to reporters while attending a conference at Matamek, Quebec. This conference, while extremely useful for his second major research interest, the cyclic fluctuation in animal numbers, was detrimental to his migration studies, because Rowan's late return to Alberta upset the planned timing of the first stage of the experiment. "The Matamek

conference did me out of hundreds of Crows" complained Rowan in a letter to Taverner in September 1931. "In spite of wonderful weather, fine and hot throughout most of August, the crows left on schedule around the 15th in huge numbers."[60] Instead of the one thousand crows, Rowan managed to trap only about four hundred and fifty. With the help of Robert Lister, his long time technician, Rowan used a variety of methods to entice crows. These included large nets, caged decoys, a live Great Horned Owl (Bubo virginianus), and large number of rotten eggs, which were apparently irresistible to crows. None of the methods were entirely successful, however, and crows managed to evade most of the devices some of the time. With local help in the Edmonton area, Rowan managed to accumulate five hundred crows (some of them contributed by school-boys). Some of the birds perished during transportation, others escaped. The necessary periodic sampling of experimental birds further reduced their number, until at the end of the experimental period Rowan had less than three hundred birds.

Rowan originally planned to liberate the birds at Medicine Hat, about 250 miles southeast of Edmonton. Unfortunately for him, however, the weather at the end of November 1931 proved unsuitable for carrying out his original plan. Rowan chartered a small aircraft to transport him and his birds to Medicine Hat, but thick morning fog delayed their

departure on the plane, and the impatient Rowan had to wait till the early afternoon before they could take off. Because of this late start the plane could not fly to Medicine Hat in daylight and had to land at Hackett, one hundred and ten miles southeast from Edmonton where Rowan released the crows.

Despite these difficulties the 1931 returns finally proved satisfactory, though initial results were not promising. In a letter addressed to Taverner, Rowan gave full vent to his frustration concerning the slow recapture of his banded and colour marked experimental birds:

> Damn all Crows. After treating them like princes, feeding them to repletion...to bursting point, after removing the testicles from many of them...after injecting them with extracts specially made for their delectation, after giving them a royal treat to finish with in the form of a $ 125 aeroplane ride to the sunny south, damn my soul if they aren't continuing south under their own steam instead of fulfilling my prayers and vehement behests and returning to our balmy north. That is what it looks like now at all events if the latest radio reports from the south are half correct.[61]

Written only a few days after the release of crows, the outburst greatly exaggerated the situation. By March 1932 Rowan received a considerable number of returns, and was able to write up his paper and draw tentative conclusions.

"Experiments in Bird Migration, III. The Effects of Artificial Light, Castration and Certain Extracts on the Autumn Movement of the American Crow (Corvus brachyrhynchos)" was published as the second paper on crow migration in the Proceedings of the National Academy of Sciences in 1932. (An

earlier brief report, entitled "Experiments in Bird Migration. II. Reversed Migration" was published in 1930 and dealt only with the initial crow experiments and the returns of birds released near Edmonton). THe 1932 paper included histological and other data from both sets of experiments, in addition to data resulting from experiments conducted only in 1931. It also included nine maps showing the direction and extent of dispersal of various groups of crows. Rowan's expanded research was carried out in the following manner. In addition to the usual experimental groups receiving light treatment, and controls, who were left alone, Rowan had "subsidiary groups," made up of capons, that is castrated birds. One group of these was subjected to the illumination experiment, another was injected with testicular extract; a third group of "unoperated individuals" were given pituitary extracts, while a fourth group of birds was given placental extracts. Castrated birds exposed to illumination travelled southward proving that "as far as the southward trek is concerned, it can be certainly stated that the fall condition of the gonads is not concerned in the story."[62] Capons injected with testicular extracts proved to be "completely sedentary. The southward impulse was evidently killed,"[63] although Rowan admitted that the amounts of the extracts may not have been sufficient to induce migration. The same was true of birds who received the pituitary extract, whereas birds receiving placental extracts showed "a tendency to travel south."[64]

Thanks to the high publicity achieved by Rowan, through talks in schools, through the radio, and via articles in various newspapers, returns were reasonably high. The lowest return, 48%, was from the illuminated experimentals, which travelled through the lightly inhabited northwest of Alberta and were returned in much smaller numbers. Although this lowered the average of the returns, 58% of all released birds were recovered.[65] Rowan cautiously concluded that "Whatever may be the case with northward [i.e. spring] migration, the southward is evidently not associated with the state of the reproductive organs. The movement must depend on some other, at present undetermined factor."[66] Hormonal experiments also proved inconclusive.

In spite of the less than satisfactory results Rowan's experiments created great interest in scientific circles. They also received wide publicity in the popular press. A born showman, Rowan enjoyed giving lectures and radio talks. He also wrote popular articles and managed to involve students, farmers, and university professors in Alberta, and the northern U.S. in "crow watches." It was the scientific community that followed his experiments with the greatest of interest, and his innovative approach in migration study stimulated much experimental work on the subject both in North America and in Europe. T.H. Bissonnette, Emil Witchi, S.C. Kendeigh and Albert Wolfson in the U.S., R.E. Moreau in

England, and J. Benoit and his team at Strassbourg, France, were among the outstanding researchers who took their cue from Rowan's experiments.

Rowan's interest in migration continued until his death in 1957, although he did less and less actual experimental work on bird migration, concentrating instead on the cyclic fluctuation in animal numbers. He did some experimental work on crows in 1935 and 1940, however. Based on the striking sense of direction experimental and control birds exhibited in 1931, when they flew to northwest and southeast respectively after release at Hackett, Rowan was curious to find whether migration, like homing, depends on previous experience or not.[67] In 1935 about eighty Alberta-caught crows were taken to Manitoba, where they were released at Portage la Prairie. Only three birds were returned to Rowan, but these followed the expected migration route of birds to the southeast. Similar experiments in Germany proved that crows transported away from their customary lane of flight still follow a certain direction. A further experiment in Alberta in 1940, on winter-detained crows, who were well fed but not subjected to light treatment or castration, proved that birds, many of them migrating for the first time followed the standard northwest to southeast direction. Rowan concluded that whatever the initial impetus of migration, birds follow an inherited sense of direction.[68]

Other migration experiments were conducted during

Rowan's 1937 visit to England. In these he attempted to refute Bissonnette's experimental work on Starlings (Sturnus vulgaris) which did not follow the path laid down by Rowan's work on juncos. Apparently starlings, well known to be restless birds, resisted being kept in captivity, and while they responded to light experiments as expected with recrudescence of the gonads, the enforced exercise experiment, introduced by Rowan in 1928, did not work with them. Some London starlings, however, received extended periods of activity quite naturally. These were birds roosting near the West End theatre district, where the late evening illumination influenced more physiological activity than in other parts of town where by that time starlings roosted in the dark. During a January night in 1937, Rowan collected some starlings in the theatre district, and with the help of British ornithologist James Fisher, smuggled these into the laboratory of University College, London. The 2 a.m. dissection proved that the gonads of these birds "were in a high state of development, roughly two months ahead of their country cousins of the same date." Rowan was pleased to state that the London starlings "disturbed at night in very feeble lighting, and when not temperamentally upset [like Bissonnette's birds] did react precisely like my complacent little juncos."[69] Rowan's finding was supported by Witchi's experiments on sparrows roosting in total darkness along busy

Iowa highways. In spite of the darkness, the disturbance and subsequent physiological activity induced the development of gonads in these birds.

In a paper read before the Royal Society of Canada in 1946 Rowan reviewed his more than twenty years' of migration research, and indicated a change in approach. He said:

> In the many papers that have now appeared on the topic, the authors have confined their attention to the effect of lighting on the gonads and of course the pituitary, on the activities of which the seasonal fluctuation of the gonads directly depend. But it seems to me that that is only part of the story, because the entire physiology of the animal must inevitably be involved.[70]

Although Rowan's research focused on the immediate stimulus for migration, in his book, The Riddle of Migration (1931) he also formulated, albeit cautiously, a theory of migration. By using the example of the Lapland Longspur (Calcarius lapponicus) Rowan "painted a scenario" for the evolution of migration. While Rowan concluded that factors responsible for the evolution of migration working at the present are the same or similar to factors which worked in the distant past, he made certain evolutionary assumptions which indicate that he did not totally discard the Lamarckian view of evolution.[71] There are a few cautious mentions of the Lamarckian hypothesis in Rowan's work and correspondence, both in connection with migration and with the question of subspecies, and the effect of environment on the development of subspecies. In The Riddle of Migration Rowan writes:

> ...we have assumed that the constant repetition of a north and south oscillation has finally established the tendency [of migration] as an inherited instinct. In the light of present biological knowledge such an assumption is almost wholly unwarranted. It supposes that the Lamarckian hypothesis - that acquired characteristics can be inherited - is acceptable. Experiments of great variety and ingenuity have been devised to put this conception to the test but none has been a convincing success. Yet there is this to be said. Failure to prove a given hypothesis is an entirely different thing from disproving it and if we may not accept the Lamarckian view as established we are still fully entitled to consider it an open question. It has admittedly never been proved, but neither has it been disproved.[72]

Rowan's cautious approach to Lamarckianism may be surprising, because in his earlier writing he showed no evidence of interest in the subject, although many field naturalists and experimental biologists in the 1920s were still Lamarckian in orientation. In his recent The Eclipse of Darwinism, Peter Bowler attributes this seeming anachronism to the incomplete understanding of the mechanism of evolutionary biology.[73] As S.A. Gauthreaux points out that it was only in the 1930s and 1940s, that "the last remnants of Lamarckian influence were eliminated from serious discussions of the evolutionary process." Undercurrents of Lamarckianism were so common, he argues, that even theories of migration which were developed in the early 1940s "contained statements that suggest an incomplete understanding of how natural selection operates."[74]

Rowan in his 1938 "Light and Seasonal Reproduction in Animals," refers to his original 1924 experiments, and states that these "owed their inception to a desire to induce

reversed migration in some species of bird as a possible contribution to the Lamarckian hypothesis."[70] There is no evidence at present that he ever communicated this desire to Taverner, however. Lamarckianism as a topic occurs in their correspondence, with Taverner coming out strongly aganist it. In a letter to Rowan written April 25, 1925 the older ornithologist remarked, a propos the evolution of subspecies:

> Whether evolution is Lamarckian, Darwinian or mutational is really beside the question, that merely tells how the progress is made, whether by volition [Lamarckian] or accidental wandering, or small steps or long leaps. I note a more or less recrudescence of Lamarckism nowadays that I see no basis for. It is an intriguing theory like Christian Science but is it true?...I must admit that I know very little of chromosomes. Modern geneticists have made a little world of their own with a special language that none but the initiated can know.

In spite of his occasional mention of Lamarckianism, Rowan concentrated more on the immediate, proximate, factors of migration and less on the ultimate, evolutionary, factors. He was a keen field naturalist and experimental biologist, and although he wished to contribute to theories of migration, it was his experimental work which made him a pioneer of modern ornithological research. By placing the study of migration onto an experimental basis, Rowan changed the course of ornithology.

The importance of his experiments were almost immediately perceived by scientists in Europe, the United States, and Canada. The amount of research stimulated by his research is impressive and in addition to ornithologists and

physiologists mentioned above, a number of well known scientists co-operated with Rowan, providing him with advice, and other kinds of assistance. J.B. Collip, of insulin fame, provided him with placental extracts; American mathematicians E.B. Phelps and E.S. Keeping helped in theoretical ways and financial assistance came from noted American naturalists Dr. John C. Phillips and Colonel J.E. Thayer.

VI

Although Rowan was the most important scientist in migration research in Canada, achieving world-wide fame by initiating a new approach in migration study, other methods retained their importance. The work of observers and banders across Canada has been important since the second decade of the twentieth century. The long-term banding efforts of widely distributed ornithologists provided continuous records of migration patterns which can be correlated with weather and other environmental factors. Other topics also received considerable input from these studies. These are size of bird populations, ratio of adult to young and ratio of the sexes, and the moult sequence of birds. Individual ornithologists sent their reports to the Biological Survey, the Dominion Parks Branch, the National Museum of Canada, and to regional compilers of the continent-wide migration reports published in

Audubon Field Notes. Others continued publishing papers on migration. By the middle of the twentieth century, ornithologists in general came to understand that there are more than just one or two factors in migration. It is now generally recognized that there are evolutionary, or "ultimate," and immediate or "proximate" factors. Observations, banding, and individual studies all contribute to the study of avian migration systems. However, Rowan's research on proximate causes was a turning point in migration research, a field which remains a major aspect of twentieth century avian biology.

Notes

1. S.A. Gauthreaux, "The Ecology and Evolution of Avian Migration Systems," in D.S. Farner and J.R. King eds., Avian Biology Vol. 6. (New York: Academic Press, 1982). p. 101.

2. D.E. Allen, The Naturalist in Britain. A Social History (London: Pelican Books, 1978), p. 119.

3. Ibid., pp. 214-23.

4. Ian McLaren, The Birds of Sable Island (Halifax: Nova Scotia Institute of Science, 1981), pp. 6-9.

5. C.S. Houston, "The Wemyss sisters: Saskatchewan's First Lady Birdwatchers, 1898-1940," Blue Jay 39 (1981): 25-29.

6. NMNS, Taverner papers, Percy Taverner to William Rowan, 18 January 1985.

7. P.A. Taverner, "A Discussion of the Origin of Migration," The Auk 21 (1904): 333.

8. For a more detailed account see M.G. Ainley, "Lewis McIver Terrill-Promoter of Bird Study and Conservation in Quebec," Tchebec 12 (1982): 72-85.

9. NMNS, Uncatalogued papers of Lewis McIver Terrill (hereafter Terrill papers), Alexander Wetmore to Lewis Terrill, 15 September 1925.

10. H.B. Wood, "The History of Bird Banding," The Auk 62 (1945): 256-65.

11. L.J. Cole, "Suggestions for a Method of Studying the Migration of Birds," 3rd. Report of the Michigan Academy of Sciences, 1901, pp. 67-70; reprinted in the Bulletin of the Michigan Ornithological Club 4 (1903): 67-70.

12. The Auk 21 (1904): 410.

13. ROM, SC 30, Uncatalogued papers of the Great Lakes Ornithological Club (hereafter GLOC papers), P.A. Taverner, "The tagging of birds," Circular Letter, 2/05; Wood in his history states that S.P. Baldwin was the first, in 1913, to use traps in bird banding. Although Wood corresponded with Taverner concerning the latter's role in banding, the ailing Taverner forgot to mention this brick trap.

14. NMNS, Taverner papers, Percy Taverner to H.B. Wood, 12 February 1944.

15. The New England (later Northeastern) Bird Banding Association was founded in 1922, the Eastern in 1923, the Inland in 1922, and the Western in 1925.

16. Miner shot crows, hawks and anything else that he considered a threat to his waterfowl. See J. Miner, Jack Miner and the Birds (Chicago: The Reillie and Lee Company, 1923); J.M. Linton and C.W. Moore, The Story of Wild Goose Jack. The Life and Work of Jack Miner (Toronto: CBC Enterprises, 1984).

17. See notes to this effect in The Condor, 1923, and Bird Banding 1930.

18. R.I. Bowman, "Chimney Swift Banding at Kinston, Ontario from 1928 to 1947," The Canadian Field Naturalist 66 (1952): 151-64.

19. NMNS, Taverner papers, V.C. Wynne-Edwards to Percy Taverner, 18 November 1930.

20. W. Rowan, "The Scientific Aspects of Bird Banding," Bulletin of the Northeaster Bird Banding Association 4 (1928): 32.

21. W. Rowan, "Experiments in Bird Migration," Transactions of the Royal Society of Canada, 3rd. Series, Section V, 40 (1946): 123.

22. NMNS, Taverner papers, William Rowan to Percy Taverner, 21 November 1919.

23. ROM, Fleming papers, William Rowan to J.H. Fleming, 22 September 1920.

24. Ibid.

25. NMNS, Taverner papers, William Rowan to Percy Taverner, 27 December 1922.

26. Ibid.

27. ROM, Fleming papers, William Rowan to J.H. Fleming, 17 February 1924.

28. W. Rowan, "Experiments in Bird Migration," p. 123.

29. Ibid., pp. 123-24.

30. NMNS, Taverner papers, William Rowan to Percy Taverner, 5 January 1925.

31. W. Rowan, "Relation of Light to Bird Migration and Developmental Changes," Nature, April 4, 1925, p. 495.

32. NMNS, Taverner papers, William Rowan to Percy Taverner, 31 January 1925.

33. Ibid., 16 December 1925.

34. Ibid.

35. W. Rowan, "On Photoperiodism, Reproductive Periodicity, and the Annual Migration of Birds and Certain Fishes," Proceedings of the Boston Society of Natural History 1926, p. 183.

36. Ibid., p. 182.

37. Ibid., p. 183.

38. NMNS, Taverner papers, William Rowan to Percy Taverner, 19 August 1926.

39. H.F. Lewis, in a review of Rowan's published thesis, The

Canadian Field Naturalist 44 (1930): 71.

40. ROM, Fleming papers, William Rowan to J.H. Fleming, 30 April 1927.

41. Ibid; Rowan apparently collected great number of Eared Grebe embryos, but never used them for research. R. Lister, The Birds and Birders of Beaverhills Lake (Edmonton: The Edmonton Bird Club, 1979), pp. 48-49.

