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EMERGING RESEARCH

Ducks across the pond - challenges and opportunities for collaboration between North America and Europe

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Abstract

Many waterfowl species and closely related congeners are shared across the Holarctic, and are culturally and economically important in both North America and Europe. Accordingly, both continents have developed science and management frameworks in an attempt to establish evidence-based conservation practices for this guild of birds. However, the 2 continents have approached this shared challenge from surprisingly different angles, wherein there is much to be learned from each other via increased collaboration across the Pond. In the United States and Canada, there is relatively strong alignment of conservation values, and the role of hunters in the science and management of waterfowl has a deeply embedded cultural and financial legacy. This differs markedly from Europe, where there is much more discordance among countries and constituents, resulting in regulatory policies that are uneven and generally rely on the precautionary principle. Here, we describe key differences in the waterfowl science and management enterprises in North American and Europe, and highlight key avenues for increased collaboration for mutual benefit.

KEYWORDS

harvest, history, international, management, policy, waterfowl

Waterfowl are found on every continent except Antarctica and represent a relatively recent adaptive radiation, with examples of both shared ancestry and convergent evolution across hemispheres (Kear 2005, Baldassarre 2014). In particular, North America and Europe share numerous duck species (e.g., mallard *Anas platyrhynchos*, northern pintail *Anas acuta*, gadwall *Mareca strepera*), closely-related congeners (e.g., American *M. americana* and Eurasian wigeon *M. penelope*), and examples of convergent evolution (e.g., hooded merganser *Lophodytes cucullatus* and smew *Mergellus albellus*; Nudds et al. 1994, Messmer et al. 2025). Across both North America and Europe, ducks are prized by hunters and embody important aspects of both culture and economics (e.g., Hirschfeld et al. 2019, Raftovich et al. 2024).

Both continents face important knowledge gaps and management challenges, and each has developed strengths that could usefully inform the other. Waterfowl populations are relatively healthy in North America (Rosenberg et al. 2019), but there are notable exceptions where populations are experiencing long-term declines (e.g., lesser scaup [Austin et al. 2000], northern pintail) or where there is a paucity of data regarding population trends and demographic drivers (e.g., most sea ducks [Savard et al. 2015]). In Europe, some duck populations are considered species of conservation concern, and there is insufficient biological information to inform management decisions. For example, the European Commission has called for improved management of species like common pochard (*Aythya ferina*), Eurasian wigeon, Eurasian teal (*Anas crecca*), northern pintail, and northern shoveler (*Spatula clypeata*), but recognizes that demographic models do not yet exist for any of them.

Improved collaboration between North America and Europe could significantly advance such basic and applied waterfowl science, and enable mutual learning through exchange of harvest management and habitat conservation strategies. At present, much of this knowledge is generated and used within regions, which limits its potential to inform management and conservation across global flyways. For example, there has been extensive research on canvasback (*Aythya valisineria*) ecology and demography in North America (reviewed in Baldassarre 2014), which may provide valuable information and research directions that would inform our understanding of the decline of its sister species common pochard in Europe (e.g., Fox et al. 2016) and potentially point to mechanisms to improve management for this species. As another example, the Integrated Population Model expected by the European Commission for Northern Pintail in the Western Palearctic could leverage the demographic components of pintail models from North America (Osnas et al. 2021). Opportunities for cross-fostering therefore no doubt exist, and some links between particular teams have long been established. However, alliance of approaches has been infrequent, perhaps because each of the communities on both sides of the Atlantic is already active and subsumed with its own issues and ways of conducting research and conservation. As a notable counter-example, geese have been studied in a more collaborative fashion in Europe and North America for a long time (e.g., Fox and Leafloor 2018).

In August 2025, scientists from both sides of the Atlantic coordinated a workshop at the 7th Pan-European Duck Symposium. The objective of the workshop was to identify challenges and opportunities for furthering collaboration on basic and applied science and management of ducks on both continents. In this paper, we summarize the outcomes of that discussion. First, we describe the status and integration of science and conservation for ducks in North America. Next, we describe the state of science and conservation in Europe. Finally, we will focus on opportunities for collaboration in the domains of research, conservation/management, and training/teaching, and develop a roadmap for how North America and Europe might begin to work together more closely, highlighting how combining these different approaches could lead to more effective and efficient conservation outcomes.

