

Extract only - complete publication at www.jncc.gov.uk/worldwaterbirds

Waterbirds around the world

A global overview of the conservation,
management and research of the
world's waterbird flyways

Edited by G.C. Boere, C.A. Galbraith and D.A. Stroud

*Assisted by L.K. Bridge, I. Colquhoun, D.A. Scott,
D.B.A. Thompson and L.G. Underhill*



landbouw, natuur en
voedselkwaliteit



SCOTTISH EXECUTIVE



EDINBURGH, UK: THE STATIONERY OFFICE

© Scottish Natural Heritage 2006

First published in 2006 by The Stationery Office Limited
71 Lothian Road, Edinburgh EH3 9AZ, UK.

Applications for reproduction should be made to Scottish Natural Heritage,
Great Glen House, Leachkin Road, Inverness IV3 8NW, UK.

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN 0 11 497333 4

Recommended citation:

Boere, G.C., Galbraith, C.A. & Stroud, D.A. (eds). 2006.
Waterbirds around the world. The Stationery Office, Edinburgh, UK. 960 pp.

Names used for geographical entities do not imply recognition, by the organisers of the *Waterbirds around the world* conference or other supporting organisations or governments, of the political status or boundaries of any particular territory. Names of territories used (and any alternatives) are included solely to help users of this publication apply information contained within this volume for waterbird conservation purposes. The views expressed in papers included within this volume do not necessarily represent views of the editors or the organisations and governments that supported the conference and this publication.

Cover photography: Whooper Swans *Cygnus cygnus* arriving at Martin Mere, England. Photo: Paul Marshall.
(www.paulmarshallphotography.com)

Copyright of all photographs used in this publication resides with the named photographers.

Integrated waterfowl management in North America

Robert J. Blohm¹, David E. Sharp², Paul I. Padding³, Ronald W. Kokel¹ & Kenneth D. Richkus³

¹U.S. Fish and Wildlife Service, 4401 N. Fairfax Drive, Arlington, Virginia 22203, USA. (email: Robert_Blohm@fws.gov)

²U.S. Fish and Wildlife Service, PO Box 25486 DFC-DMBM, Denver, Colorado 80225, USA.

³U.S. Fish and Wildlife Service, 10815 Loblolly Pine Drive, Laurel, Maryland 20708, USA.

Blohm, R.J., Sharp, D.E., Padding, P.I., Kokel, R.W. & Richkus, K.D. 2006. Integrated waterfowl management in North America. *Waterbirds around the world*. Eds. G.C. Boere, C.A. Galbraith & D.A. Stroud. The Stationery Office, Edinburgh, UK. pp. 199-203.

ABSTRACT

Waterfowl management in North America has its legal foundation in treaties among the continent's three countries that established guidelines for the cooperative management of migratory birds. Within those guidelines, each country determines its own waterfowl hunting regulations each year, based upon the results of cooperative annual programs that monitor the status of waterfowl populations, habitat conditions, migratory movements, and harvest on a continental scale. In the United States, the process for setting regulations involves a cooperative effort by the U.S. Fish and Wildlife Service, representing the Federal government, and Flyway Councils that represent the State governments. This effort culminates with the annual publication of rule-making documents that provide the legal foundation for the establishment of hunting seasons. The United States has recently implemented an adaptive approach for setting annual duck-hunting regulations. This process, called Adaptive Harvest Management, uses model-driven assessments of the results of monitoring programs to set hunting regulations, whereupon the impacts of those regulations are measured in subsequent monitoring efforts, and the cycle is repeated.

INTRODUCTION

In North America, migratory birds are an important natural resource, with a rich tradition of economic and recreational use and an aesthetic value shared across international boundaries. However, the transitory nature of migratory birds contributes to a unique set of management challenges, due principally to the large number of species and individuals, their widespread distribution, seasonal migration, habitat requirements, and variation in population attributes. The biological complexity is compounded by the fact that these birds migrate to, and through, many different political jurisdictions throughout the continent each year. Furthermore, there are numerous and sometimes competing interests, both within and among jurisdictions, with regard to the management of these species. Thus, managing recreational use, namely the regulation of harvests on the continent, is probably one of the most complicated examples of allocating a renewable resource.