42. ROM, Ibid.

43. NMNS, Taverner papers, William Rowan to Percy Taverner, 11 February 1928.

44. NMNS, Taverner papers, William Rowan to Percy Taverner, 11 February 1928.

45. T.H. Levere, "What is Canadian about Science in Canadian History," in R.A. Jarrell and N.R. Ball, eds., Science, Technology and Canadian History (Waterloo: Wilfrid Laurier University Press, 1980), p. 20.

46. Editors' "Preface," in R.A. Jarrell and A.E. Roos, Critical Issues in the History of Canadian Science, Technology and Medicine (Thornhill: HSTC Publications, 1983), p. xiv.

47. M.W. Thistle, The Inner Ring. The Early History of the National Research Council of Canada (Toronto: University of Toronto Press, 1966), p. 19.

48. Ibid., pp. 130-31.

49. Ibid., p. 131.

50. Ibid., p. 409; letter dated 11 January 1932.

51. Ibid.

52. Ibid.

53. National Research Council, Proceedings of the Eighty-Fourth Meeting of the Council 1930, p. 35.

54. Ibid.

55. Ibid., p. 36.

56. National Research Council, Proceedings of the 123rd Meeting of the Council, 1938, p. Y-2.

57. This act, passed in 1917, is between the U.S. and Canada. It protects most migratory birds, but does not protect crows, magpies, and imported birds.

58. Apparently some members of the Alberta Game League were not able to distinguish between scientific collecting and wholesale slaughter of birds. See, NMNS, Taverner papers, William Rowan to Percy Taverner, 30 April 1929.

59. Lister, Ibid., pp. 106-155.

60. NMNS, Taverner papers, William Rowan to Percy Taverner, 20 September 1931.

61. Ibid., 1 December 1931. Rowan not only banded his birds, but also had canary-yellow automobile "Ducco" paint applied to the tail of his experimental birds.

62. W. Rowan, "Experiments in Bird Migration," p. 132.

63. Ibid., p. 133.

64. W. Rowan, "Experiments in Bird Migration III." The Effect of Artificial Light, Castrations and Certain Extracts on the Autumn Movement of the American Crow (Corvus brachyrhynchos). Proceedings of the National Academy of Sciences 18 (1932): 653.

65. Ibid., p. 641.

66. Ibid., p. 652.

67. W. Rowan, "Experiments in Bird Migration," pp. 133-34.

68. Ibid., p. 135.

69. Ibid., p. 128.

70. Ibid., pp. 128-29.

71. S.A. Gauthreaux, Ibid., p. 106.

72. W. Rowan, The Riddle of Migration (Baltimore: The Williams and Wilkins Company, 1931), p. 103.

73. (Baltimore: The Johns Hopkins University Press, 1983), pp. 98-106.

74. S.A. Gauthreaux, Ibid., p. 107.

CHAPTER 7

RAMIFICATIONS AND INTERCONNECTIONS IN CANADIAN ORNITHOLOGY, 1920-1950

I

By the second quarter of the twentieth century the transformation from natural history-ornithology to avian biology was well on its way. This change in orientation occurred simultaneously in Europe and North America, and Canadian ornithology, in spite of its difficulties, was part of this larger trend. Stresemann referred to this transformation as "ramification and interconnection" in the science of ornithology.

> Ramification through particular lines of research that have proliferated enormously from the fruitful soil of old and new problems; interconnection as the result of persistent investigation of the organic complex, leading everywhere to contact with neighboring disciplines.[1]

Factors responsible for changes in ornithological research included conceptual developments, the use of new techniques, and the strengthening of interconnections with other fields of biology. The increased need for economic ornithology and wildlife management, together with the discovery of birds as a renewable resource and later as environmental indicators, led to the growth of applied ornithology. Conceptual changes were noticeable in life history, behaviour, and migration studies. Techniques such as bird banding, colour marking, and recording

of avian vocalisations greatly facilitated these studies. Increased concern over conservation and a growing interest in wildlife management led to a large number of publications from studies carried out on the biology and ecology of these species. Ecological research, which began in the 1920s, increased greatly during the 1940s. After World War Two the scare about the effects of DDT and other pesticides on bird populations augmented research into the physiology and toxicology of birds, and underlined the need for increased environmental control.

Research prompted by conservation concerns had been conducted simultaneously in the U.S. and Canada during the 1920-1950 period. In many cases these studies complemented each other, although originally American ornithologists, as conservationists in general, were much ahead of Canadians in their concern about the rapidly diminishing numbers of birds.[2] In the U.S. a conservation philosophy was developed in the late nineteenth century by John Muir and others, who crusaded for the preservation of wilderness. Individual ornithologists, and representatives of the A.O.U., spoke out against the wholesale slaughter of birds for food or the millinery trade. The A.O.U.'s Committee on Protection of Birds, and later the Audubon Society publicized the plight of endangered birds to the extent that the U.S. government was pressured into bird-protection legislation, such as the Lacey Act of

1900 and the Weeks-Maclean Bill of 1913.[3]

In contrast, in Canada, there were no citizens' groups or scientific associations to lobby for wildlife preservation, and the federal government took little interest in the matter. The British North America Act of 1867 does not specifically mention wildlife, and the dominion government assumed that "wildlife, like other natural resources, would be the responsibility of the individual provinces."[4] Although between 1873 and 1909 "thirteen Royal Commissions were appointed to enquire into matter related in one way or another to conservation," navigable streams and rivers, and the forest industry took precedence over wildlife.[5] The Commission of Conservation, established in 1909, was an outgrowth of Canadian attempts to apply the results of up-to-date science and technology to industry. Conservation was a term simply used to introduce the notion that natural resources should be used "reasonably" for better development.[6] The provinces, on the other hand, did have some game legislation on their statute books. The present province of Ontario led conservation efforts in Canada. In 1839 it passed a comprehensive law protecting game birds; later this was extended to include fur bearing animals and insectivorous birds. Unprotected species, such as the Passenger Pigeon (Ectopistes migratorius), declined with great rapidity, however, following the westward spread of settlers, which was inevitably followed by large-scale destruction of the virgin

forest in Ontario. By the time the Ontario Government established a Royal Commission of Game and Fish in 1892, the condition of wildlife in the settled areas of the province had become dismal. The Commission's Report stressed the disappearance of several species of animals. Following the Report the government changed the Fish and Game Act, established Rondeau and Algonquin Provincial Parks, and hired nearly four hundred game wardens. In 1893, Ontario established its Game Protection Act. Some other provinces followed suit, and similar acts were established by British Columbia in 1895, Quebec in 1899, and Manitoba in 1900. Unfortunately the dominion government was not as enlightened in this areas as were the provincial ones. Nevertheless, the establishment of Canada's first waterfowl refuge at Long Lake (now Last Mountain Lake, Sask.) in 1887, and the regulations providing sanctuary conditions in Canada's national parks (1889, 1890), showed the beginnings of interest in wildlife conservation. Moreover, the unorganized Territories Game Act of 1894 included protection of wildlife in the Northwest Territories.[7] However, the federal government was slow to realize that wildlife and wildlife habitat are not endless resources. Janet Foster describes this, and points out that the concept of wildlife conservation in Canada was born at the "level of the senior civil servants," who made decisions which later influenced the government's wildlife policy.[8] Three men

in particular were responsible for the change in the government's attitude: J.B. Harkin, Commissioner of National Parks, C. Gordon Hewitt, Dominion Entomologist and Consulting Zoologist, and Maxwell Graham, who was in charge of the Animal Division of the Parks Branch.[9] These civil servants were aware of recent American conservation philosophy, and they were also familiar with the American legislation, and the scientific work of the U.S. Biological Survey.

Beginning in 1913, Harkin, Hewitt and Maxwell held a series of consultations with Canadian ornithologists Allan Brooks, J.H. Fleming, P.A. Taverner and W.E. Saunders, who stressed the need for conservation legislations for Canadian birds. The civil servants and ornithologists were both instrumental in formulating and drafting an important agreement between Canada and the U.S. The so-called Treaty for International Protection of Migratory Birds (1916), usually referred to as the "Migratory Bird Treaty," was a major advance in North American bird protection. In 1917 the Treaty was ratified and passed as the Migratory Bird Convention Act, which protected bird species named in the Treaty. These were mostly economically useful species, such as waterfowl, game birds and insect eating birds. "Vermin" species, such as hawks and owls, suspected of taking poultry, other birds accused of eating grain, introduced birds, such as the House Sparrow (Passer domesticus) and crows and magpies, were excluded from the Act.[10]

The assumption of responsibility by the government for bird protection was an important step in the development of certain lines or ornithological work in Canada. Although the federal government's concern was the reinforcement of bird protection, Migratory Bird Officers conducted "mission-oriented research" leading to conservation, and at the same time these studies of waterfowl and game birds resulted in papers which also had implications for pure science. The amount of scientific information produced by Migratory Bird Officers is remarkable, because, despite the utilitarian aspect of bird protection, conserving economically useful species of birds, money remained scarce and few people were involved in the work. Dominion Ornithologist Hoyes Lloyd, in charge of administering the Act, gave his full support, and encouraged ornithological research by his officers.[11]

Lloyd was born in Hamilton in 1888, but the family moved to Toronto while he was a young child. In his teens he became friendly with a number of naturalists, including Charles Nash, J.H. Fleming, and Professor A.B. Bensley of the University of Toronto. Lloyd, like many of his contemporaries, did not see a future in ornithology, and instead studied chemistry at the University of Toronto. He graduated with an M.A. in 1911 and from 1912 to 1918 he pursued a successful career as chemist in charge of milk control in the city's health laboratories. During the summer

of 1918, the position of Dominion Ornithologist (created at Harkin's urging), was advertised in the Canadian press. The thirty year old Lloyd, as keen on ornithology as ever, sought the advice of his influential friends concerning the advisability of changing his career. With the support of Bensley and Fleming, he entered and won the competition. His initial salary was $ 2,200 per annum, about the same as an assistant professor's.

Lloyd moved to Ottawa in late 1918, and for the rest of his life was involved in various aspects of ornithology and wildlife conservation. In 1919 his official title changed to that of Supervisor of Wildlife Protection. In this capacity he travelled across the country inspecting existing wildlife sanctuaries, surveying areas naturalists thought needed protection, meeting with farmers, hunters, ornithologists. To help him with the enforcement of bird protection, Lloyd appointed a number of temporary game wardens in 1919. He later recruited three experienced ornithologists as Federal Migratory Bird Officers, at an initial salary of $ 1,500 per annum: Robie Tufts, appointed in 1919, to take charge of Nova Scotia, Harrison F. Lewis, in 1920 to take charge of Quebec and Ontario, and James A. Munro, who became responsible for the four western provinces during the same year. In 1934 the western provinces were divided, with Munro retaining responsibility for B.C., and J. Dewey Soper becoming Migratory Bird Officer for the Prairie Provinces.

The Migratory Bird Officers were the precursors of the wildlife officers of the Canadian Wildlife Service. They carried out ornithological research, even though their original mandate was for the enforcement of the migratory bird regulations. By the time Leslie M. Tuck was hired as "Wildlife officer" for the new Canadian province of Newfoundland in 1949, scientific research became an important part of the Dominion Wildlife Service. From the late 1920s a number of scientists were hired on contracts, and after World War Two student assistants worked with American wildlife biologists on waterfowl surveys under the auspices of the U.S. Fish and Wildlife and the Dominion Wildlife Service. Graham Cooch and other students obtained excellent field experience this way, which was put to use when they became part of the scientific staff of the Canadian Wildlife Service.[13]

During the 1920s and 1930s most of the scientific activity undertaken by Migratory Bird Officers concerned waterfowl. Their efforts were part of a continent wide attempt to increase knowledge of the ecology and biology of waterfowl, which in the 1930s led to the establishment of two private organizations for waterfowl research, conservation and habitat management.

The enormous number of waterfowl nesting on lakes, sloughs, marshes, and potholes in western Canada has impressed hunters, settlers, and naturalists for a long time. When

westward settlement eliminated much of waterfowl habitat in the United States and southern Canada, nesting birds retreated towards the undeveloped parts of the continent. They continued to use their ancient flyways on migration and congregated on their usual staging areas in huge numbers, where they provided sport for an increasing number of hunters, and a supplementary food supply for the rural population. Although waterfowl had been studied by many naturalists since the time of early explorations, in the twentieth century their economic importance promoted a renewed interest in their breeding biology, diseases and habitat requirements. Writing in 1920, the artist-naturalist Allan Brooks emphasized the urgent need for more study "on these hitherto rather neglected birds," the ducks.[14]

In the eastern parts of Canada, Robie W. Tufts and H.F. Lewis investigated waterfowl biology. Tufts was born in Wolfville, Nova Scotia in 1884. He was greatly influenced by his mother, a keen botanist and Principal of the Acadia Ladies' Seminary. Young Robie began to collect birds and eggs, and record his observations of nature at an early age. Tufts attended Acadia University, where his father was a professor of economics, and after his graduation he went to work for the Bank of Montreal in Wolfville. In 1918 he resigned from the bank to study the birds of Nova Scotia. His appointment as Federal Migratory Bird Officer enabled him to do just that. His mandate was to educate the public on bird

conservation, and enforce migratory bird laws. Tufts was one of the first Canadians to band waterfowl, and his knowledge and enthusiasm inspired many young students to pursue bird studies. W. Earl Godfrey wrote recently that he "wisely instructed his proteges in the fundamentals of ornithology and impressed upon them the necessity of a formal education."[15] Tufts had many useful connections, and was instrumental in securing "foothold employment" for many of his promising young friends. Godfrey regards this as one of his "major accomplishments, for his students went on to hold positions, including some of the highest, in museums, universities, wildlife management organizations, and other institutions in both Canada and the U.S."[16] Lewis' contributions to life history studies have already been discussed in chapter 5. He also published numerous papers on conservation, bird-banding, and the economic importance of birds. His studies on the food habits and numbers of waterfowl were particularly important, and his interest in the Starling and the Double-crested Cormorant made these birds the subjects of his Master's and Doctoral thesis respectively. Soper's explorations have been dealt with in chapter 4. As Migratory Bird Officer he continued his investigation in the life history of the Blue Goose, and published papers on the biology and ecology of waterfowl.

The economic importance and ecology of waterfowl

figured prominently in the researches of James Alexander Munro. J.A. Munro, a keen conservationist and ornithologist, was born in Manitoba in 1884. In 1898 the family moved to Toronto, where young Jim began to work for a silk company. In his spare time he started collecting birds. In the rather small community of Toronto naturalists it was inevitable that he should meet Dr. William Brodie, and other local ornithologists. Brodie, an excellent all round naturalist, encouraged Munro's interest and influenced his decision to become a full-time collector and naturalist. In 1911 Munro moved to the Okanagan Valley of British Columbia, where he operated a small fruit farm. One of his neighbours was Allan Brooks, and the two ornithologists began spending considerable time together in the field, a pursuit more attractive to Munro that fruit farming. When Hoyes Lloyd suggested that he apply for the position of Migratory Bird Officer for the western provinces, Munro complied with alacrity, and remained in the employment of the Parks Branch for the rest of his career. His duties included selecting lands for sanctuaries and public hunting grounds, lecturing, writing popular articles, and to a lesser extent, scientific research on migratory birds, chiefly waterfowl. A prolific writer, Munro began publishing ornithological papers while stil living in Toronto. After 1920 his scientific output increased and diversified. He became concerned with the ecology of waterfowl, discussing such areas as food, predator-prey relationships, and diseases.

His quarter-century of research on waterfowl in the western provinces also investigated issues important from an economic point of view, such as the possible harmfulness of ducks for fisheries. Most important among his many publications were his 1923 study on the relations of ducks and gulls to the propagation of sockeye salmon, and a series of works co-authored with W.A. Clemens, Director of the Pacific Biological Station (Department of Fisheries), on the food of mergansers and other waterfowl. The papers discussed the relationship of these birds to salmon and herring, and to each other, related prey items, according to size, to various ducks, and listed stomach contents of the birds under investigation. Like Allan Brooks before him, Munro was aware of the significance of habitat, including shelter, type of vegetation and food, to waterfowl. The importance of habitat in waterfowl biology became recognized as an urgent topic for investigation during the 1930s, when the decline in waterfowl numbers, combined with the effects of an extended drought, necessitated studies for their conservation and management.

II

Although members of the scientific staff of the Dominion Parks Branch had huge territories under investigation, they had to carry out their research on a shoestring budget. In contrast, large-scale, well organized

waterfowl studies were pursued in Canada by two private organizations. These were the Delta Waterfowl Research Station and Ducks Unlimited (Canada), which began functioning in the late 1930s.

The Delta Waterfowl Research Station was the creation of James Ford Bell, an American industrialist and conservationist. Bell, an avid hunter, was familiar with Delta Marsh, at the southern end of Lake Manitoba, a region used by migrating waterfowl as a staging area. Many species of waterfowl also nested at Delta Marsh, and these features made it a hunter's paradise. Concerned about the rapidly diminishing numbers of waterfowl, and convinced that waterfowl is a renewable resource, Bell decided to try raising ducks in a hatchery.

Bell established his hatchery in 1931 and his plan to return more ducks to the marsh than had been taken by hunters proved to be a success. Within a few years he looked for ways of learning more about wild nesting ducks. After a number of discussions with various American and Canadian scientists Bell decided to establish a waterfowl research station, where researchers could use the resources of both the hatchery and the marsh itself. At the hatchery, Bell and his manager Edward Ward had begun to look "deeper by testing the effects of various hormonal and ultraviolet light treatments on reproduction" under the direction of William Rowan.[17] Rowan was also one of three scientists recruited to serve as

Advisory Board for the new research station.