DUCK SCIENCE AND CONSERVATION IN NORTH AMERICA

Policy and regulation

Science, harvest, and conservation of ducks in the United States is intertwined by institutional mechanisms at international, federal, and state levels. Federal waterfowl management in the U.S. began in the early 1900s in

response to market hunting (e.g., Smalley and Reeves 2022). Season restrictions and bag limits have been imposed for more than 100 years (Anderson et al. 2018), and federal licensing and taxes on firearms and ammunition have provided >$12 billion in funding that includes waterfowl habitat protection (Vaughan Branch et al. 2022). Duck stamps (a form of federal hunting license) have helped protect an estimated 6 million acres in North America over the same period (Miller and Ahlers 2017). Cooperation between the United States and Canada accelerated in the 1980s with the development of the North American Waterfowl Management Plan, a conservation framework that delineated species-specific population goals and linked them with habitat objectives in specific geographies (U.S. Fish and Wildlife Service 2024). Mexico was added as a signatory in 1994, and these programs strongly coupled the natural capital of wetlands and waterfowl to habitat conservation, and leveraged public-private partnerships to fund and strategically advance the management of ducks in North America.

Monitoring and research

As a consequence of this socioeconomic conservation framework in North America, substantial funding for applied research on waterfowl is available on the continent at both the federal and state level, and through non-profit entities and private philanthropy. Accordingly, the ecological science of ducks and their habitats is mature, with hundreds of studies on movement and habitat use, and hundreds more quantifying the food value of various habitat types (Baldassarre 2014). Demographic science is supported by a continent-wide preseason banding program conducted in late summer, before hunting begins, that allows estimation of harvest and survival rates (e.g., Arnold et al. 2020). Vast numbers of studies have been conducted on nest survival and other key demographic rates that permit development of integrated population models that incorporate these various demographic data streams (Arnold et al. 2020). Monitoring of duck populations is extensive. The Breeding Waterfowl Population and Habitat Survey (BPop), an aerial breeding duck and habitat survey that covers 2 million square miles, dates back more than 70 years (U.S. Fish and Wildlife Service 2024). This investment in waterfowl and wetland science increased through at least the 1980s, inclusive of the expansion within government agencies, conservation NGOs, and academia, and even the recent devaluation of waterfowl science *per se* in academia (Kaminski 2013) has galvanized the community towards ensuring the future health of the profession (Ringelman and Eggeman 2022).

Habitat management

Habitat conservation in North America is strategically targeted and is substantively funded by public programs at the federal and state level. Much of this funding goes towards land rights acquisition (fee-title or conservation easement), habitat restoration, and enhancement of private lands (e.g., via incentive programs), because the majority (~90%) of duck habitat is privately owned. In addition to government-funded habitat conservation programs, there is a culture of substantial private investment in habitat through either direct management of properties under owner control, typically to improve habitat conditions to attract ducks for hunting, or via philanthropic gifts to non-governmental organizations to protect and enhance northern breeding habitats (e.g., Cox Enterprises made a donation of $100 M to Ducks Unlimited in 2024). The direct support of non-governmental organizations such as Ducks Unlimited, Delta Waterfowl Foundation, and numerous state waterfowl associations provides supplemental funding to that already received by federal and state governments through mandatory licensing and fees. Waterfowl NGOs in North America employ deep expertise in waterfowl and wetlands biology, engineering, real estate, and policy and thus serve as a focal point for coordinating and implementing both applied research and conservation action. These NGOs encompass a broad geographic, socio-economic, and political constituency, and can be a powerful lobbying force for local and national policy decisions affecting waterfowl and their habitats.

Hunting regulation and contribution to science

It is estimated that about 1.3 million hunters harvested 18.2 million waterfowl in the United States during the 2023 season (Raftovich et al. 2024). Duck harvest is regulated by the federal government, although states are permitted to set more restrictive regulations. In modern "liberal" years, seasons are 60–107 days depending on flyway (e.g., Atlantic, Mississippi, Central, or Pacific) with a daily 6 or 7 duck limit and further species- and sex-specific restrictions. Hunters may provide input into harvest regulations via state commission meetings and human dimensions research surveys. Regulations are set annually based on results of the aerial breeding population and habitat survey using harvest/population models that are updated every year. Harvest is monitored by surveying all hunters to assess avidity, then stratifying that sample and requesting hunters to report the number of ducks they shot in a season (diary survey) or to submit a wing of each bird they shot (parts collection survey). The combination of these surveys allows annual county-level harvest estimation that is parsed by species, sex, and age. Given that the number of outings is known, hunter efficiency can be calculated. It was estimated to be 2.36 ducks harvested during the regular season per hunter per outing in 2022, and 1.92 in 2023 (Raftovich et al. 2024). Hunters generally abide by hunting regulations—inclusive of the U.S. national ban on lead shot in 1991—primarily through the evolution of cultural norms, but also via routine enforcement on public hunting areas.