This paper is an overview of the approaches that have been taken in North America to resolve some of the issues that are inherent to managing waterfowl, i.e. migratory ducks, geese, and swans. We describe the legal foundation for cooperation among the nations that share this natural resource, and we provide an overview of cooperative monitoring efforts that establish the biological basis for making sound conservation decisions. Additionally, we describe the administrative processes that are involved in setting annual waterfowl hunting regulations in the United States, including a brief discussion of the Adaptive

Harvest Management protocol that has been adopted for the management of duck harvests in the past decade. Finally, we discuss some of the current issues and challenges that are facing North American waterfowl managers today.

LEGAL FOUNDATION

Waterfowl, like most migratory birds, are a shared multinational resource. In North America, the importance each country holds for all or portions of the annual cycle of migratory birds is underscored in the respective treaties between those countries. Guidelines for the cooperative protection and management of waterfowl and other migratory bird species were agreed upon and established through treaties (Bean 1983). The first such treaty was the 1916 Convention for the Protection of Migratory Birds between the United States and Great Britain (on behalf of Canada). In 1936, the United States signed a treaty with Mexico at the Mexico Convention for the Protection of Migratory Birds and Game Mammals. This treaty was amended in 1972. Canada and Mexico cooperate under a separate agreement. The United States later entered similar treaties with Japan in 1972 (amended in 1974) and Russia (then the Soviet Union) in 1976. As a result of these treaties, all of the countries involved are jointly responsible for ensuring that healthy migratory bird populations will be available to future generations for all to enjoy.

The treaties define when seasons for hunting are allowed, the species that may be hunted, and the conditions under which hunting seasons may be considered. Within these general guidelines, each nation may implement its own hunting seasons. Each year, representatives of Canada, the United States, and Mexico meet to discuss a wide spectrum of migratory bird topics in order to fulfill their respective mandates for this shared resource.

In the United States, the Migratory Bird Treaty Act of 1918 is the domestic legislation that implements these migratory bird treaties (Bean 1983). Under this Act, the Secretary of the Interior is authorized to determine when and how hunting of migratory game birds can take place, and to adopt regulations for this purpose. Those regulations are written based on the distribution, abundance, economic value, and breeding and migration habits of migratory game birds, and they are updated annually. The Department of the Interior has delegated the federal authority for managing and conserving migratory birds to one of its agencies, the U.S. Fish and Wildlife Service.

The purpose of hunting regulations is to provide opportunities for hunters to take migratory game birds, while ensuring the welfare and long-term sustainability of populations of hunted birds (U.S. Fish and Wildlife Service 1988). This is the common thread that links regulated hunting activities in all three countries on the North American continent. In the United States, our objectives in setting annual hunting regulations are to provide equitable

hunting opportunities for all who wish to hunt migratory birds, including sport hunters, subsistence hunters, and those who hunt on Indian reservations. However, we must also ensure that the total annual harvest is compatible with the overall goal of maintaining sustainable populations. In some cases, this means using harvest as a tool to help manage over-abundant species.

Hunting with firearms and falconry are the two legal methods of sport hunting for waterfowl in the United States. As established by treaty, sport hunting of waterfowl may only occur from 1 September to 10 March (open period). The Migratory Bird Treaty Act allows State governments to make and enforce laws or regulations about migratory bird hunting, provided that they do not extend beyond the frameworks that are approved by the Secretary of the Interior (U.S. Fish and Wildlife Service 1988). In other words, States always have the latitude to establish more conservative hunting regulations, but never more liberal regulations. Thus, a key feature of the regulations-setting process for hunting migratory birds in the United States is cooperation with the States.