Bell's original plan, supported by his advisors, was to create a station where graduate students would conduct research on waterfowl. This pioneering concept was so successful that by the early 1950s students from nine different universities in Canada, the U.S. and Britain had investigated various aspects of waterfowl biology. Best known among them in H. Albert Hochbaum.

Hochbaum was born in Colorado in 1911, and studied at Cornell. In the mid-1930s Hochbaum spent three years working for the American national parks system. Later, at the University of Wisconsin, he became a graduate student of Aldo Leopold who, impressed with Hochbaum's potential, [redacted] that he undertake research on the Canvasback (Aythya valisineria) at Delta, and at the same time manage the small station.[18] With an initial grant of $ 1,000 from the American Wildlife Institute, Hochbaum arrived at Delta in 1938 to pursue the research that was to make both him and the research station famous. In addition to the Canvasback, Hochbaum also investigated other ducks nesting at Delta Marsh, studying such topics as sex ratio, courtship, territoriality, and broods. He also stressed the importance of vegetation, loafing areas, and the post-breeding season. His book, The Canvasback on a Prairie Marsh was published in 1944 by the American Wildlife Institute. Among the book's most important contributions was

the recognition of appropriate breeding territory. Hochbaum later said that "it became clear that many square miles were required to produce a flock of ducks; that a wilderness marsh could hold no higher densities of pairs than slough and pothole country in rich agricultural land."[19] The author's smooth descriptive style, multitude of pertinent observations, solid scientific data and lovely pen and ink illustrations made the book an instant success among naturalists. It has remained a classic study of waterfowl biology to this day. The book brought Hochbaum many honours. He was awarded the prestigious Brewster Medal of the A.O.U. in 1945, even before he was elected Member of that organization.[20] He also received the Literary Award of the Wildlife Society. At the University of Wisconsin he received an M.Sc. for research done at Delta Waterfowl Research Station. He subsequently published a series of important papers on both waterfowl biology and practices of waterfowl management, and two more books on waterfowl.

A great advantage of Delta Station has been the opportunity to study problems simultaneously using both captive and wild birds, and graduate students from many universities have taken advantage of this. By 1982 more than fifty North American universities had sent their students to Delta: seventy masters and forty doctoral theses have been concluded since 1938, and hundreds of publications had resulted from these studies.[21] The Delta Waterfowl Research

Station was the first instance of joint American-Canadian venture in ornithological research. Although sponsored by the American Wildlife Institute, scientists and students were assisted from a variety of resources. The Dominion Parks Branch (and later the CWS) supplied banding and collecting permits for certain projects. The U.S. Fish and Wildlife Service, the Manitoba Department of Mines and Resources, and the Manitoba Game and Fisheries Branch also provided advice and assistance. Students were funded by their own universities, the American Wildlife Institute and in some cases the National Research Council of Canada. Delta Station also received cooperation from Ducks Unlimited.

Ducks Unlimited (Canada) is a good example of a cooperative conservation and management establishment which incidentally produces studies of significance to waterfowl biology. Like Delta Station, Ducks Unlimited has also evolved from a background of private initiative and funding. The precursor of Ducks Unlimited was an American organization named "The More Game Birds in America Foundation" which, after analysing available data on game birds in 1930, proposed a ten year plan for the "restoration of Game Birds" in North America. In 1931 the Foundation published "More Waterfowl by Assisting Nature," which was prepared with the cooperation of American and Canadian hunters, conservationists and naturalists. This publication, as Ducks Unlimited historian

W.G. Leitch has commented, was probably the "first contact" between Canada and the United States "for the purpose of discussing the current status of waterfowl resource, the destruction of habitat, and the remedial actions which might be taken."[22] It recommended that an international agency be founded to increase migratory waterfowl production, and outlined plans for raising funds to finance acquiring breeding grounds, and to develop techniques of habitat management. It also called for the establishment of waterfowl refuges.

The proposal for the establishment of such an international agency was a major step in Canadian waterfowl conservation and management, since there were no private Canadian conservation agencies and no large scale programs for habitat management. In the early 1930s Delta Station was still a newly established duck hatchery, and the Dominion Parks Branch, as we have seen, had only three permanent employees to study game bird biology, ecology and conservation and attempt to enforce migratory laws. No private or public funds were available for improving waterfowl breeding grounds, an unfortunate situation in view of the disastrous drought of the 1930s, which destroyed considerable waterfowl breeding areas. Conservation and hunting interests south of the border changed this. The More Game Birds in America Foundation conducted a survey of Canadian waterfowl in the early 1930s. Officials of the Foundation met with a number of Canadian naturalists, "sportsmen" and businessmen,

to discuss what could be done to improve the waterfowl situtation. Two of the more important people involved in these preliminary discussions were E.B. Pitbaldo, a Winnipeg lawyer, who was a member of various provincial fish and game associations, and Bertram W. Cartwright, a noted Winnipeg ornithologist. The information provided by them, and other Canadian "contacts" enabled the Foundation to publish "The Duck Decline in the West" in 1933. This publication recommended the idea that waterfowl should be censused on their breeding grounds. This proved to be so successful that after World War Two both the Canadian and the U.S. Fish and Wildlife service carried out regular breeding ground censuses. An experimental air survey in 1934 introduced another useful method which is still used. And finally an International Waterfowl Census was conducted by the Foundation in 1935. This consisted of ground surveys in the Prairie Provinces, Minnesota and the Dakotas, and aerial surveys in areas north of the agricultural fringe. The results of this census had long-term implications for waterfowl conservation and research in Canada, since it established beyond any doubt that nearly 95% of waterfowl in the surveyed areas nested in Canada.[23]. To preserve this extensive Canadian breeding ground a concerted effort was needed. In the absence of Canadian initiative and funding, the organization and financial backing for such a scheme came from America.

At the suggestion of the Foundation, Ducks Unlimited (Canada) was established and incorporated in early 1937. It was governed by a joint Canadian-American board composed of businessmen and sportsmen, and was financed by funds contributed by American hunters. However, since the aims of Ducks Unlimited were the conservation and management of Canadian waterfowl, the organization proposed to cooperate with both federal and provincial wildlife officials.

Ducks Unlimited was, on the whole, welcome in Canada. The Fish and Game Associations of Manitoba, Saskatchewan and Alberta were all in favour of it, although some individuals objected to an American based organization operating in Canada because they feared that it would benefit only Americans. It took a long time and extensive public relation efforts to allay these fears. Ducks Unlimited began functioning in 1938, when the sum of $ 100,000 was made available for its operation.[24] Early in that year T.C. Main, a water engineer with the Canadian National Railways, became its General Manager, and Bertram W. Cartwright was hired as Chief Naturalist.

Cartwright was born in England in 1890, emigrated to Canada in 1911, and settled in Winnipeg, where he became friendly with local ornithologists A.G. Lawrence, C.G. Harrold and C.L. Broley. However, ornithology had to remain an avocation for Cartwright until 1938. When the newly organized Ducks Unlimited recruited personnel, Cartwright first applied

for the post of General Manager. When Main was appointed to that position, Cartwright, with the support of Lawrence and Broley, received the post of Chief Naturalist, and held it until his retirement in 1960. Cartwright, like many other naturalists, had been interested in conservation. He had taken part in the Manitoba Fish and Game Association's game and waterbird censuses, useful experience when he began to organize surveys for Ducks Unlimited. The surveys estimated waterfowl populations at the end of each breeding season, and since many of the ducks nested in otherwise inaccessible northern areas, surveys from planes became the annual task of the naturalists. Luckily for him, Cartwright was one of those people who remain unaffected by bumpy rides in small planes, and while his coworkers were air-sick much of the time, "Bert bounced happily up and down on the front seat, recording ducks, geese, pelicans, and anthying else that interested him."[25]

In addition to breeding ground surveys, Ducks Unlimited instituted major projects in each Prairie Province, banded ducks, (more than 42,000 were banded up to the end of 1945, a remarkable achievement considering war-time travel restrictions), studied duck diseases, and was involved in habitat management. This latter work included restoring and managing former breeding areas, control of fires and predators, managing sanctuaries and creating new breeding

areas.

From its inception the organization created job opportunities for summer students. W. Ray Salt and Victor Solman were among those who spent summer seasons in the field studying waterfowl habitat requirements and predation. Salt, later professor of human anatomy at the University of Alberta, and author of the Birds of Alberta, was the first to show that jackfish predation results in duck mortality. Solman spent three summers in the field investigating a number of biological problems. His study of Northern Pike (Esox lucius) predation on ducklings formed the basis of his doctoral dissertation, and was published in Ecology in 1945.

Developing and maintaining good public relations was important for Ducks Unlimited. In 1939 Angus Shortt, a Manitoba artist-naturalist was engaged as artist-technician-writer. Popularizing knowledge of waterfowl brought farmers, hunters and naturalists up-to-date on current problems, census work, and other aspects of the organization's work. Shortt worked closely with Cartwright on newsletters, radio broadcasts and films, and they cooperated in the publication of Know your ducks and geese (1948) and Hawks of Western Canada (1949).

At the end of World War Two, Ducks Unlimited programs were expanded. After conducting initial surveys of waterfowl breeding habitats and studying ecological requirements of breeding duck populations the organization initiated a cost-

sharing program with the three Prairie Provinces to protect marshes on the northern fringe of agriculture. This was prompted by fear that the "return of veterans would result in the same land rush, with the same attendant poor land-use decisions that characterized the period immediately after the First World War."[26] The expansion of the organization into eastern Canada was of major importance, and was prompted by the studies of an American "flyway biologist" working for the U.S. Fish and Wildlife Service who made an initial survey of the Black Duck (Anas rubripes). Since the eastern Black Duck population needed extensive study, Ducks Unlimited engaged Bruce Wright to study this species, at facilities provided by the University of New Brunswick. Wright had studied forestry before the war. His interest in wildlife biology prompted him to accept the position with Ducks Unlimited, and to pursue graduate studies in wildlife management at the University of Wisconsin. In 1947, when Ducks Unlimited and the Wildlife Management Institute established an eastern research centre, as a counterpart to Delta, Wright became its Director. The Wildlife Management Institute supported the Northeastern Wildlife Station at the University of New Brunswick until 1963. After that time, until Wright's death in 1975, it came under the auspices of the University of New Brunswick. Wright published two books on his Black Duck research, and he and other biologists at the Station also published numerous

articles on waterfowl biology.

The publications of ornithologists employed by the Dominion Parks Branch, Ducks Unlimited, Delta Waterfowl Research Station and the Northeastern Wildlife Station provided information for both conservation and management and basic biology. Wildlife management has been defined as "the art of making land produce valuable populations of wildlife."[27] However, natural populations do vary in size, sex-age composition, reproduction, and mortality rates. To be able to manage wildlife, biologists must have a great deal of life history data at their disposal, to provide information on all aspects of the biology and ecology of the species. Lewis, Munro, Soper, Hochbaum, Cartwright, Solman and Wright were among those Canadians who pursued pioneering studies on waterfowl biology and ecology. The resulting increased understanding of a number of species and their specific requirements enabled governmental agencies and private conservation organization to provide suitable nesting and staging areas. Only this way were serious population declines avoided and the extinction of several species prevented.

Ducks Unlimited and the Delta Waterfowl Research Station were also important for another reason. At a time when the Parks Branch lacked trained manpower and elaborate facilities for conducting biological investigations of waterfowl, Ducks Unlimited and Delta provided much needed employment opportunities for scientists and graduate students,

which led to the establishment of new career options for aspiring Canadian ornithologists.

III

During the 1920-1950 period there was an increased emphasis on ecological studies of birds. Some of these were on individual species, bringing an ecological orientation into life history studies. Others were conducted on bird populations. Through them ornithologists began to investigate biological problems affecting their and other disciplines. They started to cooperate with botanists, meteorologists, ichthyologists, mammalogists, entomologists and parasitologists.

Investigation of the relationship of birds with vegetation and with other animals was relatively new in the early 1920s. While plant ecology flourished in Britain and in the United States, animal ecology, in spite of important early publications by C.C. Adams and Victor Shelford, lagged behind. Percy Taverner blamed the slow development of avian ecology on incorrect methodology; ecologists, he wrote to Fleming "have usually failed lamentably with birds because they attempt to use the methods they have evolved in botany with an absolutely stationary population."[28] There were exceptions: In Canada the studies of H.F. Lewis and J.A. Munro considered such factors as habitat requirements, food, predator-prey

relationships. Game birds, also economically useful species, provided the subject of many other projects. The studies of breeding biology and population fluctuations of non-migratory game birds, otherwise called gallinaceous birds, or birds of the grouse family, were particularly important. Research on them constituted the first interconnection of ornithology with population ecology.

Gallinaceous birds were known to exhibit extreme population variations. Some years they were abundant, in others almost totally absent. Similar population fluctuations were also observed amongst fur-bearing animals, insects, fish and other birds. Settlers in the west have long been familiar with periodic outbreaks of grasshoppers. Hunters reported a lack of game birds in Ontario in Forest and Stream in 1883, and the fur-trading records of the Hudson's Bay Company and the Moravian Mission in Labrador contained references to good and bad years in fur catches. Reports of the early naturalists also mentioned extremes in animal populations, but the idea of fluctuating populations did not appear in the "ornithological literature until after it was well established by sportsmen."[29]

Research on animal populations and the factors affecting them began at about the same time across various parts of the northern hemisphere. There were obvious economic benefits from the ability to predict periods of abundance and dearth in animal numbers, and scientists, hunters, fishermen

and conservationists set out to find the causes for their fluctuations. Ernest T. Seton was the first naturalist to plot graphically the obvious periodicity of fur-bearing animals, using old records of the Hudson's Bay Company.[30] J.H. Fleming used old publications to document the occurrence of the birds of Toronto, noting peak years of Snowy Owls (Nyctea scandiaca).[31] W.E. Saunders and E.M.S. Dale documented the fluctuations of Pine Grosbeaks (Pinicola enucleator).[32] C. Gordon Hewitt, referred to Seton's graphs, in his Conservation of the Wild Life in Canada and discussed the periodic or cyclic nature of animal populations.[33] At about the same time Norman Criddle began his long-time investigations of the population fluctuations of grasshoppers and grouse in Manitoba.

By the early 1920s ornithologists began to consider the study of non-migratory game birds, and their periodic outbreaks and "crashes", as an interesting "problem" for scientific research. The widespread documented evidence of numerical changes at last caused them to question the "how" and "why" of changes in game bird populations. Other scientists became interested in the periodicity of fur-bearing animals, and since mammal fluctuations were correlated with the fluctuations of certain birds of prey, such as the Snowy Owl, the Great Horned Owl and the Rough-legged Hawk (Buteo lagopus), questions such as predator-prey relationship,

availability of food supply, breeding and mortality rates, and habitat requirements began to come to the fore. At the National Museum, R.M. Anderson and P.A. Taverner, after several seasons of field work, had plenty of first hand evidence of changing animal populations, which was supported by naturalists across the country. In 1919 Taverner suggested to Saskatchewan Game Commissioner Fred Bradshaw that grouse population fluctuations would make an interesting study.[34] Bradshaw followed Taverner's advice; the Game Commissioner's Annual Reports of the early 1920s documented the increase in grouse numbers. In Alberta, William Rowan became aware of the "problem" soon after he joined the Alberta Game League in 1920. A few years later he apparently "scandalised" the Game League, when he predicted another "crash" for 1927. He later told Taverner, that at the time "[Prairie] Chicken were just beginning to get really thick again through central Alberta, and all thought that I was cracked."[35] He began research on this species, actually the Sharp-tailed Grouse (Tympanuchus phasianellus), in 1924, and decided to "Work the rabbit [Snowshoe or Varying Hare] at the same time, partially as a check."[36] In northern New York State and Minnesota, conservationists and ornithologists had investigated population changes in the Ruffed Grouse (Bonasa umbellus) since 1917. In Britain, after an early government inquiry into the diminishing numbers of game birds, the study of animal populations gained scientific respectability following

Charles Elton's work on small mammal population changes in Spitzbergen. His Animal Ecology (1924) initiated a new orientation in the study of birds and other animals.

In another example of American initiative and funding, researchers working on a variety of animals exhibiting population fluctuations met in July 1931 at Matamek, Quebec, as guests of American conservationist Copley Amory. The "Matamek Conference of Biological Cycles" was the first instance of scientists of a number of disciplines meeting to discuss the specific problem of fluctuating animal populations. Amory's aim was to provide a forum for exchange of information, not only by researchers, but also by representatives of various industries, such as forestry, transportation, fisheries, and by government officials. He hoped that the conference would help to coordinate future research, and possibly even to lead to the establishment of a permanent headquarters where such studies could be pursued.

Amory's interest in the subject had been awakened by the plight of the Indians living near his hunting lodge on the North Shore of the St. Lawrence. Dependent on fish, fur-bearing animals and game birds, during periods of scarcity the Indians lived in extreme poverty. After discussions with both the Hudson's Bay and Royal Danish Trading Companies, Amory became convinced that these companies "would benefit in economy and efficiency by conducting their trade with more

knowledge of the phenomenon of cycles."[37] Hudson's Bay officials arranged a meeting at Oxford between Amory and Elton, who since 1925 had been working as consultant for the company. Elton persuaded him that the subject would benefit greatly from a conference at which researchers from various backgrounds could discuss their ideas, and the wealthy American invited scientists from Canada, the U.S. and Europe to meet with Government officials, representatives of fisheries, forestry, transportation, and the Hudson's Bay Company for scientific sessions and round-table discussions. Participants were responsible for their own transportation to Matamek, but once there they were Amory's guests.