Comparison with Canada and Mexico

Canada was an initial signatory of the North American Waterfowl Management Plan, and their system of integrating hunters, science, and conservation is similar to that of the United States. They benefit from the same breeding survey that annually indexes populations and habitats, survey hunters to track harvest and its composition, and have various provincial and federal programs that provide funding for or otherwise incentivize habitat conservation (with some important differences in enforcement). Bag limits tend to be more liberal and without sex-specific restrictions, both of which are due in part to the fact that ducks in Canada are typically only present through mid-autumn (i.e., total season length is short), and many males are still completing body molt into alternate plumage (i.e., when harvested in Canada, males can look much like females and difficult for hunters to distinguish). For additional detail on the evolution of waterfowl science and management in the United States and Canada, see the excellent review by Anderson and Padding (2015).

Waterfowl harvest, science, and management all differ substantially in Mexico compared to the United States and Canada. The cultural heritage of hunting in Mexico is more closely tied to the pursuit of larger animals such as deer (*Odocoileus* spp.), javelina (Tayassuidae), and turkeys (*Meleagris gallopavo*), and that largely persists today among Mexican nationals (E. Carrera, Ducks Unlimited de México, personal communication). Since the start of record keeping, waterfowl hunting in Mexico has been primarily pursued by American tourists (Kramer et al. 1995), and total harvest in the 1980s–1990s was roughly estimated to be an order of magnitude less than the state of California in a given year (Kramer et al. 1995). Total harvest has almost certainly declined since then (although no data are available): while the states of Sinaloa and Sonora used to account for ~50% of the waterfowl harvest in Mexico, the number of guides has declined over the last 2 decades from 15–20 in that region to the low single digits out of growing security concerns and coincident reductions in hunting tourism (E. Carrera, Ducks Unlimited de México, personal communication).

The current waterfowl hunting framework has grown from a 1988 requirement that all foreign hunters use guides registered with the Mexican federal government, now known as the Unidad para la Conservación, Manejo y Aprovechamiento Sustentable de la Vida Silvestre (translated: Unit for the Conservation, Management and Sustainable Use of Wildlife; abbreviated as the UMA system). Within this framework, registered guides select parcels of land—either in public or private ownership—on which to apply for hunting permits. They use their own field technicians to conduct waterfowl surveys in that area and then use those data to solicit the Mexican government for hunting quotas specific to that area. Inconsistencies in these waterfowl surveys even in adjacent areas suggest

that such a system has the potential for self-dealing or at least a lack of transparency and scientific rigor, and accordingly is the subject of ongoing debate within natural resource circles in Mexico (E. Carrera, Ducks Unlimited de México, personal communication). Licensed guides are obligated to report their harvest to the government, but those data are not publicly available and what little data exist indicate potential biases in reporting (Kramer et al. 1995). Low levels of harvest outside of foreign hunting tourism also persist: guides that hunt in wetlands around Mexico City typically cater to city professionals, and rural communities are permitted to (collectively) own one single-shot shotgun for subsistence hunting, but those hunters typically pursue game larger than waterfowl. Steel shot for hunting is required but enforcement of all hunting regulations is lax given the relative uncommonness of the sport and other pressing law enforcement concerns.

Waterfowl science in Mexico has been most consistently undertaken by the conservation nonprofit Ducks Unlimited de México (DUMAC), which in recent years has attempted to revitalize the historic midwinter survey that was conducted in partnership with the U.S. Fish and Wildlife Service until 2006. These surveys focus on important habitats along the Pacific coast, Yucatán mangrove swamps, and the central and northern highlands. When coupled with remotely-sensed habitat data, these data represent the only insight into waterfowl population and habitat trends. Such trends are mostly negative (Pérez-Arteaga and Gaston 2004), as coastal mangroves are converted to shrimp aquaculture and interior wetlands are degraded from increasing pressure from agriculture and urban development. Still, aerial surveys and data from telemetered birds migrating south from the United States (VonBank et al. 2022) allow DUMAC to target habitat protection and restoration where they will have the greatest impact on the waterfowl resource (Pérez-Arteaga and Gaston 2004). In addition to a lack of funding for habitat delivery, there is a lack of university-trained natural resource professionals in Mexico due to a paucity of academic programs in wildlife ecology and related fields. Accordingly, several biologists from DUMAC have undertaken university training in the United States before returning to Mexico where they programmatically transfer knowledge to others throughout Latin America, although these international training programs are also now under threat due to declining financial support. Despite all of this, Mexico remains an important wintering habitat for waterfowl in North America (Rubio-Cisneros et al. 2014), and human dimensions studies confirm widespread support among the Mexican public for waterfowl conservation activities (Haefele et al. 2019).