Although the 1916 treaty between the United States and Canada prohibited the taking of migratory birds from 11 March to 31 August (closed period), native residents of northern Canada and Alaska traditionally harvested migratory birds for nutritional purposes during the spring and summer months (Klein 1966). In recognition of this long-standing, traditional use of migratory birds, the governments of Canada, Mexico, and the United States amended their treaties and agreements in 1997. The amendments provide for the legal subsistence harvest of migratory birds and their eggs in Alaska and Canada during the closed period. However, no take is allowed for a 30-day period during the peak of the nesting season for each species or population.

Beginning with the 1985 hunting season, we have employed separate guidelines and administrative processes for migratory game bird hunting regulations on Indian reservations and ceded lands in the United States (U.S. Fish and Wildlife Service 1988). We developed these parallel guidelines in response to tribal requests for our recognition of their reserved hunting rights, and for some tribes, recognition of their authority to regulate hunting throughout their reservations and ceded lands. In all cases, tribal regulations established under the guidelines must be consistent with the provisions of the international migratory bird treaties, including the outside dates for hunting seasons.

MONITORING EFFORTS

There are five categories of migratory bird monitoring efforts that are conducted annually in North America: population surveys, productivity surveys, habitat surveys, banding and marking studies, and harvest surveys (Smith *et al.* 1989).

Each year, waterfowl population surveys are conducted on breeding, migration, and wintering areas. The May waterfowl breeding population and habitat survey represents one of the most extensive and respected wildlife surveys in the world. This annual aerial survey has been conducted systematically since 1955, and it is a cooperative effort of the U.S. Fish and Wildlife Service, the Canadian Wildlife Service, and numerous state, provincial, and tribal agencies. The area covered by the survey represents more than 5 400 000 square km of the key waterfowl breeding grounds on the continent. In this survey, pilot-biologists survey the number of breeding waterfowl from aircraft by counting breeding birds seen along established transect lines

(Canadian Wildlife Service & U.S. Fish and Wildlife Service 1977, Reynolds 1987). Biologists on the ground also count birds and assess breeding habitats on a sample of the same transect lines during the same period of time. This provides the basis for correcting the aerial counts to account for the fact that not all birds present along the transect lines can be seen from the air. The corrected counts are expanded to provide species-specific estimates of breeding populations for the entire survey area.

The May breeding population and habitat survey is followed by a July production survey later in the summer, during which broods are counted from the air. The July production survey is conducted on a smaller sample of the same transect lines that are flown during the May breeding population survey. In both surveys, habitat information is an important component of data-gathering efforts. The number and types of ponds are of particular importance as predictors of productivity, and are an important component of the population models that are used to help set hunting regulations. Overall, pilot-biologists fly a total of roughly 128 000 km during the breeding population and production surveys.

The mid-winter survey is another survey of continental waterfowl populations. Conducted annually since 1935, this monitoring program is a census of waterfowl on major wintering areas throughout the United States, and is typically carried out during early January. The mid-winter survey yields general information for most waterfowl species, including relative abundance and distribution on wintering habitats. However, the survey does provide the best population data available for some species, including Tundra Swans *Cygnus columbianus*, Black Brant *Branta bernicla nigricans*, and Snow Geese *Chen (Anser) caerulescens*.

The Mexico waterfowl survey is another aerial survey that is conducted cooperatively by biologists from Canada, Mexico, and the United States. This survey began in 1936, and it augments the mid-winter survey in the United States. The survey covers the major waterfowl wintering grounds of Mexico, including the east coast, the west coast, and the interior highlands. Parts of the survey are conducted annually, but the entire survey is carried out at three-year intervals.