The conference attracted a surprisingly large and diverse group of participants, although not everyone invited was able to attend. The Canadian government was represented by the Hon. Pierre Casgrain, Charles Camsell, and J.B. Harkin; Quebec by L.A. Richards, Edgar Rochette, and Col. Frank Staunton. There were also other non-scientists: inspectors of fisheries, representatives of a pulp and paper company, an administrator of the St. Lawrence district of the Hudson's Bay Company, the President of the Quebec Fish and Game Association, and various Canadian and American fisheries agents and commissioners.

The invited members of the scientific community included museum curators, ichthyologists, entomologists, mammalogists, ornithologists, parasitologists, meteorologists

and an astronomer. Canadian scientists present were R.M. Anderson of the National Museum of Canada, J.R. Dymond, representing both the Royal Ontario Museum and the University of Toronto, Harrison F. Lewis, William Rowan and marine biologist A.G. Huntsman from the University of Toronto and the Department of Marine and Fisheries. Ralph de Lury of the Dominion Observatory was also present.

The first paper was Elton's "Fluctuation in wildlife" in which he discussed the world wide nature of the problem, and stressed the need for more data. Elton reported that Vito Volterra, the Italian mathematician working on theoretical formulations of the population problem, found that in the late 1920s there were still not enough biological data for him to use in his work. In view of the later importance of Volterra's equation for population biology, his complaint is an indication of the elementary state of the subject in that period. Elton also emphasized that the study of animal populations was important for both "economic considerations" and for the investigations of evolution and behaviour of wild animals.[38]

Canadian contributions included talks by Rowan, Lewis, Anderson and Dymond. Rowan discussed the fluctuation of wildlife in western Canada, and theorized that the phenomenon of population cycles might be affected by the amount of ultraviolet radiation, the presence or absence of Vitamin D,

and the detrimental effects of parasites on game birds. Lewis used census data collected by the National Parks Service to show that weather influenced the size of seabird colonies in the Gulf of St. Lawrence. As representative of the National Museum, Anderson discussed the importance of surveys and life history studies of all animals for obtaining information on population numbers. J.R. Dymond spoke about turning museums into repositories, not only for study skins and exhibition material, but also to make such research material as a stomach contents and parasites "readily available for other researchers."[39] American scientists gave papers on their investigations of game bird cycles, Snowy Owl invasions, and diseases of wild animals.

The conference also became a forum for discussion of training and financing of researchers, and the problems of Canadian research were highlighted by the comparison with the financial support available in Britain and the U.S. At Oxford, with the aid of the Hudson's Bay Company, preparations were under way to establish a Bureau of Animal Population under Elton's direction. In the U.S. the ammunition and sporting good companies provided fellowships in agricultural colleges for cooperative studies of animal populations. In Canada, Dymond pointed out, there were no private sources to fund research, and government agencies had been unable or unwilling to provide in their stead. Other than ichthyology, relatively well funded because of its economic importance to

fishery, graduate work in ornithology and mammalogy went unsupported, and with few employment prospects these fields attracted few graduate students.[40]

The gloomy fiscal prognosis for Canadian research clouded discussion of future study of population fluctuations. American scientists proposed to continue their regional and state-wide studies, while their British counterparts pinned their hopes on Elton's Bureau of Animal Population. Dymond's and Rowan's plans for increased Canadian work were cautiously optimistic. Dymond admitted that, although the University of Toronto had been interested in the subject, no research was actually under way. Much accumulated data was available for research on populations, however, both at the University and at the Royal Ontario Museum. Moreover, the Museum, which served as a clearing house for Ontario naturalists, was in an excellent position to gather further information on bird and mammal populations in Ontario.[41] Rowan spoke of his hopes for inter-departmental cooperation at the University of Alberta.

As had happened so often before, Canada provided the natural setting for research funded and conducted by non-Canadians. Following the conference three sets of studies got under way. The Bureau of Animal Population, funded by the Hudson's Bay Company, Oxford University, the Carnegie Corporation and various other agencies, began functioning in 1932. During the 1930s and the 1940s Elton, together with

Mary Nicholson, Dennis and Helen Chitty, conducted extensive investigations, mostly based on questionnaires, in Canada. Their long-term investigations of the Lynx (Lynx canadensis), Snowshoe Hare (Lepus americanus), and other forms of wildlife in the Canadian Arctic began in the early 1930s at the request of Commissioner of National Parks, J.B. Harkin. The Bureau of Animal Population was the logical choice for this research. It was well funded, and its members were researchers competent to investigate problems in population ecology. Since most of the cyclic fluctuations in animals occurred in the northern part of the northern hemisphere, the large tracts of practically uninhabited areas of Canada were an ideal area for the study of the problem. Moreover, the long-standing records of the Hudson's Bay Company, derived from virtually the same area, could be compared to and correlated with modern data. The Wildlife Division of the National Parks Branch was chiefly an administrative organization; it could only encourage small scale research, such as that pursued by Munro and other Migratory Bird Officers, and scientists working on seasonal contracts. It was, therefore, pleased to cooperate with the Bureau of the Aminal Population and reap the benefits of their long-term research.

At the University of Alberta, Rowan began work on a limited scale. He proposed an intensive multidisciplinary study of the ten-year cycle in the Edmonton district as early as 1929, and had been in touch with Elton for a number of

years, because Elton provided him with information on the subject of cycles from sources "entirely out of reach of an institution like ours with a limited library."[42] On the basis of data collected since 1924, Rowan attempted to organize various departments at the University of Alberta for a cooperative study. The botany department was to investigate tree-rings, the biochemistry department was to do a series of experiments "to get an idea of the connection between ultraviolet light and the animals concerned," the pathology department was to investigate diseases in fluctuating animal populations, and the physics department was to record ultraviolet radiation for at least ten years. The records of the meteorological office in Edmonton went back before the turn of the century, and Rowan hoped to use these in coordinating the results of various aspects of this project.[43]

Despite this well-thought out project, Rowan's output on cycles was surprisingly low. Although his work encompassed three decades, the long time periods involved in studying complete cycles, and his increasingly onerous duties as teacher in a rapidly expanding zoology deparment, prevented him from fully exploring the topic in his publications. Although he came to regard the problem of fluctuating animal populations as "Canada's Premier Problem of Animal Conservation," and in an article he reviewed the ecological variables contributing to population fluctuations, he had no

solution to the problem.[44] Rowan did inspire others to take up the subject, however. Lloyd B. Keith, one of Rowan's many excellent graduate students, later summarized all that was then known in Wildlife's Ten Year Cycle (1963). He dedicated his book to the memory of William Rowan, "a distinguished scientists, my teacher, and friend."[45]

In contrast to the research project at the University of Alberta, Dymond and his students at the University of Toronto, and researchers at the Royal Ontario Museum, produced a number of significant publications on the problems of cyclic phenomena and general population ecology. An important figure in Canadian zoology and conservation, J.R. Dymond was born in Ontario in 1887, and after teaching public school, studied at the University of Toronto. He graduated with a B.A. in 1912, and went to work for the Department of Agriculture as a seed analyst. In 1919 he returned to the University of Toronto, and in 1920 graduated with an M.A. in zoology. Subsequently he lectured in systematic zoology, and conducted faunal surveys in Ontario, particularly on fish. As Secretary of the Royal Ontario Museum in 1922, he initiated faunal surveys by the museum staff. At the time of the Matamek conference he was Assistant Director of the Royal Ontario Museum, and his double appointment at the university and the museum enabled him to use the resources of both and direct students to undertake research to up-to-date importance.

When Dymond returned to Toronto after the Matamek

conference he persuaded C.H.D. Clarke to enter graduate school in the Department of Biology to study the cycle of the Ruffed Grouse in Ontario. At the same time Duncan MacLulich, another graduate student in the department, began to investigate the cycle of the Snowshoe Hare. In the following years Dymond encuraged J. Murray Speirs to undertake population studies of birds, and it was probably due to Dymond's interest in population studies that Margaret Mitchell, at the museum, undertook her research on the Passenger Pigeon in Ontario.

C.H.D. Clarke, son of a Methodist minister, was born in Kerwood, Ontario in 1909. His mother, a teacher and naturalist, interested him in birds at an early age and he was later influenced by W.E. Saunders and Hoyes Lloyd. With poor prospects for a career in biology, Clarke decided to study forestry, because the booming lumber and paper industries in the 1920s meant that jobs were virtually guaranteed to students. In 1931, returning from a summer job he met Dymond, who rushed him through registration in the graduate school at the University of Toronto, and gave him place in his office, where MacLulich occupied the other desk. Pleased to be returning to his first scientific interest, Clarke was happy to work on the fluctuations of the Ruffed Grouse, while MacLulich pursued the companion study on the Hare. During the following years the two used the facilities of the Ontario Fisheries Laboratory at Lake Nipissing to carry out field work

in the area. Later they stayed at an old hunting cabin at Algonquin Park. In 1934 Clark was hired by the Superintendent of Algonquin Park, who immediately freed him from all duties as ranger to enable him to complete his project. Clarke's experience demonstrates how public servants were sometimes able to support ornithological research, even though their government gave them neither money nor mandate to do so.

After finishing his dissertation Clarke worked for the National Museum, collecting for Anderson. Later he was employed by the Dominion Parks Branch and in the mid-1940s he moved to the Ontario Department of Lands and Forests and became actively involved in the development of wildlife management in Ontario. In this position he was instrumental in channelling Department funds to young researchers working on their dissertations in ornithology.[46]

For his research into the fluctuation of the Ruffed Grouse, Clarke conducted censuses of populations of spring adults, and broods of young, and studied the life history of the species. He investigated the ecological type preference of the bird and studied the "distribution of grouse territories in various cover types"[47] By mapping these, he was able to establish the vegetation in each territory. Clarke found not only that grouse abundance varied in different parts of the province in any given year, but that in some localities the population increased, while in other it decreased. In his conclusions of the immediate cause of dying

off in grouse populations Clarke demonstrated that theoretical relationships between prey and predator, studied by Volterra, might apply in the case of grouse populations. In predator-prey relationships, according to Volterra, in which one species destroys the other, the "numbers" of the "eater" are a function of the numbers of the "eaten," a relationship which the Italian mathematician demonstrated will lead to a cycle. Clarke found that this relationship is valid for the parasite Leucocytozoon bonasa and the Ruffed Grouse, provided the "eater" is the number of black flies infected with the parasite.[48]

Clarke's paper was well received by the scientific community. Taverner praised it as a contribution to the ecology and life history of the Ruffed Grouse. Witmer Stone, Editor of The Auk, considered it such a valuable study that he recommended that it be read by state and provincial game commissioners in all areas where the grouse occurs,[49] and it has remained a classic study to this day. Clarke's work had benefited from MacLulich carrying on research on a different animal in the same area. Since the Ruffed Grouse and Snowshoe Hare both have cycles of approximately ten years, many of the basic biological and ecological problems encountered by Clarke were also encountered by MacLulich. Their cooperation enabled them to consider larger biological and ecological problems of population fluctuations and as a result they produced landmark

papers in this field.

IV

Margaret Mitchell, The Passenger Pigeon in Ontario, was another landmark publication, because it investigated the causes of perilous population decline in a once abundant species of bird. Mitchell was born in Toronto in 1901. As a child she became interested in birds and after graduating from the University of Toronto with a B.A. in 1924, she became affiliated with the Royal Ontario Museum. From 1929 to 1935 she conducted investigations into the reasons for the disappearance of the Passenger Pigeon, a species that occurred in enormous numbers in North America until the middle of the nineteenth century. The extinction of this species raised many questions among naturalists-conservationists. Speculations and theories of its disappearance were numerous, yet there was no firm evidence to substantiate any explanation.

Ontario ornithologists J.H. Fleming, L.L. Snyder and J.L. Baillie have long been interested in the debate concerning the reasons for the extinction of this species. Actually Fleming's interest began around the turn of the century, when the Passenger Pigeon still existed, albeit in very small numbers. The Royal Ontario Museum's interest was further encouraged by naturalist Paul Hahn, who over the years had tracked down many specimens of this species, buying them

from farmhouses, barbershops, and taxidermists. By donating this collection to the Royal Ontario Musuem, Hahn created the largest existing collection in Canada, seventy birds as compared with the National Museum's three.[50]

In 1926, a dozen years after the last of the species died in the Cincinnati Zoo, the Royal Ontario Museum decided to circulate a questionnaire to people across Ontario, many of whom still remembered the Passenger Pigeon. The questionnaire was designed to accumulate data on the range, nesting, food, migration and numbers, and destruction of the species. Supplemental information was requested on questions such as "In what ways were they prepared for the table?" "Was there any use made of the feather?" and "Give names of persons who have mounted specimens of the pigeon."

Responses to the questionnaire provided a "mass of data." These, combined with descriptions found in letters and diaries of early settlers, and articles by early naturalists, plus information provided by museum specimens, enabled Mitchell to publish the first monograph of this species. Her approach was ecological. The book demonstrates the close relationship between the Passenger Pigeon and forest distribution in North America. Although all of Ontario was within its range, it bred mostly in well forested areas. It was also found, albeit irregularly, towards the north. Following the outline of the questionnaire, Mitchell discussed

food items taken by the bird at different seasons and at different parts of its range. She stressed the correlation between the bird's habitat, behaviour and existence, and tabulated all information concerning the locality, date, and size of nesting colonies, indicating the types of trees used.

The food value of the pigeon was important, so it was hunted by settlers and market hunters alike. It also provided good sport and was used as a live target in trap shooting. In the nineteenth century American professional pigeoners conducted a brisk trade in pigeons; millions of birds were killed by poling, trapping, shooting and netting at their communal roosts and nests. Because the birds periodically fed on freshly sown seeds, farmers considered them as nuisance, and welcomed their wholesale destruction.

Mitchell, familiar with Elton's publications and with current research in population studies conducted under the auspices of the museum and the University of Toronto, questioned whether the Passenger Pigeon could have exhibited cylcic fluctuation. She found that, although there was considerable evidence of local abundance and decline, repeated over large areas of North America, these were not indications of cyclic fluctuation. Pigeon years occurred simultaneously over large areas annually between 1853 and 1879. After that, all populations declined rapidly.[51] In The Passenger Pigeon in Ontario (1935), Mitchell argued that a variety of factors were responsible for its disappearance: loss of habitat,

extensive market hunting, high specialization and lack of adaptability, and the possibility of diseases and parasites. These combinations of circumstances resulted in a decrease in population density below the minimum needed for perpetuating a breeding population. Although at the time no scientific explanation could be given for this, she considered the lack of adaptability of the species as an important factor in its inability to recover from low population density. Mitchell argued that man was the immediate cause of decline in populations, but that extinction followed for biological reasons. Although she could not determine what would have constituted a viable breeding population, it was evident that by the time game legislation added the Passenger Pigeon to the list of protected species, it was too late.[52]

Mitchell's book was favourably reviewed in ornithological journals. Stone praised it for its care in "selection and use of data and in scientific method" and commended the author for "prosecuting such a piece of research."[53] In addition to its inherent scientific interest the book deserves mention as the first major contribution by a Canadian woman ornithologist. Her subsequent publications included a number of articles on ecology and behaviour of birds, and a book on the birds of southeastern Brazil.

Fluctuations in birds other than game were studied in the late 1930s by J. Murray Speirs, a graduate student at the

University of Toronto. Speirs was born in Toronto in 1909, and began keeping notes on birds as a teenager. As an undergraduate at the University of Toronto, he became interested in numbers of birds seen in the Toronto district. After working at the University as demonstrator in astronomy and zoology, he began graduate studies in zoology as a Wright's scholar, and received an M.A. in 1938. He pursued doctoral studies at the University of Illinois, receiving a Ph.D. in ornithology in 1946 with a thesis on the local and migratory movement of the American Robin in Eastern North America. Working for the Ontario Department of Lands and Forest in 1946, he was the first Canadian ornithologist to study the effects of DDT on birds and other forest vertebrates. In 1947 he joined the Zoology Department of the University of Toronto as lecturer, and has been active in Ontario conservation and population studies of Ontario birds. His work included radar investigations of bird migration, life history studies, and research on breeding biology and population dynamics.

In his first major paper on population biology, Speirs discussed species exhibiting cyclic fluctuations which had been neglected, or only considered by very few researchers. He established three sets of cycles, the 3-5 year cycle of the Rough-legged Hawk and the Northern Shrike (Lanius excubitor), a 5-6 year cycle of the Pine Grosbeak, and a 9-11 year cycle of the Goshawk (Accipiter gentilis) and the Great Horned Owl.