DUCK SCIENCE AND CONSERVATION IN EUROPE

Policy and regulation

Although an international agreement was signed in Paris as early as 1902 (Bowman 2014), it was not before the signature of the European Union (EU) Birds Directive in 1979 that hunting policy and regulation began to be coordinated among nations. The Birds Directive has an overarching role as it prevents hunting during spring migration and breeding, the dates of which are regularly updated for each species and country in an associated "Key Concepts" document to reflect effects of climate change. The Birds Directive also purports to promote sustainable harvest and now requires regular reporting of national population sizes and trends as well as hunting bag sizes by Member States (European Environment Agency 2020). Besides political enrollment in the European Union, many countries of the continent are also part of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago (https://www.unep-aewa.org). The AEWA re-evaluates sizes and trends for waterbird populations (Conservation Status Reports, https://iwc-wi.shinyapps.io/csr9/), and aims at fostering (with moderate audience sometimes) collaboration among countries along the flyways and wise exploitation of species via adaptive harvest management (Madsen et al. 2015). Although it is not always followed by all contracting parties, AEWA is expected to play a major role in national waterbird conservation policies. On the balance, however, such agreements mostly set very general rules,

such as the prohibition of hunting migratory birds in spring as they move towards their breeding grounds. Despite the European Commission pushing for coordinated management or protection of migratory bird populations, more detailed regulations are often very different between countries even within the same flyway. Legal protection based on guidance provided by AEWA requires individual countries to implement changes to their national legislation, and coordinated international action agreed upon by the parties to AEWA is often slow to arrive or discordant. For example, in 2018 AEWA (MOP7) called for strict protection of common pochard following a pronounced population decline in Western Europe, which led Denmark to ban hunting of this species in 2020, France to introduce an annual 5,000 birds hunting quota, and Spain to maintain hunting with no bag limit in 2025.

Monitoring and research

Most European management strategies are based on winter population sizes and trends inferred from the International Waterbird Census (IWC). This is necessary given that many waterbird species breed and molt at low densities in remote geographic areas (e.g., Russia, northern Scandinavia), where it is considered geopolitically intractable or logistically and financially impractical to comprehensively estimate numbers during spring and summer over large scales. NGOs such as Migratory Birds of the Western Palearctic [OMPO] do support such surveys at more local scales, and some countries carry out long-term national waterbird breeding surveys, e.g., Piha et al. (2025). The International Waterbird Census is carried out in mid-January when birds flock in European countries where they are more easily surveyed. Wetlands International, an international NGO, plays a major role in coordinating such simultaneous counts over tens of thousands of sites in Eurasia and Africa, with the limitation that some waterbird populations winter in large numbers in the sub-Saharan region where surveys are incomplete (Nagy et al. 2022). Winter counts heavily depend on thousands of community science volunteers, such that the system is very different and much less expensive than the extensive aerial surveys conducted by professionals in North America. The IWC has nevertheless been shown to be robust for estimating waterbird population trends, if not population sizes (Thaxter et al. 2025). Potential short-stopping aspects need to be considered (Fox et al. 2019), but such counts also provide a very efficient means of studying changes in winter ranges of populations in response to climate change (e.g. Lehikoinen et al. 2013).

Apart from the IWC which illustrates a very effective and long-standing collaboration, there is limited large-scale alignment among European countries for research and conservation of waterfowl, although projects run by the European Bird Census Council (EBCC), such as breeding bird atlases and the Pan-European Common Bird Monitoring Scheme, also provide valuable information on waterbirds. Furthermore, scientific collaboration obviously exists on a peer-to-peer basis, promoted and funded by European and nation state public funds for example. Some exceptions are the work carried out by OMPO mentioned above, and the creation of the European Federation for Hunting and Conservation (FACE), which aims at greater harmonization and joint research projects across and between hunting, nature conservation, and wetland organizations (e.g., Lecocq et al. 2011). Comparable initiatives exist among NGOs such as BirdLife International and their national partner organizations, where research projects often run in parallel with conservation actions. Significant social and reputational barriers can arise in creating effective collaborations. In some cases, hunters and their organizations are encouraged to fund applied research or take part in surveys such as IWC, yet the legitimacy of such research or habitat management actions may later be questioned by opposing nature conservation NGOs (e.g., Rodríguez-Estival et al. 2025).

Given that European ducks largely breed and molt in remote northeastern areas where access is challenging, preseason banding is rarely practiced in Europe (see however some intensive long-term breeding studies, notably in Finland, e.g., Pöysä 2025). Most banding occurs over extended periods on migration stopovers and wintering grounds. While there are excellent teams of demographers developing advanced tools to handle such data (e.g., in Montpellier, Choquet et al. 2009; in the UK, Walker et al. 2020), the analyses nevertheless become complicated because individuals are not equally exposed to hunting after banding depending on exact timing of capture

(Devineau et al. 2010). Banding activities are coordinated at tnational level, which report and share data through the EURING databank (Du Feu et al. 2016).