Banding is also an important tool of waterfowl management. To date, biologists in North America have banded more than 63 000 000 birds in total, and have accumulated more than 3 500 000 recoveries. In any one year, biologists will band more than 200 000 ducks and nearly 150 000 geese and swans. In addition to delineating migration routes and chronology, biologists can estimate harvest rates and survival rates for some waterfowl species from band recovery data. These harvest and survival rates are critical pieces of information that are used in efforts to model the population dynamics for particular species or populations (e.g. Anderson & Burnham 1976, Burnham *et al.* 1984). Estimating harvest rates from band recoveries requires accurate estimates of band reporting rates, which reflect the willingness of people who recover bands to report this information to the Bird Banding Laboratory. Band reporting rates were studied extensively in the late 1980s (Nichols *et al.* 1991, Nichols *et al.* 1995), but in recent years, use of a toll-free telephone number imprinted on bands has raised reporting rates significantly from the levels reported earlier. In 2002, biologists began a continent-wide investigation to determine current reporting rates and whether they vary by region and species.

Surveys of sport hunters are conducted annually in both Canada and the United States to assess their level of participation and success during the hunting season. These surveys consist of asking a sample of waterfowl hunters to report the number of ducks and geese they harvested during the hunting season (Martin & Carney 1977, Cooch *et al.* 1978). Both countries also conduct annual wing surveys that provide data on species, age, and sex composition. Additionally, a survey of subsistence hunters is conducted in Alaska each year that provides species-specific estimates of subsistence harvest. These survey systems have been in place since 1961 in the United States, since 1967 in Canada, and for subsistence harvest, since 1980 in Alaska. Harvest surveys provide species-specific estimates of harvest, estimates of hunter effort, and age and sex ratio estimates that are used in population modeling efforts.

ADMINISTRATIVE PROCESSES

Understanding the migration habits of birds is a primary requisite for all nations participating in the management of our shared waterfowl resource. Long-standing analyses of numerous band recovery records show that waterfowl appear to follow distinct, traditional migration corridors or flyways in their annual travels between breeding and wintering areas (Lincoln 1935, Bellrose 1980). Since 1948, we have managed waterfowl by four administrative Flyways that are based on those migration paths: the Atlantic, Mississippi, Central, and Pacific Flyways (Fig. 1). Some of the important waterfowl hunting regulations that are set each year, including season length and daily bag limits, are specific to these individual Flyways.

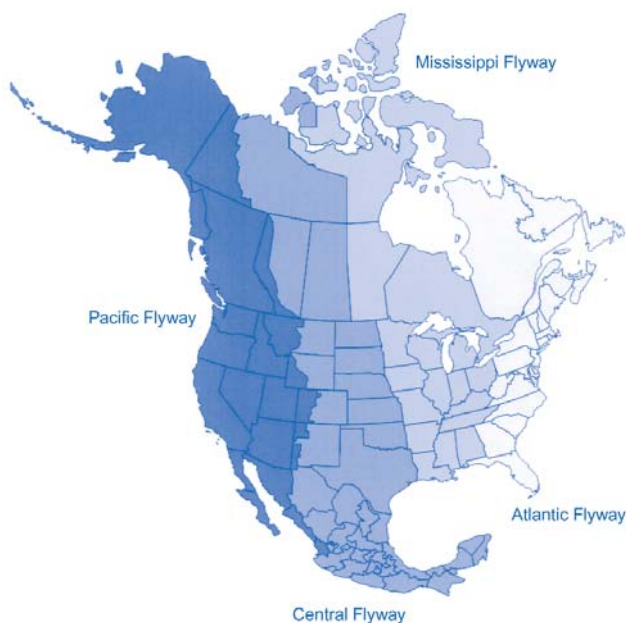


Fig. 1. The waterfowl flyways of North America.

Each Flyway has a Flyway Council, which is a formal organization that is composed of one member from each State and Province in that Flyway. Recently, Mexico has also provided representation at Pacific and Central Flyway meetings and discussions. The Flyway Councils are involved in many aspects of migratory game bird management, including development of

recommendations for hunting regulations and assisting in research and habitat management activities.