He also correlated the cycles of the Great Horned Owl, Rough-legged Hawk, Snowy Owl and Northern Shrike with their prey, voles (Microtus sp.), living in northern regions. He found that the peaks of abundance of predators and prey have sometimes failed to coincide, and the examination of birds, found dead during periods of abundance, proved that the specimens were in seemingly good physical condition. He concluded, therefore, that emigrations and fluctuations did not occur simply because of lack of food. Instead, he attributed the occasional southward movements of birds of prey to high population densities which accentuated their migratory tendencies.[54]

Canadian investigations of population fluctuations continued throughout the 1940s, although the efforts, according to Dymond, were not "commensurate with either need or opportunity."[55] This was partly due to the usual lack of funding and the absence of sufficient number of trained researchers in Canada, and partly to the absence of a central Canadian organization to undertake research in population biology. Moreover, research in population studies was not the only area that lagged behind that of waterfowl studies. In contrast to waterfowl management programs instituted in the 1930s, game management did not advance at all until after the middle of the century. Only in the early 1950s did Manitoba begin to experiment with habitat management "to improve the

productivity of its pheasant range."[56] Following Rowan's recommendations, Alberta "pioneered in an attempt to harvest a much larger proportion of the [grouse] population during years of great abundance." This program aimed to "remove" birds which otherwise overcrowd an area, and "become subject to displacement hazards," and attempt to reduce "the severity of the decline by reducing the density that precedes it."[57]

V

In the post 1950 period, trends begun in the previous decades continued and intensified. Research on migration, life history, behaviour, physiology, ecology, conservation and management of birds was pursued on an increasingly scientific basis, in the form of more experimentation, numerical analyses, and theoretical formulations. Although unaffiliated researchers continued to contribute to ornithology, there were more employment opportunities in Canada for university trained ornithologists and wildlife biologists. The Canadian Wildlife Service, under the direction of Harrison F. Lewis, increased its scientific staff considerably after the middle of the century.[58] Provincial departments of wildlife and conservation, museums, universities, and private consulting agencies also provided career opportunities. After the harmful effects of DDT and other pesticides were demonstrated by ornithologists, studies in the ecology, physiology, and toxicology of songbirds and birds of prey increased. Birds

became recognized as excellent environmental indicators, ensuring funding for ornithological research.[59]

By the middle of the twentieth century, the day of the all round ornithologist was past. Natural history studies have been replaced by others on biology, behaviour, systematics, ecology and evolution of birds. Although the ramifications and interconnections of ornithology with other disciplines have reached new heights since 1950, it is evident that the transformation from natural history to avian biology was accomplished in the 1900-1950 period.

NOTES

1. Erwin Stresemann, Ornithology. From Aristotle to the Present (Cambridge: Harvard University Press, 1975), p. 351.

2. In 1870, "sportsmen," that is hunters, in Toronto distributed posters to encourage compliance with Upper Canada Game Laws.

3. The Lacey Act was the first federal statute for bird protection in the U.S., designed to abolish market hunting by forbidding transportation of birds across state lines. It also prohibited the importation of foreign birds, considered injurious to native birds and to agriculture. The Weeks-Maclean Bill authorized the Department of Agriculture to protect migratory birds.

4. Janet Foster, Working for Wildlife. The Beginning of Preservation in Canada (Toronto: University of Toronto Press, 1978), p. 8.

5. B. Sinclair, N.R. Ball, and J.O. Peterson, Let us be Honest and Modest. Technology and Society in Canadian History (Toronto: Oxford University Press, 1974), p. 261.

6. Official Report of the Debates of the House of Commons of the Dominion of Canada, 1909, pp. 355-370.

7. F.W. Lothian, A History of Canada's National Parks. 4 vols. (Ottawa: Minister of Supply and Services of Canada, 1981), 4: 52.

8. Foster, Ibid. p. 13.

9. The Parks Branch was established in 1911. Both Harkin and Graham joined in 1912. Hewitt came to Canada from England in 1909. He was the only one of the three with a degree in zoology.

10. The Act gave authority to the Governor-General-in-Council to make necessary regulations to protect the birds defined in the Act.

11. The importance of Hoyes Lloyd, administrator, conservationist, A.O.U. President, and an important figure in international bird protection cannot be adequately dealt with here. Although a keen amateur ornithologist, his major contributions were in bird portection, rather than in ornithology.

12. See, C.H.D. Clarke, "In Memoriam: Hoyes Lloyd," The Auk 96 (1979): 402-406, and V.E.F. Solman, "Hoyes Lloyd," in A.S. Hawkins et al. (eds.) Flyways. Pioneering Waterfowl Management in North America (Washington: U.S. Government Printing Office, 1984), p. 101.

13. Lothian, Ibid., pp. 59-60. In 1947, with the splitting of the Department of Mines and Resources, the National Parks Bureau became the National Parks Service. At the same time the former Wildlife Division became the Dominion Wildlife Service, CWS, in 1950.

14. Allan Brooks, "Notes on Some American Ducks," The Auk 37 (1920): 353.

15. W.E. Godfrey, "A Tribute to Robie Wilfred Tufts, 1884-1982," The Canadian Field Naturalist 98 (1984): 514.

16. Ibid.

17. Charles H. Bell and Peter Ward, "Delta Waterfowl Research Station," in Hawkins et al., Flyways, p. 327.

18. Aldo Leopold, often called the "Father of Wildlife Management," established the first Department of Wildlife Management in the United States, at the University of

Wisconsin in the early 1930s. His ideas on management were laid down in Game Management, published in 1933, which influenced management practices for the next two decades.

19. H.A. Hochbaum and E.F. Bossenm ier, "Waterfowl Research-Accomplishments, needs, objectives," Transactions of the Thirtieth North American Wildlife and Natural Resources Conference, 1965, p. 223.

20. The Brewster Award, named after pioneering American ornithologist William Brewster, was the only prestigious award given by the A.O.U. at the time. In 1945 the committee administering the award recommended Francis H. Kortright, a Toronto sportsman, who compiled a useful manual on the ducks, geese, and swans of North America. Because the author carried out no original research the committee's recommendation was not accepted and instead Hochbaum received the Award. He became Member of the A.O.U. in 1946. In 1947 Kortright was recommended again and received the Brewster Award; see M. G. Ainley, "Recognitions of Excellence" in K. B. Sterling and M. G. Ainley, A Centennial History of the A. O. U. (Washington:A.O.U.), [in press].

21. Bell and Ward., Ibid.

22. W.G. Leitch, Ducks and Men. Forty Years of Cooperation in Conservation (Winnipeg: Ducks Unlimited, 1978), p. 14.

23. Of the 42,700,000 ducks surveyed, 40,500,000 nested in Canada.

24. In contrast, Delta Station had an expenditure of only 2,000 in 1940, and government appropriations for migratory birds increased from $ 8,600 in 1918-19 to $ 51,000 in 1938-39.

25. Leitch, Ibid., p. 32.

26. Ibid., p. 131.

27. J.A. Bailey, Principles of Wildlife Conservation (New York: John Wiley and Son, 1984), p. 7.

28. NMNS, Taverner papers, Percy Taverner to J.H. Fleming, 27 December 1932.

29. C.H.D. Clarke, "Fluctuation in Numbers of Ruffed Grouse Bonasa umbellus (Linne), University of Toronto Studies, Biological Series, 41 (Toronto: University of Toronto

Press, 1936), p. 7.

30. E.T. Seton, Life Histories of Northern Animals 2 vols. (New York: Charles Scribner's Sons, 1909), and Arctic Prairies (New York: Scribner's, 1911), pp. 95-112.

31. J.H. Fleming, "The Birds of Toronto," The Auk 24 (1907): 71-89.

32. W.E. Saunders and E.M.S. Dale, "A History and List of the Birds of Middlesex County, Ontario, Canada, to December 31st, 1931," Transactions of the Royal Canadian Institute Vol. 19, Part 2, (1933): 161-248.

33. C. Gordon Hewitt, The Conservation of the Wild Life in Canada (New York: Charles Scribner's Son, 1921).

34. NMNS, Taverner papers, Percy Taverner to Fred Bradshaw, 6 November 1919.

35. NMNS, Taverner papers, William Rowan to Percy Taverner, 2 December 1930.

36. Ibid., 13 February 1924.

37. Proceedings of the Matamek Conference on Biological Cycles Matamek, 1932, p. 2.

38. Ibid., pp. 14-17.

39. Ibid., p. 38.

40. Ibid., p. 25.

41. Ibid., p. 289.

42. Ibid., p. 295.

43. Ibid.

44. William Rowan, "Canada's Premier Problem of Conservation. A Question of Cycles," New Biology 9 (1950): 38-57.

45. Lloyd B. Keith, Wildlife's Ten-Year Cycle (Madison: The University of Wisconsin Press, 1963).

46. One of the young researchers who benefited from Clarke's encouragement and financial assistance provided by the Ontario Department of Lands and Forests, was Dr. Kathleen Fetherston Ball, granddaughter of W.E. Saunders. Ball studied zoology at the University of Western Ontario,

graduating with B.A. honours zoology in 1944. During the next year she worked as research assistant to H.F. Lewis, but was not allowed to do field work. With the encouragment of Dr. Oliver Hewitt, Chief Migratory Bird Officer for Quebec and Ontario, she went to graduate school at Cornell, M.S. 1946, and Ph.D. 1949. She spent three summer seasons doing field work on Pelee Island, the area of the densest population of Ring-necked Pheasant (Phasianus colchicus) in Canada.

47. Clarke, Ibid., p. 11.

48. Ibid., pp. 105-106.

49. Witmer Stone, "Recent Literature," The Auk 53 (1936): 463.

50. Margaret H. Mitchell, The Passenger Pigeon in Ontario (Toronto: University of Toronto Press, 1935), pp. 150-52.

51. Ibid., pp. 129-130.

52. Ibid., pp. 137-139.

53. Witmer Stone, "Recent Literature," The Auk 53 (1936): 113.

54. J. Murray Speirs, "Fluctuation in Numbers of Birds in the Toronto Region," The Auk 56 (1939): 411-19.

55. J.R. Dymond, "Fluctuations in Animal Populations with Special Reference to Those of Canada," Transactions of the Royal Society of Canada, Vol. 41, Series 3, 1947, p. 26.

56. Ian McTaggart Cowan, "Wildlife Conservation in Canada," The Journal of Wildlife Management 19 (1955): 174.

57. Ibid., p. 173.

58. By the late 1970s, sixty ornithologists and a number of mammalogists, limnologists, etc., worked for the CWS.

59. The Canadian National Sportsmen Fund and Canadian Industries Limited were among the first to fund game bird research in the post-1950 period.

CONCLUSION

By the middle of the twentieth century the transition from natural history to avian biology had been accomplished in North American ornithology, and Canadian ornithologists were among those whose work had contributed to this transformation. New methods, new approaches and new theories permeated all aspects of ornithology during the first half of the century. In addition to mere observations and descriptions, which characterized old fashioned natural history studies, experiments complemented field observations of birds. The combination of laboratory (aviary) and field studies reoriented life history, behaviour and migration research. Bird photography and bird banding became useful tools in these studies.

Museum work also changed. In the late nineteenth and early twentieth centuries museum curators aimed to build study collections of representative series of birds inhabiting each particular geographic area, and to pursue taxonomic studies based on these collections. They also organized displays for exhibitions, which served an important function in public education. Although these remained major aspects of museum work, field expeditions studying geographic distribution from evolutionary and ecological points of view began to take over from old fashioned collecting expeditions.

Science in Canada has long been guided by an "entrepreneurial scientific ideology,"[1] which discouraged the development of certain lines of research. Because of this prevailing utilitarian attitude to science, ornithology was not promoted by the Canadian government until the second decade of the twentieth century. During the following decades the National Research Council of Canada, imbued with notions of practical science, did not support the research of even the most outstanding of Canadian ornithologists. Universities, struggling to maintain some lines of basic research, were also unable to fund research on birds. Consequently most Canadian ornithologists pursued research on their own initiative and in their own time. The absence of financial support forced Canadian ornithology to develop predominantly outside the institutional framework, universities and research institutions, usually considered necessary for scientific research. In addition to the lack of government funding, Canada had no large pools of private capital willing to underwrite scientific research. Until the 1950s, funding for Canadian ornithologists came from foreign sources: the Royal Society of London, the U.S. National Research Council, and various private and university research funds.

This might seem to suggest that Canadian ornithology was dependent on external influences for its development, but this is only partially correct. Although certain lines of

investigation, such as waterfowl research, conservation, and the expansion of Rowan's migration research benefited considerably from American and British funds, most of Canadian ornithology developed despite the absence of funding.

This is not to say that there were no external influences on ornithology in Canada. The framework of Basalla's three-stage model of the "spread" of western science has some applicability to the development of ornithology in Canada. During the seveteenth, eighteenth and early nineteenth centuries, birds and other natural history specimens were sent to Europe where the scientists who had requested them in the first place incorporated them into their existing schemes of classification.[2] From the mid-eighteenth to the mid-nineteenth century Britain was the scientific centre for Canadian natural history-ornithology. Bird specimens were sent to the Royal Society of London, or to the Zoological Society, and also to some natural history museums. Articles on birds found in Canada were published in British journals. Books by Edwards, Pennant, Latham and Richardson contained observations and descriptions of Canadian birds. Even after some Canadian learned societies were established in the 1820s, Canadian naturalists were influenced by British ideas and institutions of natural history. The learned societies were not only scientific but also social institutions, and it was not until the 1850s that they became

truly scientifically oriented, and began to publish their own scientific journals.[3]

After the middle of the nineteenth century the British influence in Canadian natural history diminished and the United States began to assume importance in its stead. American natural history surveys began to penetrate Canadian territory, the specimens collected by American naturalists were sent back to the U.S., and some Canadian naturalists also began to provide specimens and observations to American natural history museums. Articles by American naturalists-ornithologists on Canadian birds began to appear in American journals, while Canadian naturalists began to publish articles in the new Canadian scientific periodicals, and also in some American journals. At the same time their contributions to British journals decreased. During this period, Canadian ornithologists began to visit American natural history collections, form friendships with American naturalists, and exchange specimens and information with their American colleagues. In spite of the prevailing rhetoric about British and Canadian ties in science, the development of Canadian natural history in the second half of the nineteenth century took place in a larger North American context.[4] At a time when American naturalists began extending their investigations into Canadian territory, Canadian naturalists also began to study the flora and fauna of their own country. In the 1880s, Canadian ornithologists established institutional affiliations

with American ornithologists; Thomas McIlwraith and Montague Chamberlain were among the founders of the American Ornithologists' Union, and later worked on several committees. Chamberlain was also Associate Editor of The Auk. Other Canadians, including H.G. Vennor, W.E. Saunders and John Macoun, became Members and Fellows of that organization.

The emergence of an active, albeit small, ornithological community in late nineteenth century Canada meant that, in spite of the slow institutionalization of the science, Canadian ornithology was not a "colony" of American ornithology in the sense of Basalla's second phase. Indeed, the relationship between Canadian ornithologists and their American colleagues in the established centres of the eastern seaboard was similar to that between western American ornithologists and their eastern colleagues. While Canadian and American ornithologists regarded themselves as equals, there was a difference between the amount of ornithological work accomplished by American and Canadian institutions. In the United States, the older Biological Survey and the various natural history museums had more funds and personnel than the Dominion Parks Branch and the Victoria Memorial and Royal Ontario museums, all established in the second decade of the twentieth century. American institutions could send more frequent and better equipped expeditions into Canada than could their Canadian counterparts, and as a result they

acquired better collections of Canadian birds. Because they had more personnel, American institutions allowed their curators to devote more of their time to research. At the various Canadian museums of natural history there was little time for taxonomic research; consequently this aspect of Canadian ornithology advanced very little during the 1860-1950 period.

In the areas of life history, behaviour, migration, and the biology of economically important species of birds, Canadians contributed to theoretical and methodological advances in ornithology. Henry Mousley was a pioneer of the territoriality theory, and an early experimentalist in life history study. Roy Ivor was one of the first to study 'anting' in birds and to conduct comparative studies on wild and semi-tame birds. J.A. Munro, H.F. Lewis and H.A. Hochbaum studied the biology and ecology of waterfowl. The well-known experimental research of William Rowan on the physiological basis of migration initiated a large volume of new research in Europe and in the United States and brought him world-wide fame.

Recognition of the achievements of Canadian ornithologists came from scientists at home and abroad, although formal recognition of their scientific excellence was quicker in the U.S. than in Canada. Canadian ornithologists were elected Members and Fellows of the American Ornithologists' Union as early as 1883; some were

corresponding members of the British Ornithologists' Union. Taverner, who became a Fellow of the A.O.U. in 1917, did not become Fellow of the Royal Society of Canada until 1935. Rowan, who had been a Member of the A.O.U. since 1927, was not elected to the RSC until 1934.

The accomplishments of Canadian ornithologists were an important part of North American ornithology, and Canadians were an integral part of the North American ornithological community, rather than a colonial appendage.[5] Their research contributions were instrumental in the transformation of ornithology from nineteenth century natural history to modern avian biology; they also helped establish the tradition of ornithological research in Canada. This in the 1950s led to the expansions of the Canadian Wildlife Service, the ornithology departments of the National Museum of Natural Sciences, the Royal Ontario Museum and other provincial museums of natural history. Ornithology also became part of academic training in biology, ecology and wildlife management in Canadian universities.

The works of Canadian ornithologists discussed in this thesis are still cited; they have stood the test of time.

Notes

1. T.H. Levere, 'What is Canadian abut Science in Canadian History?" in R.A. Jarrell and N.R. Ball, eds., Science, Technology and Canadian History (Waterloo: Wildfrid Laurier University Press, 1980), p. 20.

2. Basalla, Ibid., pp. 359-381.

3. R.A. Jarrell, "The Social Function of the Scientific Society in Nineteenth-Century Canada," in Richard A. Jarrell and Arnold E. Roos, eds. Critical Issues..., pp. 31-47.

4. R.A. Jarrell, "British Scientific Institutions and Canada: The Rhetoric and the Reality," in Transactions of the Royal Society of Canada Series 4, Vol. 20 (1982): 533-547.