Habitat management

Perhaps because of high human density and widespread intensive urbanization, wintering European ducks mostly congregate in protected areas during daylight hours. These areas are most often public grounds (Madsen 1998). Some individuals remain in such reserves to feed at night but, as in North America, most individuals disperse during the night to distinct foraging grounds (Tamisier 1978). These nocturnal foraging areas can be natural wetlands or agricultural lands. A greater proportion of these areas are private, calling for greater consideration of these sites in habitat conservation planning (Brochet et al. 2009a). While regulation in many EU states does occur on public and protected area sites (e.g., Natura 2000 or SPA/SAC coastal wetlands), the laissez faire approach taken by most European states to regulation on private lands means that harvest rates of wild ducks are effectively unregulated aside from the legally set hunting season length. Legal baiting (in many countries) contributes to high per capita harvest levels that can exceed those observed in North America (for a UK example see Ellis and Cameron 2022, Cameron et al. 2026). In sum, the most common regulatory levers for countries in Europe are: 1) to open or close the season on particular species, which lacks the finer scale titrations of bag limits and season lengths on realized harvest rates; and 2) heavily restrict hunting on public land, which ignores the main source of waterfowl harvest which is on private land (Ellis and Cameron 2022, Madden et al. 2025, Cameron et al. 2026).

Compared to North America, habitat management is mostly carried out in Europe through protection of areas from detrimental effects of human activities (i.e., nature reserves). Although managers try to ensure habitat availability to provide for the various needs of species, there is no quantitative framework such as the estimation of available food resources and computation of potential duck use days in each area based on daily energy requirements (see e.g., energy landscape availability in Ringelman et al. [2018]).

Hunting regulation and contribution to science

Regulation of hunting activity in Europe is mostly through season length and listing of huntable species in each country; bag limits are seldom practiced, and few of these regulatory levers are managed in a synchronized manner among countries (see above). Exceptions exist for some goose species in Northern Europe and recently for turtle dove *Streptopelia turtur* (Carboneras et al. 2025, Sørensen et al. 2025), but international regulation of duck hunting is thus far non-adaptive, and generally lacks a scientific basis and coordination. While it is mandatory for EU countries to report bag sizes of all hunted bird species to the Commission (Article 12 of Birds Directive), there is no coordination of bag survey methods, and few nations have state support for such activities (Aubry et al. 2020), making collective management at the flyway scale difficult. While it is not possible to assess the number of waterfowlers *per se* because no specific licence is generally required for different game species, the total number of hunters is large and amounts to 7 million people in Europe (https://www.face.eu/nature-conservation/hunters-for-conservation/). However, as compared to the United States and Canada, European hunters are not culturally exposed to the same types of statutory and voluntary data collection on their effort or bag success. While European hunters often make other meaningful contributions to waterfowl science (e.g., participating in bird counts, supporting wing surveys, and disease monitoring) their contributions to wildlife monitoring are often viewed with the same skepticism they themselves would have of other wildlife advocacy groups. So, while waterfowl hunting remains prominent in many places in Europe, and some valuable initiatives do exist, the degree to which hunters contribute to monitoring and research of wildlife and the socio-logical hunting system is much lower than in the United States and Canada.

COMPARATIVE HIGHLIGHTS

The most profound difference between North America and Europe when it comes to duck research, management, and conservation is philosophical: in North America, waterfowl conservation has been elevated and sustained by the widely shared notion that wildlife are a public trust resource to be managed by the government for use by people now and in the future (i.e., essentially utilitarian and bottom-up), whereas bird conservation in Europe has largely been nature-centric and deontological which often places human harvest in opposition to waterfowl conservation (and more generally, hunting in opposition to wildlife conservation, e.g., Paulson 2012, Veríssimo and Campbell 2015).

Duck conservation in Europe is largely driven by international protectionist laws and treaties that constrain hunting based on the precautionary principle, and there is less appetite for the collection and application of data to move towards science-based and adaptive harvest management of ducks. Some of this reticence is practical: with little access to breeding season data, inconsistent harvest reporting, and no coordinated regulations to implement or enforce, the integrative demographic management approach practiced in North American is difficult to achieve. Some of the hesitancy also comes from the dominance of protectionist-based conservation science in Europe, with social and professional barriers to adopting the natural resource-based utilitarian conservation worldview amongst scientists and regulators—which may originate from the general feeling of a more pressured and degraded wildlife in Europe. In contrast, harvesting, monitoring, studying, and conserving waterfowl are inextricably intertwined in North America, which engages governments, NGOs, and hunters in all aspects of the conservation and management enterprise, including data collection and analysis. There has been some swell of support from grassroots and political interest in conserving hunted species and landscapes in Europe, leading to the creation of private organizations and NGOs such as the British Trust for Ornithology, Wildfowl and Wetlands Trust, Fondation Tour du Valat, International Waterfowl and Wetlands Research Bureau, Wildfowlers' Association of Great Britain and Ireland (now BASC), OMPO, the Waterfowler's Network, etc. However, such initiatives are generally not coordinated with one another, probably because of somewhat different cultural histories and motivations even among EU states, so that duck conservation has most generally followed disparate paths among countries in Europe.