In the United States, the process of establishing annual hunting regulations is a complex merging of biological, administrative, and legal considerations (U.S. Fish and Wildlife Service 1988). Waterfowl biologists within each Flyway meet several times annually to review the biological data from monitoring programs. Following these reviews, they prepare a series of recommendations for the upcoming hunting season that are presented to their respective Flyway Councils. The recommendations that are adopted by the Flyway Councils are then presented to the U.S. Fish and Wildlife Service's Regulations Committee for consideration. The Regulations Committee evaluates each Flyway's proposals and then submits its findings and recommendations to the Director of the U.S. Fish and Wildlife Service. Final approval is given by the Assistant Secretary of the Department of the Interior, representing the Secretary, whereupon the annual hunting regulations are formally adopted after public review and comment. Throughout this process, the general public are provided with ample opportunity to comment on the recommendations and decisions.

Waterfowl hunting seasons must be established by late August for a few species and areas, and by late September for all of the other species and areas. However, most of the biological data are not available until July. Thus, much of the regulations-setting process in the United States occurs during a very compressed time frame. As one would expect, the processes for developing annual regulations in Canada and Mexico differ from this in terms of both procedures and timing (see Boyd 1979).

The U.S. Fish and Wildlife Service develops waterfowl hunting regulations by establishing the frameworks, or outside limits, for season opening and closing dates, season lengths, bag limits, and shooting hours (U.S. Fish and Wildlife Service 1988). States then select their seasons within these frameworks, considering factors such as distribution, abundance, and timing of migration to and/or from their State, as well as other factors important to their hunting communities. Again, States may always be more restrictive than the federal regulations, but never more liberal.

To help improve the overall regulations-setting process in the United States, the U.S. Fish and Wildlife Service and the States worked together in the early 1990s to develop an Adaptive Harvest Management approach for regulating duck harvest (Johnson *et al.* 1993). Adaptive Harvest Management serves as a way for all interested groups to work cooperatively to review

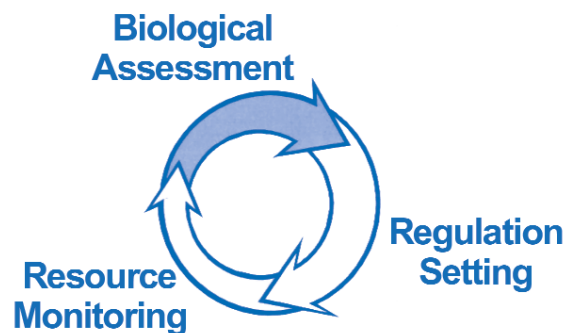


Fig. 2. The monitoring, assessment and decision-making cycle employed annually by the Adaptive Harvest Management process that is used to set annual duck hunting regulations in the United States.

the available biological information and develop as much consensus as possible with regard to setting duck hunting regulations each year. The explicit goal of Adaptive Harvest Management is to optimize long-term hunter opportunity while ensuring healthy waterfowl populations.

Adaptive Harvest Management is an iterative process that each year uses the results of monitoring to inform a series of biological assessments that help establish particular hunting regulations in a given year. The impacts of those regulations are then measured by subsequent monitoring activities, and the cycle is repeated (Fig. 2). The biological assessments are based on statistical models that all parties have agreed to use, which helps promote objective decision-making despite acknowledging an incomplete understanding of the role that harvest plays in duck population dynamics (Williams *et al.* 1996). Annual regulatory decisions about season length and daily bag limits are limited to a fixed set of clear alternatives, and the alternative selected in any given year is based upon the results of the models. The heart of the process is its adaptive nature; when new information is obtained, it is continually incorporated into the process, thereby reducing our uncertainty about the relationship between harvest and duck numbers. This underscores the value of our monitoring programs, and our need to maintain their accuracy and reliability.