5. M.G. Ainley, "Canadian Involvement in the A.O.U.," in K.B. Sterling and M.G. Ainley, A Centennial History of the A.O.U., [in press].

APPENDIX

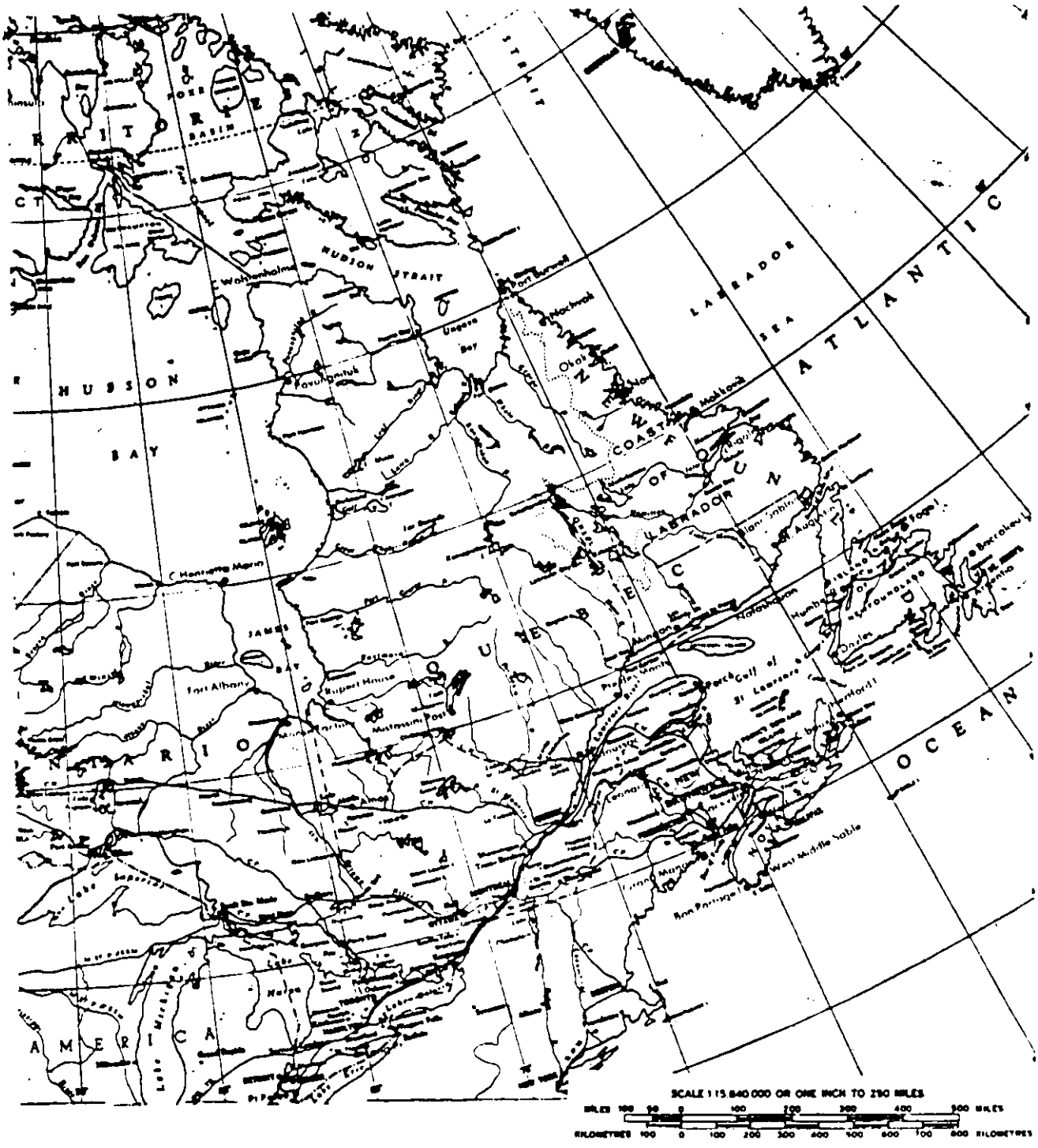

Fig. 1. Locations of Ornithological Importance in Eastern Canada

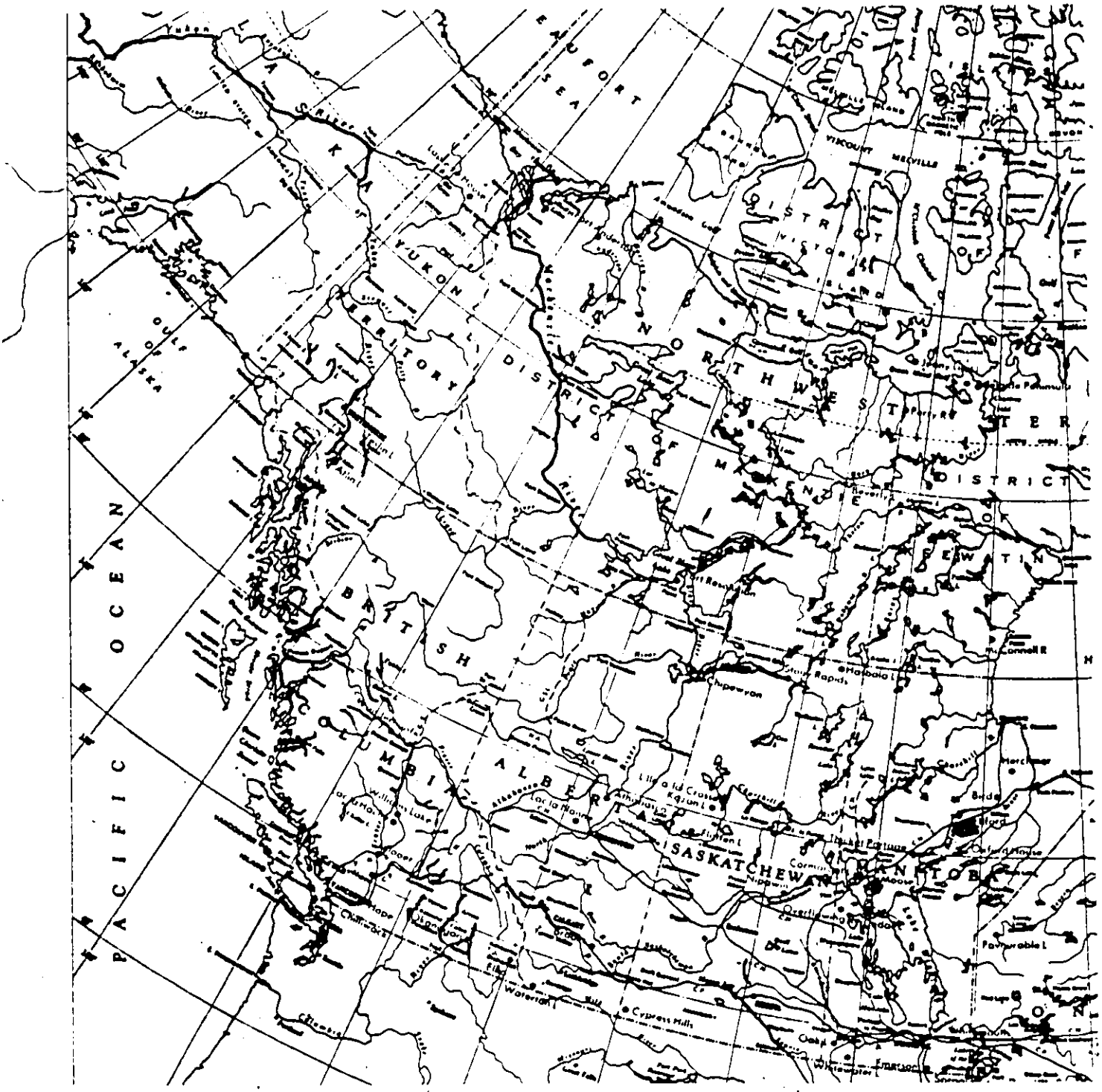

Fig. 2. Locations of Ornithological Importance in Western Canada

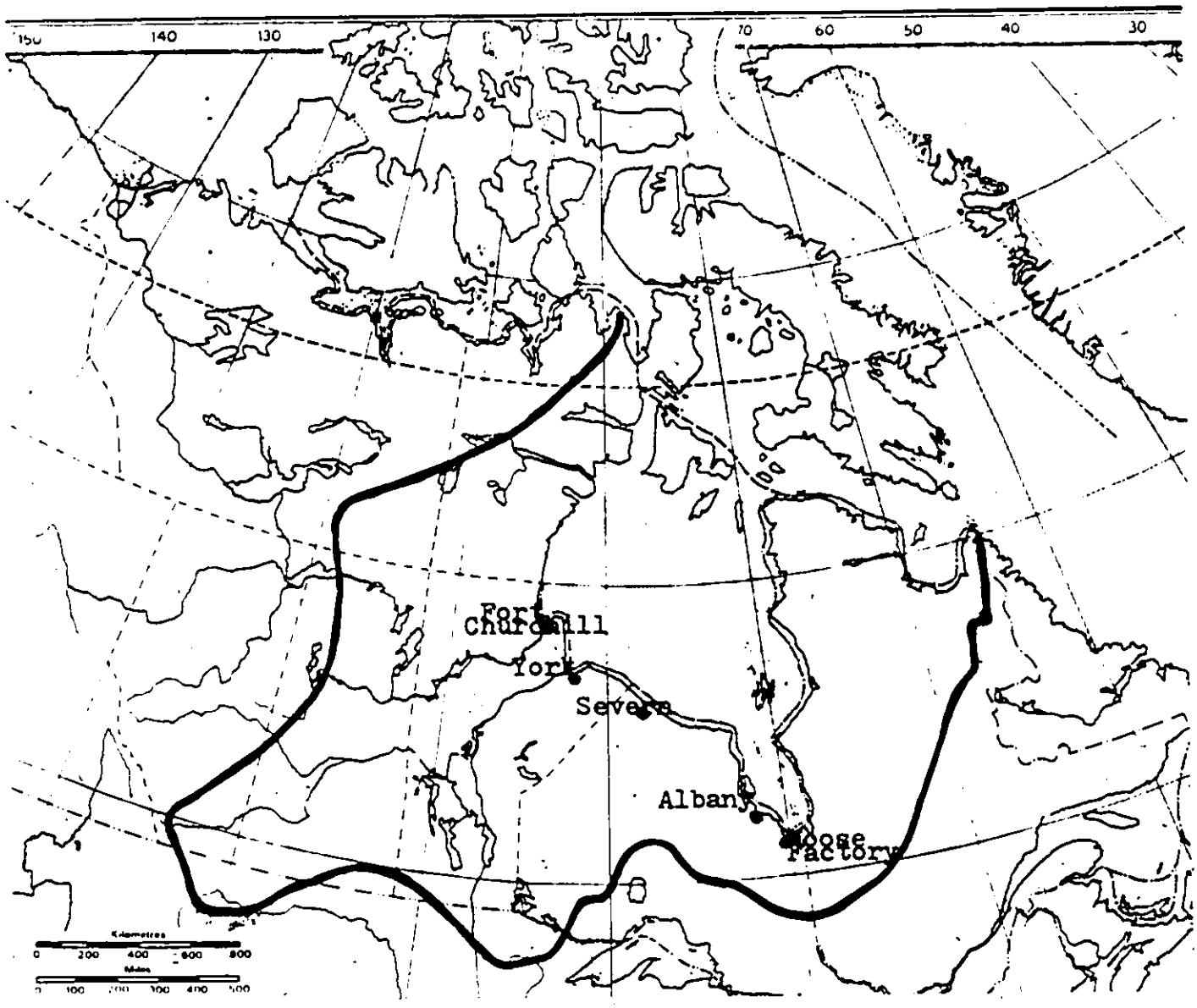

Fig. 3. Hudson's Bay Territory, 1670-1870

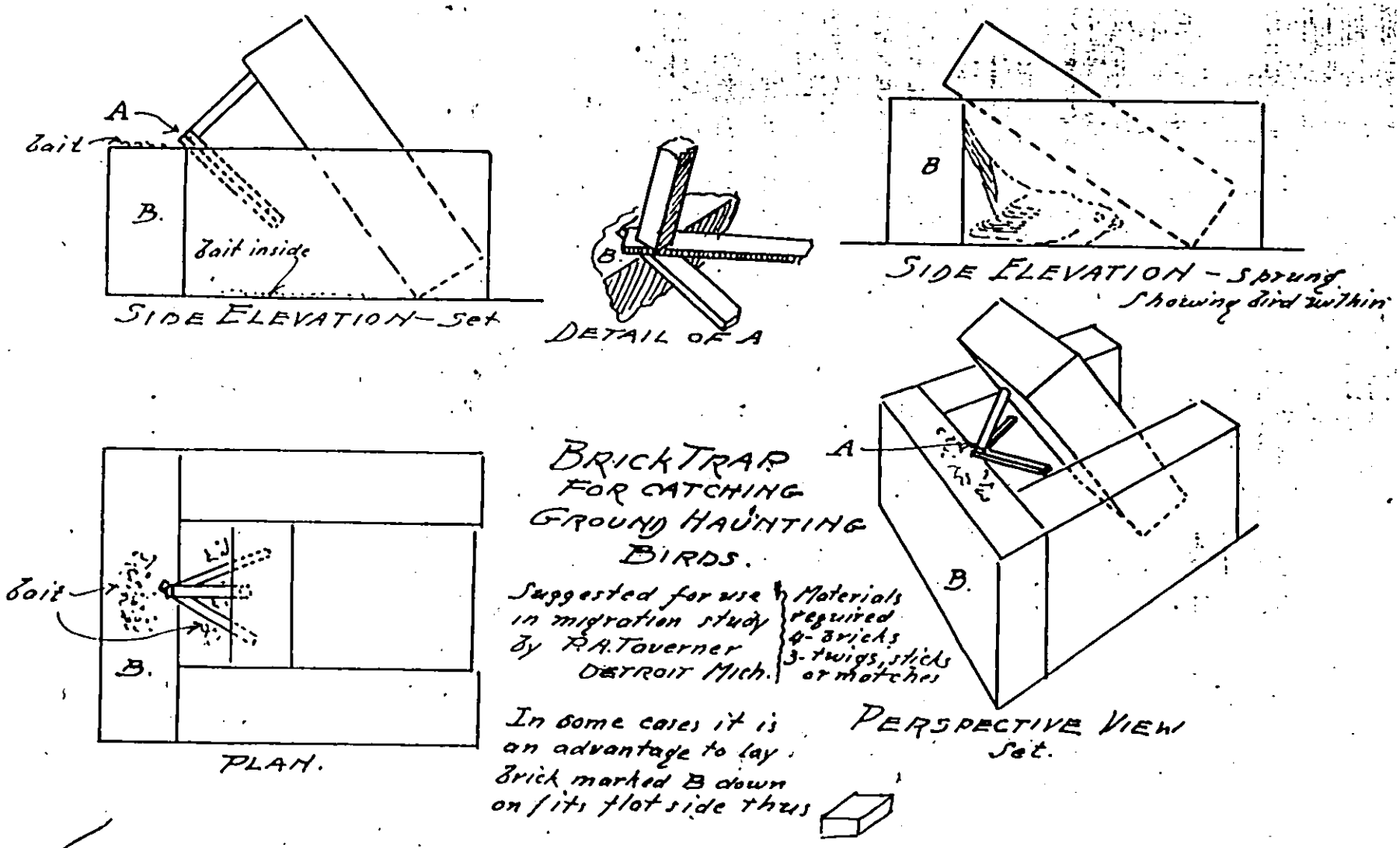

Fig. 4. Taverner's Brick Trap for Catching Birds, 1905.