Such philosophical differences translate into the way governance is built and shared among stakeholders, with a more vertical organization in Europe, and little tolerance for conservation risk or utilitarian harvest management compared to North America. Wildlife hunting is a significant element of North American culture and hunters are generally accepted by the public as legitimate stakeholders in the system (Responsive Management 2024), as opposed to often being regarded as zero-sum consumptive users in Europe (although likely less so for waterfowlers than other hunters, given their more active management of private and public wetland hunting sites). Hunters in the United States and Canada play a more prominent role in both data collection and revenue generation for conservation, such that the declining number of waterfowl hunters is viewed as a major threat to conservation funding and political prioritization in North America (Vrtiska et al. 2013). In Europe, hunting pressure and indirect effects such as disturbance, displacement, crippling, etc. are more generally viewed as limiting factors for duck populations. This has not been demonstrated scientifically (see Pöysä et al. 2013, Cameron et al. 2026), but the enormous growth in some wetland bird populations in recent decades, following partial protection imposed by the Birds Directive, suggests such constraints may at least have been operating in the past.

In North America, cultural inertia of the waterfowling legacy and scientifically-derived waterfowl management frameworks give it the legitimacy to leverage broad societal support, inclusive of strong representation in the larger conservation community. There are many hundreds of waterfowl professionals, and the cultural, economic, and political infrastructure they occupy translates into dedicated training systems, where specific university courses and waterfowl-specific academic positions (some of which are endowed) are relatively numerous, albeit declining (Kaminski 2013). Parallel systems are rare in Europe and Mexico, where students receive a general training in ecology and biological conservation, then potentially learn the specificities of waterfowl and wetland management through internships or hands-on experience, all of which are vanishingly less common in Europe than in United States or Canada. Only a very small number of universities in Europe have such dedicated training, with the notable exception of the University of Helsinki in Finland providing an MSc and PhD curriculum in wildlife biology.

EXAMPLES FOR FUTURE COLLABORATIONS

Differences in the eco-socio-scientific systems between North America and Europe have engendered unique constraints on monitoring, applied research, and management and conservation of waterfowl, leading the scientific communities to explore different domains of waterfowl ecology or to approach similar questions in different ways. The divergent attitude towards hunting on the 2 continents leads to very different types of contributions by hunters themselves, hence the data available, and hence the type of science that can be conducted. However, the species of interest on the 2 continents are the same or are very similar and share similar ecological requirements and biological constraints (Messmer et al. 2025). This creates opportunity for cross-fertilization of ideas and fostering tighter collaboration between North American and European research teams. We argue that knowledge gained on one continent may initiate new management procedures or solve conservation problems on the other continent, benefiting duck populations some of which are data poor or of conservation concern.

Shared interest in duck habitat conservation and management leads to similar needs for understanding waterfowl use of human-modified landscapes, especially during the non-breeding season, when waterfowl must choose among habitats that vary in quality (i.e., foraging value, risk from hunting; Kaminski and Elmberg 2014). This shared research question has been approached from 2 different directions by researchers on the 2 continents. North American scientists have spent tens of millions of dollars to deploy telemetry devices on ducks to study habitat use and selection (e.g., Lancaster et al. 2024), largely from an applied management perspective. In contrast, Europe has a long history of approaching such questions from the theoretical foundations of optimal foraging ecology (e.g., Madsen 1988, Van Eerden 1997). The 2 approaches are beginning to coalesce: applied telemetry studies are revealing empirical support for the marginal value theorem (Charnov 1976, Highway et al. 2024), and individual-based models relying on resource selection functions and behavioral ecology, formerly developed in Europe (e.g., Stillman 2008) are being adapted and used as habitat decision-support tools in North America (Weller et al. 2023). Further integration in study design and implementation of applied and theoretical perspectives common to North America and Europe, would enhance the value of future studies on both continents (Guillemain et al. 2017). A better assessment of bird space use processes, coupled with a better understanding of physiological constraints, would advance conservation efforts that target appropriate habitat for ducks at the right place and at the right time. The energy-based framework for management of wetlands to increase habitat carrying capacity for ducks would be valuable to transfer to Europe, because it provides a quantitative metric for comparing alternative conservation actions (Ringelman et al. 2018). This would help define protected areas not only on the basis of safety from external human pressures, but also draw attention to the need for them to provide foraging resources (Brochet et al. 2009a).