The U.S. Fish and Wildlife Service and the States adopted Adaptive Harvest Management in 1995 for regulating duck harvest. Currently, this approach is only used in the United States for the development of duck hunting regulations, particularly for the Mallard *Anas platyrhynchos*. The regulatory alternative that is selected for the Atlantic Flyway is based upon the results of the population models for eastern Mallards, whereas the population models for mid-continental Mallards determine which regulatory alternative is selected for the other three Flyways. Work is ongoing to expand the Adaptive Harvest Management approach to the western Mallard population, recognizing further that stocks vary in their potential to support sport harvest. Additionally, Canada is currently working with the United States to develop an adaptive approach for the harvest of other species or populations of waterfowl besides Mallards, namely, the shared American Black Duck *Anas rubripes* population and the Atlantic population of Canada Geese *Branta canadensis*.

CURRENT ISSUES

Waterfowl populations typically fluctuate as a function of habitat and environmental conditions; thus periodic increases and decreases are expected. However, the long-term trend information provided by our monitoring efforts indicates that we have cause to be concerned about the status of some species in North America. Results of the waterfowl breeding population survey indicate that Greater Scaup *Aythya marila* and Lesser Scaup *A. affinis* have experienced a long-term decline, particularly since the early 1980s (Afton & Anderson 2001). In response to this decline, the U.S. Fish and Wildlife Service and the Flyway Councils have reduced bag limits for these two species throughout the United States. Contaminants, lower female survival, and reduced recruitment due to changes in the availability of food resources or essential habitats have been suggested as possible reasons for the decline.

The Northern Pintail *Anas acuta* is another species whose numbers have declined significantly. Unlike other prairie ducks, Northern Pintails have not rebounded during the past decade of

generally improved wetland conditions in the prairies of North America. This is probably due to increased vulnerability during the nesting season as a result of modern farming practices, particularly in the grassland areas of the north-central United States and southern Canada (Miller & Duncan 1999). As with Greater and Lesser Scaup, the U.S. Fish and Wildlife Service and the Flyway Councils have reduced the daily bag limit on Northern Pintails to decrease harvest. When low population numbers warrant, they have also reduced the number of days during which hunters may take these birds.

North America is also currently experiencing problems caused by over-abundance of some species. Several populations of Snow Geese and Ross's Geese *Chen (Anser) rossii* have increased dramatically and are causing extensive habitat damage to breeding, migration, and wintering areas (Ankney 1996). To help alleviate this problem, unusual measures have been taken recently to reduce those populations, under the authority of a Conservation Order (U.S. Fish and Wildlife Service 2001). These measures consist mainly of allowing methods of take that previously have been prohibited (e.g. electronic calling) during the period that has traditionally been closed to all migratory bird hunting (i.e. after 10 March). The goals of these efforts are to reduce the Greater Snow Goose *C. c. atlantica* population in the East from 860 000 to 500 000 birds, and to reduce Lesser Snow Goose *C. c. caerulescens* and Ross's Goose populations in the mid-continental region by 50%. These birds number 3 000 000 in mid-winter counts, but estimates from the breeding ground are as high as 5 600 000 birds.