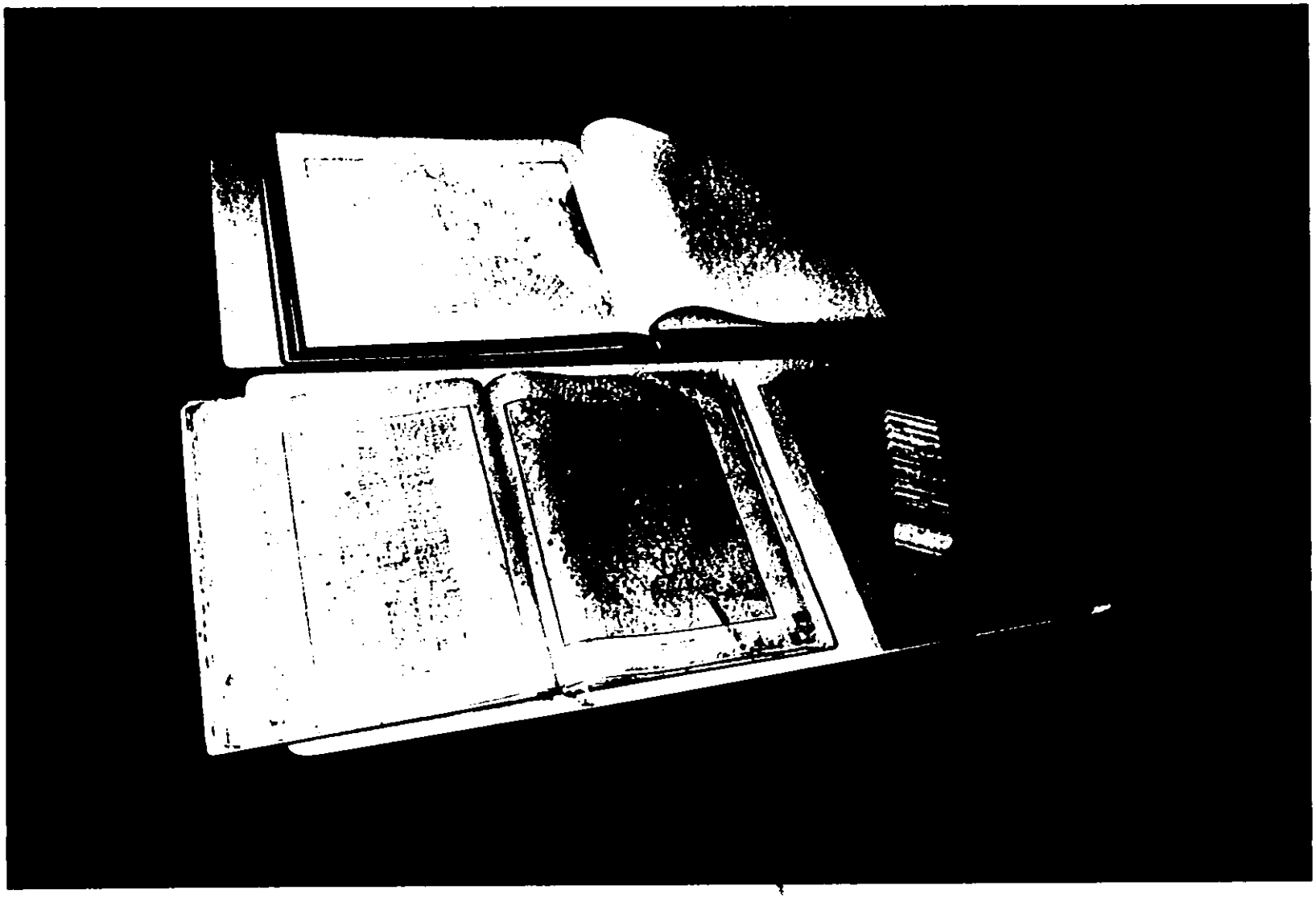

Fig. 5. Taverner's Mapping and Cataloguing System,
National Museum of Canada

Fig. 6. Taverner "preparing" a Curlew at the "Shack" at Point Pelee, c. 1909.

a)

b)

Fig. 7. Off to the 'field' in the early 1920s:
a) H. H. Mitchell in Saskatchewan
b) W. J. Brown (left) and W. H. Mousley in Quebec.

Fig. 8. The first Canadian woman field assistant:Dorothy Mitchell in Saskatchewan, 1921. Left:"collecting"; right:cooking in camp

Fig. 9. Two Canadian women ornithologists, mid-1940s.
Left: Louise de Kiriline Lawrence, banding a bird;
Right:Doris H. Speirs observing nesting birds.

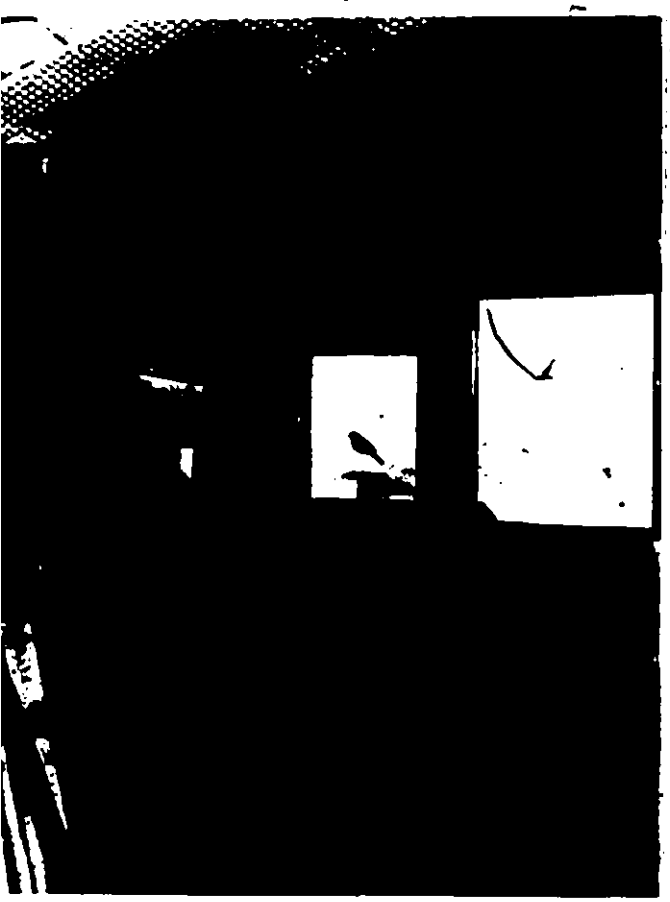

Fig. 10. William Rowan's aviaries at the University of Alberta.
Left:"Home made" aviary for Juncos, 1925;
Right: Large aviary for Crows, 1931.

Fig. 11. William Rowan in the "field," Alberta, Early 1940s.

BIBLIOGRAPHY

Manuscript Collections

Harvard University-Museum of Comparative Zoology Archives
- William Brewster Papers

McGill University-Blacker Wood Library Archives
- J.A. Allen Papers
- R. Ridgway Papers
- C.A. Wood Papers

National Museum of NaturalSciences-Vertebrate Zoology Division
- R.M. Anderson Papers
- W.E. Godfrey Papers
- P.A. Taverner Papers
- L. McIver Terrill Papers

Public Archives of Canada-Federal Archives Division
- Hoyes Lloyd Papers
- R.A. Selwyn Papers
- John Macoun Papers

Royal Ontario Museum Archives
- Great Lakes Ornithological Club Papers
- J.R. Dymond Papers
- J.H. Fleming Papers
- L.L. Snyder Papers
- P.A. Taverner Papers

Smithsonian Institutions Archives-Division of Birds
- Hoyes Lloyd Papers
- Thomas McIlwraith Papers
- Robert Ridgway Papers

University of Toronto-Thomas Fisher Rare Book Library
- J.L. Baillie Papers

Private Collections

Louise de Kiriline Lawrence-Private Papers
Doris and Murray Speirs-Private Papers

Periodicals

The Auk
The Canadian Field Naturalist
Ottawa Naturalist
Transactions of the Royal Society of Canada
The Wilson Bulletin

Government Records

House of Common Debates, 1909-1920
Sessional Papers, 1880-1925
The Canada Gazette, 1910-1925

Printed Sources

Adams, A. Leith. Field and Forest Rambles, with Notes and Observations on the Natural History of Eastern Canada. London: H.S. King and Co., 1873.

Ainley, M.G. "The Contribution of the Amateur to North American Ornithology: A Historical Perspective," Living Bird 18 (1979-80): 161-77.

_____. "Henry Mousley and the Ornithology of Hatley and Montreal, 1910-1946." Tchebec 11 (1981): 113-34.

_____. "Lewis McIver Terrill-Promoter of Bird Study and Conservation in Quebec." Tchebec 12 (1982): 72-85.

Allen, D.E. "Natural History and Social History." Journal of the Society for the Bibliography of Natural History 7 (1976): 509-16.

_____. The Naturalist in Britain: A Social History. London: Pelican Books, 1978.

Allen, Elsa G. "Nicholas Denys, A Forgotten Observer of Birds." The Auk 56 (1939): 283-90.

_____. "History of American Ornithology Before Audubon." Transactions of the American Philosophical Society N.S. 4 Part 3. 1951. pp. 387-591.

Anderson, R.M. "The Work of Bernhard Hantzsch in Arctic Ornithology." The Auk 45 (1928): 450-66.

Autobiography of John Macoun: Canadian Explorer and Naturalist, 1831-1920. Ottawa: The Ottawa Field Naturalists' Club, 1979.

Bailey, J.A. Principles of Wildlife Management. New York: John Wiley and Sons, 1984.

Baillie, J.L. "Charles Fothergill, 1782-1840." The Canadian Historical Review, December 1944, pp. 376-96.

_____. "Naturalists on Hudson Bay." Beaver, December 1946, pp. 36-39.

_____. "In Memoriam: James Alexander Munro." The Auk 86 (1969): 624-30.

Baird, P.D. "Expeditions to the Arctic." Beaver, March 1949, pp. 44-46; June 1949, pp. 41-44; September 1949, pp. 44-48.

Ball, K.E. "Nesting of the Ring-necked Pheasant on Pelee Island, Ontario." The Canadian Field Naturalist 66 (1952): 71-81.

Barrett, H.B. The 19th Century Journals and Paintings of William Pope. Toronto: M.F. Fehely Publishers Ltd., 1976.

Basalla, G. "The Spread of Western Science." Science, Vol. 156. May 1967, pp. 611-621. Reprinted in Restivo, S.P. and Vanderpool, C.H. eds. Comparative Studies in Science and Society. Columbus: C.E. Merrill and Co., 1974. pp. 359-81.

Battle, Helen I. "Zoology in Canada in Retrospect." Le Naturaliste Canadien 91 (1964): 182-90.

Berger, Carl. Science, God and Nature in Victorian Canada. Toronto: University of Toronto Press, 1983.

Blackadar, G.R. The Geological Survey of Canada. Past Achievements and Future Goals. Ottawa: Energy, Mines and Resources Canada, 1976.

Bissonnette, T.H. "Photoperiodicity in Birds." Wilson Bulletin 49 (1937): 241-70.

Blakiston, T. "Notes of a Naturalist." Zoologist, 1857, pp. 5840-43.

Bowler, P. "The Early Development of Scientific Societies in Canada." In Oleson, A. and Brown, S.C. eds. The Pursuit of Knowledge in the Early American Republic. Baltimore: The Johns Hopkins University Press, 1976. pp. 326-39.

_____. The Eclipse of Darwinism. Baltimore: The Johns Hopkins University Press, 1983.

Brodhead, M.J. "Elliott Coues and the Sparrow War." The New England Quarterly 44 (1971): 420-32.

Brown, G.W. Building the Canadian Nation. 2 Vols. New York: Macfadden Books, 1968.

Brooks, A. "The Underwater Actions of Diving Ducks." The Auk 62 (1945): 517-23.

Cameron, J. The Bureau of Biological Survey. Its History, Activities, and Organization. Baltimore: The Johns Hopkins University Press, 1929.

Canada Agriculture: The First Hundred Years. Ottawa, 1967.

Cartier, J. Voyage de Découverte au Canada entre les années 1534 et 1542. Québec: Société Litéraire et Historique de Québec, 1843.

Cartwright, B.W. and Harrold, C.G. "An Outline of the Principles of the Natural Selective Absorption of Radiant Energy." The Auk 42 (1925): 233-41.

Centenary Volume of the Literary and Historical Society of Quebec. Quebec: L'évenement Press, 1924.

Chamberlain, M. A. Catalogue of the Birds of New Brunswick. Saint John, N.B.: N.P., 1882.

_____. A Catalogue of Canadian Birds. St. John: J. and A. McMillan, 1887.

_____. A Systematic Table of Canadian Birds. St. John: N.P., 1888.

Chapman, F.M. "Remarks on the Origin of Bird Migration." The Auk 11 (1894): 12-17.

Chapman, F.M. and Palmer, T.S. Fifty Years' Progress of American Ornithology, 1883-1933. Lancaster: A.O.U., 1933.

Champlain, S. Les Voyages du Sieur de Champlain. Paris: Iean Bergeron, 1613.

Chisholm, A.H. "On the Problem of 'Anting'." Ibis 86 (1944): 389-405.

_____. "The History of Anting." Emu 59 (1959): 101-30.

Clarke, C.H.D. "Fluctuations in Ruffed Grouse Bonasa umbellus (Linné) with Special Reference to Ontario." University of Toronto Studies, Biological Series. 41 (1936): 1-118.

_____. "In Memoriam: Hoyes Lloyd." The Auk 96 (1979): 402-406.

Cowan, I. "Wildlife Conservation in Canada." The Journal of Wildlife Management 19 (1955): 161-76.

Cranmer-Byng, J. "The Great Lakes Ornithological Club. The Origin and Early Years, 1905-1911." Ontario Birds 2 (1984): 4-12.

Criddle, N. "Some Natural Factors Governing the Fluctuation of Grouse in Manitoba." The Canadian Field Naturalist 44 (1930): 77-80.

Cutright, P.R. and Brodhead, M.J. Elliott Coues, Naturalist and Frontier Historian. Urbana: University of Illinois Press, 1981.

Dagg, A.I. Canadian Wildlife and Man. Toronto: McClelland and Stewart, 1974.

Daniels, G.H. "The Process of Professionalization in American Science-The Emergent Period, 1820-1860." Isis 58 (1967): 151-66.

Dawson, G.M. "The Progress and Trend of Scientific Investigation in Canada." Transactions of the Royal Society of Canada Series 1, Vol. 12, 1894, pp. 3-17.

Deignan, H.C. "HBC and the Smithsonian." Beaver, June 1947, pp. 3-7.

Deiss, W.A. "Spencer F. Baird and his Collectors." Journal of the Society for the Bibliography of Natural History 9 (1980): 635-45.

Denys, N. Description Géographique et Historique des Costes de l'Amerique Septentrionale Avec l'Histoire Naturelle du Païs. Paris: Claude Barbin, 1672.

Dilger, W. "Methods and Objectives of Ethology." Living Bird 1 (1962): 83-92.

Dionne, C.E. Les Oiseaux du Canada. Quebec: P.G. Delisle, 1883.

_____. Catalogue des Oiseaux de la Province de Québec. Quebec: J. Dussault, 1889.

Diubaldo, R.J. Stefansson and the Canadian Arctic. Montreal: McGill-Queen's University Press, 1978.

Doern, B. Science and Politics in Canada. Montreal: McGill-Queen's University Press, 1972.

Downs, A. "On the Landbirds of Nova Scotia." Transactions of the Nova Scotia Institute of Natural Science. 1865, pp. 38-51. 1866, pp. 130-136.

Duchêne, R. "Science et Société Coloniale: Les Naturalistes du Canada FranÇais et Leur Correspondants Scientifiques, 1860-1900." HSCT Bulletin 5 (1981): 99-140.

D'Urban, W.S.M. "Notes on the Land Birds Observed Round Montreal During the Winter of 1856-57." Canadian Naturalist and Geologist 2 (1857): 138-45.

Dymond, J.R. History of the Royal Ontario Museum of Zoology. Contributions of the ROMZ, No. 18. Toronto: University of Toronto Press, 1940.

_____. "Fluctuation on Animal Populations with Special Reference to those of Canada." Transactions of the Royal Society of Canada, Series 3. Section 5. Vol. 41, 1947. pp. 1-34.

Eifrig, G. "Is Photoperiodism a Factor in the Migration of Birds?" The Auk 41 (1924): 439-44.

Elman, Robert. First in the Field: America's Pioneering Naturalists. New York: Van Nostrand Reinhold, 1977.

Emlen, J.T. "The Study of Behavior in Birds." in Wolfson, A. ed. Recent Studies in Avian Biology. Urbana: University of Illinois Press, 1955. pp. 105-153.

Farber, P.L. "The Development of Taxidermy and the History of Ornithology." Isis 68 (1977): 550-66.

_____. "The Development of Ornithological Collections in the Eighteenth and Early Nineteenth Centuries and their Relationship to the Emergence of Ornithology as a Scientific Discipline." Journal of the Society for the Bibliography of Natural History. 9 (1980): 391-94.

_____. The Emergence of Ornithology as a Scientific Discipline, 1760-1850. Boston: D. Reidel Publishing Company, 1982.

Farner, D.S. "The Annual Stimulus for Migration." Condor 52 (1950): 104-22.

Farner, D.S. and King, J.R. eds. Avian Biology. 7 Vols. New York: Academic Press, 1971-83.

Ferris, G.F. "The Contribution of Natural History to Human Progress." In A Century of Progress in the Natural Sciences, 1853-1953. San Francisco: California Academy of Sciences, 1955. pp. 75-87.

Fleming, D. "Science in Australia, Canada, and the United States: Some Comparative Remarks." Proceedings of the 10th International Congress on the History of Science. Ithaca, 1962. pp. 179-96.

Fleming, J.H. "Birds of Toronto." The Auk 23 (1906): 437-53; 24 (1907): 71-89.

Fisher, W.K. "The Future Problems and Aims of Ornithology." Condor 7 (1905): 62-67.

Foster, J. Working for Wildlife: The Beginning of Preservation in Canada. Toronto: University of Toronto Press, 1978.

Friedmann, H. "Advances in Life History Work." in Chapman, F.M. and Palmer, T.S. Fifty Years' Progress in American Ornithology, 1883-1933. Lancaster: A.O.U., 1933, pp. 101-109.

Frost, S.B. "Science Education in the Nineteenth Century. The Natural History Society of Montreal, 1827-1925." McGill Journal of Education 17 (1982): 31-43.

Fournier, P. Voyages et Découvertes Scientifiques des Missionaires Naturalistes Français a Travers le Monde. Paris: Lechevalier, 1932.

Gaboriault, V. Charles-Eusèbe Dionne: Naturaliste. La Pocatiere: La Societé Historique de la Côte-du-Sud, 1974.

Gerard, J. Charles Broley: An Extraordinary Naturalist. Headingley: White Horse Plains Publishers, 1983.

Godfrey, W.E. "Birds of the Cypress Hills and Flotten Lake Regions, Saskatchewan." Bulletin of the National Museum of Canada. No. 120. Biological Series No. 40, 1950.