A shared threat of wetland managers worldwide are invasive plants, which can profoundly affect habitat suitability for ducks (Hagy et al. 2014). Here, Europe has intensively studied long-distance alien plant dispersal by waterfowl themselves (e.g., endozoochory [Brochet et al. 2009, García-Álvarez et al. 2015]). Transfer of this knowledge and the underlying research frameworks could help North American land managers better understand and anticipate colonization by invasive aquatic species.

While breeding ecology tends to be more difficult to study in Europe due to inaccessibility of habitats, ground-nesting ducks on both sides of the Atlantic are subject to predation by expanding populations of predators, especially mesocarnivores (Greenwood et al. 1995, Nummi et al. 2019). Research in Europe and North America has explored this demographic bottleneck using both simulated (Padyšáková et al. 2010, Ringelman et al. 2012, Holopainen et al. 2020) and natural nests in relation to duck nesting habitat (Clark and Shutler 1999, Albrecht et al. 2006, Dyson et al. 2024). Additionally, North America has benefitted from larger datasets that permit local- and landscape-level analyses (Walker et al. 2013, Ringelman et al. 2018*a*), which suggest fruitful avenues of inquiry in Europe. In terms of management, invasive raccoon dogs (*Nyctereutes procyonoides*) are subject to lethal management in some areas of Northern Europe in order to improve duck nest survival (Selonen et al. 2025). This parallels a long legacy of research and management by Delta Waterfowl Foundation in the United States (e.g., Pieron and Rohwer 2010), and could be used to inform management of predators in Europe.

Studies in demography, especially those based on capture-mark-recapture analyses of banding data, are probably the domain where collaboration has been the most intense and fruitful over the last 30 years. Some of these transatlantic papers have become classics (e.g., Lebreton et al. 1992, Pradel et al. 1997) and are the basis of current demographic analyses including in ducks (Nicolai et al. 2026). Development of new analytical techniques regularly travel from one side of the Pond to the other. Scientists from both North America and Europe are currently confronted with the same general decline in band recovery rates (Dunn 2001, Robinson et al. 2009), although duck band return rates by hunters have proven to be high in the U.S. and Canada (Arnold et al. 2020). Reward band studies such as those carried out in North America (e.g., Nichols et al. 1991) are now being imported to Europe to evaluate the band return rate in the continent (Souchay et al. 2026). More generally, there is a general need to better incorporate human dimensions studies. This holds for band return rates but also for improved ways of collecting bag statistics, how to properly rely on hunters as citizen scientists (e.g., Cretois et al. 2020), and to better understand changes in the wider social license under which hunting operates on both continents (Hampton and Teh-White 2019).

Synergic moves towards collection of sex- and age-ratio data, either through field surveys (bird counts) or wing collection schemes would help parameterize more advanced structured population models while scalar models have long been the norm (Cooch et al. 2014). Europe has advanced recently in the domain of AI-automated sex and age recognition from pictures of harvested ducks sent by hunters with smartphone apps (https://www.chasseurdefrance.com/autowing/), and similar efforts are underway in North America (Blenk and Ringelman, unpublished data). Although human verification of pictures is still required, this could be co-developed with efforts in North America, saving the need for cumbersome post mailing of bird parts to wing bees and allowing the easy collection of far more data, hence more precise and reliable sex and age ratios.

Co-developing new methods for hunter data collection like effort, harvest, and harvest composition would improve demographic modelling to help derive appropriate duck management policies. The potential for cross fertilization is evident for these demographic studies: for example, the European Commission is calling for the development of integrated population models for several duck species considered to be of conservation concern. Adapting the existing North American Pintail IPM (Osnas et al. 2021) to the European pintail population would help gain time and efficiency, and could serve as a basis for the development of similar models for northern shoveler, Eurasian teal and wigeon, and other species. Given that these or sister species are also present on the other side of the Atlantic, such models could then be transferred back from Europe and help North American management.

Finally, ducks from the 2 continents share threats related to pollutants and diseases, both historic (e.g., lead, avian cholera), and more recent (e.g., per- and poly-fluoroalkyl substances, contaminants of emerging concern, avian influenza, and coronaviruses; Baldassarre 2014, Brand et al. 2025, Cullen et al. 2025, Vestal-Laborde et al. 2025). The basic biology, ecology, and demographic consequences of these threats, as well as risks to human health and food security have been identified as key research priorities. Perhaps more than any other concern, the cross-continental movements of waterfowl highlight the need for major large-scale analyses of band recovery and satellite tracking of waterfowl species in order to better understand and handle disease outbreaks (e.g., Atkinson et al. 2006, McDuie et al. 2022, Hardy 2023, Teitelbaum et al. 2026).