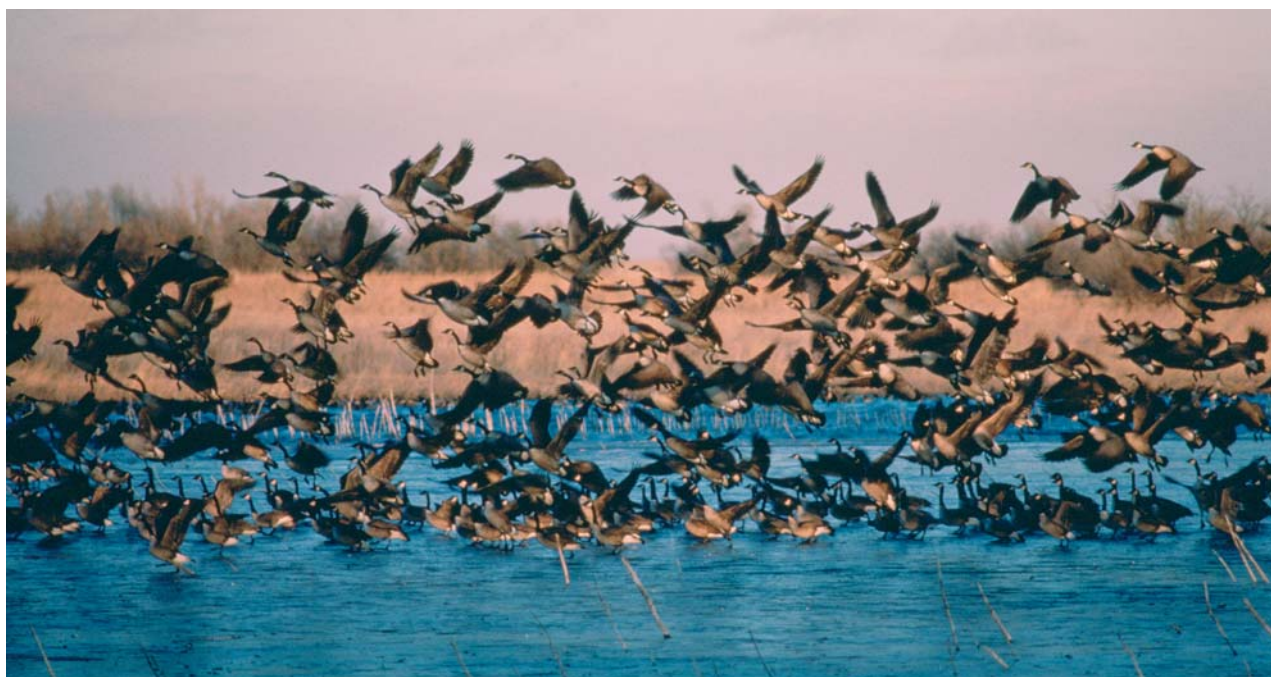
Resident populations of Canada Geese have also experienced high growth rates. These birds reside year-round in much of the United States and parts of southern Canada. Numbers of resident Canada Geese are growing at a rate of 14% per year in the Atlantic Flyway and 6% per year in the Mississippi Flyway, and these geese are increasing rapidly in the Central and Pacific Flyways as well. An over-abundance of these birds has resulted in habitat degradation, crop depredation, and an increasing incidence of conflicts with human activities in urban and suburban areas (Conover & Chasko 1985). Consequently, the U.S. Fish and Wildlife Service is currently considering several alternative management strategies to reduce and control resident Canada Goose populations (U.S. Fish and Wildlife Service 2002).

The results of annual waterfowl monitoring and management efforts in North America are available in a variety of publications and formats, including population status reports, administrative reports, technical reports and scientific papers, proceedings of various conferences and other meetings, and videotapes and DVDs. Reports and other information, including the annual migratory bird hunting regulations, are available on the web sites of the U.S. Fish and Wildlife Service and the Canadian Wildlife Service.

REFERENCES

- Afton, A.D. & Anderson, M.G. 2001. Declining scaup populations: A retrospective analysis of long-term population and harvest survey data. *Journal of Wildlife Management* 65: 781-796.
- Anderson, D.R. & Burnham, K.P. 1976. Population ecology of the mallard V: Temporal and geographic estimates of survival, recovery and harvest rates. U.S. Fish and Wildlife Service Resource Publication 125, Washington, D.C.