_____. The Birds of Canada. Ottawa: Information Canada, 1966.

_____. "In Memoriam: Lewis McIver Terrill." The Canadian Field Naturalist 86 (1972): 87-90.

_____. "A Tribute to Robie Wilfred Tufts, 1884-1982." The Canadian Field Naturalist 98 (1984): 513-18.

Goode, G.B. The Smithsonian Institution, 1846-96. Washington, D.C.: Smithsonian Institution, 1897.

Green, C. de B. "Male Birds Feeding Females." Murrelet 3 (1924): 9-10.

_____. "The Fluttering Habit of the Richardson's Grouse." Murrelet 9 (1928): 67.

Greening, W.E. "North Shore Naturalist." Beaver, September 1953, pp. 22-25.

Hanley, W. Natural History in America: from Mark Catesby to Rachel Carson. New York: Quadrangle/The New York Times Book Co., Inc., 1977.

Harris, H. "An Appreciation of Allan Brooks, Zoologist-Artist." Condor 48 (1946): 145-53.

Harris, R.S. A History of Higher Education in Canada. Toronto: University of Toronto Press, 1976.

Hawkins, A.S. et al. eds. Flyways. Pioneering Waterfowl Management in North America. Washington, D.C.: U.S. Department of Interior. Fish and Wildlife Service, 1984.

Hewitt, C.G. The Conservation of the Wild Life of Canada. New York: Charles Scribner's Sons, 1921.

Hindle, B. The Pursuit of Science in Revolutionary America. Chapel Hill: University of North Carolina Press, 1956.

Hochbaum, H.A. and Bossenmaier, E.F. "Waterfowl Research: Accomplishments, Needs, Objectives." Transactions of the 30th North American Wildlife Conference, 1965. pp. 222-28.

_____. "Wetlands and Waterfowl." The Blue Jay 18 (1960): 164-68.

Houston, C.S. "In Memoriam: Alexander George Lawrence, 1888-1961." The Blue Jay 19 (1961): 151-52.

_____. and Houston, M.I. "Four Rancher Naturalists of the Cypress Hills, Saskatchewan." The Blue Jay 37 (1979): 9-19.

_____. "The Wemyss Sisters: Saskatchewan's First Lady Bird-watchers, 1898-1940." The Blue Jay 39 (1981): 25-29.

_____. "Birds First Described from Hudson Bay." The Canadian Field Naturalist 97 (1983): 95-98.

_____. ed. Arctic Ordeal. The Journal of John Richardson, Surgeon-Naturalist with Franklin, 1820-1822. Montreal: McGill-Queens University Press, 1984.

Ivor, H.R. "Observations on 'Anting' by Birds." The Auk 58 (1941): 415-416.

_____. "Further Studies of Anting by Birds." The Auk 60 (1943): 51-55.

_____. "Birds Fear of Man." The Auk 61 (1944): 203-11.

_____. "Bird Study and Semi-captive Birds; the Rose-breasted Grosbeak." Wilson Bulletin 66 (1944): 91-104.

_____. "An Avian Creche." Nature Magazine, 1944, pp. 349-51, 381.

Jarrell, R.A. "British Scientific Institutions in Canada: The Rhetoric and the Reality." Transactions of the Royal Society of Canada, Series 4. Vol. 20. 1982. pp. 533-47.

_____. "The Rise and Fall of Science at Quebec." Histoire Social/Social History, May 1977, pp. 77-91.

_____. "Science as Culture in Victorian Toronto." Atkinson Review of Canadian Studies 1 (fall 1983): 5-12.

_____. "The Social Function of the Scientific Society in Nineteenth Century Canada." In Jarrell. R.A. and Roos, A.E. Critical Issues on the History of Canadian Science, Technology and Medicine. Thornhill: HSCT Publications, 1983. pp. 31-47.

Jarrell, R.A. and Ball, N.B. eds. Science, Technology and Canadian History. Waterloo: Wilfrid Laurier University Press, 1980.

Jenkins, A.C. The Naturalists: Pioneers of Natural History. Exeter: Webb and Bower Ltd. 1978.

Keith, L.B. Wildlife's Ten-Year Cycle. Madison: The University of Wisconsin Press, 1963.

Lack, D. "Population Ecology in Birds-A Review." Proceedings of the 10th International Ornithological Congress, Uppsala. 1950. pp. 409-48.

Laing, H.M. Allan Brooks: Artist Naturalist. Victoria: British Columbia Museum Special Publications. No. 3, 1979.

Lamontagne, R. "Les échanges scientifiques entre R-M Galissonière et les chercheurs contemporains." Revue d'Histoire Amérique Française 14 (1960): 25-33.

Leitch, W.G. Ducks and Man. Forty Years of Cooperation in Conservation. Winnipeg: Ducks Unlimited (Canada). 1978.

Levere, T.H. "What is Canadian About Science in Canadian History." In Jarrell, R.A. and Ball, N.R. eds. Science, Technology and Canadian History. Waterloo: Wilfrid Laurier University Press. 1980. pp. 14-22.

Levere, T.H. and Jarrell, R.A. A Curious Field Book. Science and Society in Canadian History. Toronto: Oxford University Press. 1980.

Lewis, H.F. The Natural History of the Double-crested Cormorant. Ottawa: Ru-Mi-Lou Books, 1929.

Lister, R. The Birds and Birders of Beaverhills Lake. Edmonton: Edmonton Bird Club, 1979.

Lortie, L. "La Trame Scientifique de l'Histoire du Canada." In Stanley, C.F.G. ed. Pioneers of Canadian Science. Toronto: University of Toronto Press, 1966. pp. 3-35.

Lothian, W.F. A History of Canada's National Parks. 4 Vols. Ottawa: Parks Canada, 1981.

Lumsden, H.G. "A Tribute to Charles Henry Douglas Clarke, 1909-1981," The Canadian Field Naturalist 98 (1984): 379-84.

McAtee, W.L. "The North American Birds of George Edwards." Journal of the Society for the Bibliography of Natural History. 2 (1949): 194-105.

_____. "Economic Ornithology." In Chapman, F.M. and Palmer, T.S. eds. Fifty Years' Progress in American Ornithology, 1883-1933. Lancaster: A.O.U., 1933. pp. 111-29.

_____. "Percy Algernon Taverner, 1875-1947." The Auk 65 (1948): 85-106.

Martin, K. "Francis Bain, Farmer Naturalist." The Island Magazine, Spring-Summer 1979, pp. 3-8.

Miers, H.A. and Markham, S.F. A Report on the Museums of Canada. Edinburgh: T. and A. Constable, 1932.

Mitchell, M.H. The Passenger Pigeon in Ontario. Toronto: University of Toronto Press, 1935.

Mousley, W.H. "A Study of Subsequent Nestings After the Loss of the First." The Auk 34 (1917): 381-93.

_____. "The Breeding of the Migrant Shrike at Hatley, Stanstead County, Quebec, 1916." The Auk 35 (1918): 33-36.

_____. " 'The Singing Tree' or How Near to the Nest do the Male Birds Sing?" The Auk 36 (1919): 339-48.

_____. "Which Sex Selects the Nesting Locality." The Auk 38 (1921): 321-28.

Munro, D.A. "Tribute to Hoyes Lloyd, 1888-1978." The Canadian Field Naturalist 93 (1979): 331-34.

Neatby, L.H. In Quest of the North West Passage. Toronto: Longmans, Green and Co., 1958.

Nice, M.M. "The Theory of Territorialism and its Development." in Chapman, F.M. and Palmer, T.S. eds. Fifty Years' Progress in American Ornithology, 1883-1933. Lancaster: A.O.U., 1933. pp. 89-100.

Ouellet, H. and Godfrey, W.E. "Ornithology in Canada in the 20th Century: A Capsule Overview." Bulletin of the British Ornithologists' Club 100 (1980): 115-18.

Owram, D. Promise of Eden. The Canadian Expansionist Movement and the Idea of the West, 1856-1900. Toronto: University of Toronto Press, 1980.

Pearse, T. "Notes on Changes in Bird Population in the Vicinity of Comox, Vancouver Island-1917 to 1944." Murrelet 27 (1946): 4-9.

_____. Birds of the Early Explorers in the Northern Pacific. Comox: T. Pearse, "The Close.", 1968.

Potvin, D. Puyjalon. Quebec: N.P., 1938.

Rand, A.L. "Lorenz's Objective Method of Interpreting Bird Behavior." The Auk 58 (1941): 189-91.

_____. "Nest Sanitation and an Alleged Releaser." The Auk 59 (1942): 404-409.

_____. "Some Irreverant Behavior in Birds." The Auk 60 (1943): 168-71.

_____. "Clutch Size in the Spruce Grouse and Theoretical Considerations of Some Factors Affecting Clutch Size." The Canadian Field Naturalist 61 (1947): 127-30.

Rich, E.E. James Isham's Observations on Hudson's Bay. Toronto: Champlain Society, 1949.

Riegert, P.W. From Arsenic to DDT. A History of Entomology in Western Canada. Toronto: University of Toronto Press, 1980.

Rowan, W. "Relation of Light to Bird Migration and Developmental Changes." Nature 115 (1925): 494-95.

_____. "On Photoperiodism, Reproductive Periodicity, and the Annual Migration of Birds and Certain Fishes." Proceedings of the Boston Society of Natural History, 1926, pp. 147-89.

_____. "The Scientific Aspects of Bird Banding." Bulletin of the Northeastern Bird Banding Association 4 (1928): 31-42.

_____. "Reproductive Rhythm in Birds." Nature 122 (1928): 11-12.

_____. "Experiments in Bird Migration. I. Manipulation of the Reproductive Cycle: Seasonal Histological Changes in the Gonads." Proceedings of the Boston Society of Natural History 39 (1929): 151-208.

_____. "Experiments in Bird Migration. II. Reversed Migration." Proceedings of the National Academy of Sciences 16 (1930): 520-25.

_____. "Experiments in Bird Migration. III. "The Effect of Artificial Light, Castration and Certain Extracts on the Autumn Movements of the American Crow (Corvus brachyrhynchos)" Proceedings of the National Academy of Sciences 18 (1932): 639-54.

---. The Riddle of Migration. Baltimore: The Williams and Wilkins Company, 1931.

---. "Experiments in Bird Migration." Transactions of the Royal Society of Canada. Series 3. Section 5. Vol. 40, 1946, pp. 123-35.

---. "Canada's Premier Problem of Animal Conservation: A Question of Cycles." New Biology 9 (1950): 38-57.

Royal Society of Canada. Fifty Years of Retrospect, 1882-1932. Ottawa: RSC, 1932.

Rutter, R.J. ed. W.E. Saunders-Naturalist. Toronto: F.O.N., 1949.

Salt, W.R. "In Memoriam: William Rowan." The Auk 75 (1958): 387-90.

Sheets-Pyenson, S. "Stones and Bones and Skeletons." McGill Journal of Education 17 (Winter 1982): 49-62.

Shortt, A.H. "Bertram William Cartwright." The Auk 88 (1971): 226-27.

Sibley, C.G. "Ornithology." In A Century of Progress in the Natural Sciences, 1853-1953. San Francisco: California Academy of Sciences, 1955, pp. 629-59.

Sinclair, B., Ball, N.R. and Petersen, J.O. Let us be Honest and Modest. Technology and Society in Canadian History. Toronto: Oxford University Press, 1974.

Smith, S.M. "The Ontogeny of Avian Behavior." In Farner, D.S. and King, J.R. eds. Avian Biology. New York: Academic Press, 1983. Vol. 7. pp. 85-106.

Snyder, L.L. "In Memoriam: James Henry Fleming." The Auk 58 (1941): 1-12.

---. Ontario Birds. Toronto: Clarke, Irwin and Co., 1951.

Solman, V.E.F. "Harrison Flint Lewis, 1893-1974." The Canadian Field Naturalist 88 (1974): 507-16.

Spry, I.M. The Palliser Expedition. An Account of John Palliser's British North America Expedition, 1857-1860. Toronto: MacMillan Co., 1963.

Speirs, J.M. "Fluctuation in Numbers of Birds in the Toronto Region." The Auk 56 (1939): 411-19.

Stearns, R.P. "The Royal Society and the Company." Beaver, June 1945, pp. 8-13.

Stearns, R.W. Science in the British Colonies of America. Urbana: University of Illinois Press, 1970.

Stevens, O.A. "The First Descriptions of North American Birds." Wilson Bulletin 48 (1936): 203-15.

Stresemann, E. "Birds Collected in the North Pacific Area During Capt. James Cook's Last Voyage (1778-79)." Ibis 91 (1949): 244-55.

_____. Ornithology. From Aristotle to the Present. Cambridge: Harvard University Press, 1975.

Taverner, P.A. "A Discussion of the Origin of Migration." The Auk 21 (1904): 322-33.

_____. "Suggestions for Ornithological Work in Canada." Ottawa Naturalist 29 (1915-16): 14-18, 21-28.

_____. "Random Notes on the FLuctuations in Numbers of Rodents and Grouse in Canada." The Canadian Field Naturalist 43 (1929): 162-64.

_____. Birds of Canada. Toronto: Musson Book Co., 1938.

_____. "Memories of William Edwin Saunders, 1861-1943." The Auk 61 (1944): 345-51.

_____. and Sutton, G.M. "The Birds of Churchill, Manitoba." Annals of the Carnegie Museum 23 (1934): 1-83.

Terrill, L.M. "Horned Larks in the Province of Quebec." Wilson Bulletin, No. 100. September 1917, pp. 130-41.

_____. "Nesting of the Saw-Whet Owl (Cryptoglaux acadica acadica) in the Montreal District." The Auk 48 (1931): 169-74.

_____. "A Sanctuary in Gaspé." Bank of Montreal Staff Magazine, June 1931, pp. 3-6.

----------. "Bird Migration." Bank of Montreal Staff Magazine April 1937. pp. 7-11.

----------. "Shorebird Migration at Montreal." The Canadian Field Naturalist 65 (1951): 87-98.

----------. "Cowbird Hosts in Southern Quebec." The Canadian Field Naturalist 75 (1961): 1-11.

Tinbergen, N. "Recent Advances in the Study of Bird Behaviour." Proceedings of the 10th International Ornithological Congress. Uppsala. 1950, pp. 360-75.

Thistle, M.W. The Inner Ring. The Early History of the National Research Council of Canada. Toronto: University of Toronto Press, 1966.

Todd, W.E.C. Birds of the Labrador Peninsula and Adjacent Areas. Toronto: University of Toronto Press, 1963.

Traylor, M.A. et al. "In Memoriam: Austin L. Rand." The Auk 101 (1984): 600-602.

Turner, A.R. "Palliser of the Triangle." Beaver, Autumn 1957, pp. 4-9.

Turner, L.M. Contributions to the Natural History of Alaska No. 2. Washington: Government Printing Office, 1886.

----------: "The Birds of Labrador, including Ungava, East Maine, Moose and Gulf Districts of the Hudson Bay Company, together with the Island of Anticosti." Proceedings of the U.S. National Museum 8 (1886): 233-254.

Vallee, A. Un Biologiste Canadien: Michel Sarrazin: 1659-1735. Quebec: N.P., 1927.

Wadland, J. Ernest Thomson Seton: Man in Nature and the Progressive Era, 1880-1915. New York: Arno Press, 1978.

Waiser, W.A. "Canada on Display: Towards a National Museum, 1881-1911." In Jarrell, R.A. and Roos, A.E. eds. Critical Issues in the History of Canadian Science, Technology and Medicine. Thornhill: HSCT Publications, 1983, pp. 167-78.

Wallace, W.E. ed. The Royal Canadian Institute Centenary Volume. Toronto: RCI. 1949.

Williams, G. Andrew Graham's Observations on Hudson's Bay 1767-91. London: Hudson's Bay Record Society, 1969.

_____. "Andrew Graham and Thomas Hutchins: Collaboration and Plagiarism in 18th Century Natural History." Beaver, Spring 1978, pp. 4-14.

Wolfson. ed. Recent Studies in Avian Biology. Urbana: University of Illinois Press, 1955.

Zaslow, M. The Opening of the Canadian North, 1870-1914. Toronto: McClelland and Stewart Ltd., 1971.

_____. Reading the Rocks. The Story of the Geological Survey of Canada, 1842-1972. Toronto: The Mcmillan Company of Canada Ltd., 1975.

Unpublished Monographs

Ainley, M.G. "La professionnalisation de l'ornithologie Américaine, 1870-1979." M.Sc. Thesis, Université de Montréal, 1980.

de Vecchi, V. "Science and Government in Nineteenth Century Canada." Ph.D. Thesis, University of Toronto, 1978.

Waiser, W.A. "Rambler: Professor John Macoun's Career with the Geological Survey of Canada, 1882-1912." Ph.D. Thesis, University of Saskatchewan, 1983.

Unpublished Papers

Ainley, M.G. "From Ornithological Work to Research in Avian Biology-The Dynamics of American Ornithology in the Twentieth Century." Paper Presented at the I.H.S.P.S. Seminar, Université de Montreal, 1981.

Kendeigh, S.C. "Preliminary Outline for a History of Photoperiodism and the Regulation of Migration." Unpublished MS. 1979.

Sheets-Pyenson, S. "The Formative Years of Canadian Science: John William Dawson and His Circle, 1865-1886." Paper presented to the History of Science Society, New York, 1979.

Waiser, W.A. "The Macoun-Merriam Connection: CAN/AM Natural Science in the Late 19th Century." Paper presented to the History of Science Society, Toronto, 1980.