- Ankney, C.D.** 1996. An embarrassment of riches: Too many geese. *Journal of Wildlife Management* 60: 217-223.
- Bean, M.J.** 1983. The evolution of wildlife law. Prager Publishers, New York, NY.
- Bellrose, F.C.** 1980. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, PA.
- Boyd, H.** 1979. Federal roles in wildlife management in Canada. *Transactions of the North American Wildlife & Natural Resources Conference* 44: 90-96.
- Burnham, K.P., White, G.C. & Anderson, D.R.** 1984. Estimating the effect of hunting on annual survival rates of adult mallards. *Journal of Wildlife Management* 48: 350-361.
- Canadian Wildlife Service & U.S. Fish and Wildlife Service** 1977. Standard operating procedures for aerial waterfowl breeding ground population and habitat surveys in North America. Unpublished report.
- Conover, M.R. & Chasko, G.G.** 1985. Nuisance Canada goose problems in the eastern United States. *Wildlife Society Bulletin* 13: 228-233.
- Cooch, F.G., Wendt, S., Smith, G.E.J. & Butler, G.** 1978. The Canada migratory game bird hunting permit and associated surveys. In: H. Boyd & G.H. Finney (eds) *Migratory game bird hunters and hunting in Canada*. Canadian Wildlife Service Report Series No. 43: 8-39.
- Johnson, F.A., Williams, B.K., Nichols, J.D., Hines, J.E., Kendall, W.L., Smith, G.W. & Caithamer, D.F.** 1993. Developing an adaptive management strategy for harvesting waterfowl in North America. *Transactions of the North American Wildlife & Natural Resources Conference* 58: 565-583.
- Klein, D.R.** 1966. Waterfowl in the economy of the Eskimos of the Yukon-Kuskokwim Delta, Alaska. *Arctic* 19(4): 319-336.
- Lincoln, F.C.** 1935. The waterfowl flyways of North America. U.S. Department of Agriculture, Circular No. 342, Washington, D.C.
- Martin, E.M. & Carney, S.M.** 1977. Population ecology of the mallard IV: A review of duck hunting regulations, activity, and success, with special reference to the mallard. U.S. Fish and Wildlife Service Resource Publication 130, Washington, D.C.
- Miller, M.R. & Duncan, D.C.** 1999. The northern pintail in North America: Status and conservation needs of a struggling population. *Wildlife Society Bulletin* 27: 788-800.
- Nichols, J.D., Blohm, R.J., Reynolds, R.E., Trost, R.E., Hines, J.E. & Bladen, J.P.** 1991. Band reporting rates for mallards with reward bands of different dollar values. *Journal of Wildlife Management* 55: 119-126.
- Nichols, J.D., Reynolds, R.E., Blohm, R.J., Trost, R.E., Hines, J.E. & Bladen, J.P.** 1995. Geographic variation in band reporting rates for mallards based on reward banding. *Journal of Wildlife Management* 59: 697-708.
- Reynolds, R.E.** 1987. Breeding duck population, production and habitat surveys, 1979-85. *Transactions of the North American Wildlife & Natural Resources Conference* 52: 186-205.
- Smith, R.I., Blohm, R.J., Kelly, S.T., Reynolds, R.E. & Caswell, F.D.** 1989. Review of data bases for managing duck harvests. *Transactions of the North American Wildlife & Natural Resources Conference* 54: 537-544.
- U.S. Fish and Wildlife Service** 1988. Issuance of annual regulations permitting the sport hunting of migratory birds. U.S. Department of the Interior, Washington, D.C.
- U.S. Fish and Wildlife Service** 2001. Draft Environmental Impact Statement: Light goose management. U.S. Department of the Interior, Washington, D.C.
- U.S. Fish and Wildlife Service** 2002. Draft Environmental Impact Statement: Resident Canada Goose management. U.S. Department of the Interior, Washington, D.C.
- Williams, B.K., Johnson, F.A. & Wilkins, K.A.** 1996. Uncertainty and the adaptive management of waterfowl harvests. *Journal of Wildlife Management* 60: 223-232.



Canada Geese *Branta canadensis* have been the subject of a very long term study with results influencing Adaptive Harvest Management policies. Photo: J. Jave.