PATHWAYS FOR ACHIEVING TIGHTER COLLABORATION

We believe there are 3 basic requirements for furthering collaboration in waterfowl science and management between North American and Europe: know each other, communicate with each other, and fund the whole process (Table 1). These components seem straightforward, and yet as our meeting in Kristianstad revealed, they have not been developed to the extent necessary for streamlined advancement of shared priorities.

The first observation is that North American and European duck scientists do not know each other very well: although piecemeal research projects or student defenses have enabled some individual researchers to meet and build personal connections across the Pond, there are generally few personal relationships among duck scientists

TABLE 1 Pathways for achieving tighter collaboration among North American and European duck scientists.

Basic requirements	Desired actions	Who should engage
KNOW	*Promote student exchanges and internships, open MSc and PhD positions to students from other continent*	Established duck scientists/ supervisors
	Invite transcontinental colleagues in MSc and PhD defense juries	Established duck scientists/ supervisors
	Attend conferences in the other continent	Established and young duck scientists
	Organize hemispheral/worldwide conference instead of continental	Conference organizing committees
	Consider and support transcontinental stays/sabbatical	Established duck scientists and their employers
COMMUNICATE	*Organize recurrent "Ducks across the pond" session in duck conferences*	Conference organizers
	Invite scientists from the other continent (inclusive of age and sex) as plenary speakers in conferences	Conference organizers
	Enroll in mailing lists/email forums	Established and young duck scientists
FUND	*Establish waterfowl chairs and courses*	Universities, governments, NGOs
	Support internships and travel grants, open these to the other continent	Governments, NGOs
	Make a heavier use of public funding for international exchanges (Fulbright, Marie Curie, etc)	Established and young duck scientists
	Develop waterfowl/wetland charities in Europe (or European chapters of existing North American charities)	NGOs

from North America and Europe. There have been some European delegates at the North American Duck symposia since the second edition in Saskatoon, Canada in 2000, and some North American participants in Pan-European Duck Symposia also since the second edition in Arles, France in 2009, but it has always been a handful of people, often the same individuals traveling from one congress to the next. It is clear that continental duck symposia should be better advertised to researchers on the other side, and participation be promoted and financially supported by employers and other stakeholders. A regular delegation of 20–30 scientists (including biologists in policy and government positions, i.e., regulators) from one continent attending conferences on the other continent would seem a minimum for building efficient collaboration networks. It would be beneficial that employers of these scientists realize this need and fund such travels. However, a broad constituency of partners would also benefit from inviting scientists from the other continent to initiate such links; e.g., financial facilitators of North American duck conferences should offer travel awards specific to European scientists, and vice-versa. "Ducks across the pond" workshops or sessions could also become recurring events during conferences in both continents.

Beyond such continental meetings, which have their own value, the organization of conferences unequivocally soliciting a worldwide audience should also be considered (e.g., the Waterbirds around the world conference in Edinburgh, Boere et al. 2006). An all-waterfowl congress is planned in Montpellier, southern France, in March 2028, with the support of European and North American stakeholders this a specific and obvious opportunity to initiate such a worldwide congress of waterfowl professionals.

In addition to such punctuated events, typically only occurring every several years, foreign stays of duck scientists on the other continent should become more common. This could take the form of sabbatical of established scientists, training of postdoctoral researchers temporarily working on the other continent or college student exchanges. At present no dedicated waterfowl academic chairs or courses exist in Europe as they do in North America, again with the exception of the university of Helsinki organizing an international waterfowl and wetland ecology course for MSc and PhD level students from across the EU in 2005 and 2019. We therefore propose that Europe should explicitly look to their North American colleagues to facilitate such exchanges given their relative wealth of opportunity for teaching and training. Indeed, discussions during the workshop suggested North American training opportunities could easily be available to European students upon demand (e.g., via online courses or student exchanges), and there was general agreement that university administrators look favorably upon and may provide funding for such opportunities. Similar to facilitating international conference attendance, it would be beneficial for North American organizations, which are more numerous and financially prosperous, to support internships from young European scientists in North America. Lastly, MSc and PhD students should be encouraged to conduct their research on the other continent. Supervisors should favor temporary stay of their students with foreign teams, advertise their internship offers between the 2 continents, and be open to applications from young scientists originating from across the Pond, providing the ground for joint and co-funded postgraduate level research that tackles questions within each continent's interest. Substantive exchanges of students through summer schools or semester internships (like the Erasmus scheme in Europe) would be the best option to train the next generation of waterfowl scientists into a shared, global scientific environment.

We recognize that funding, visas, and other governmental limitations may be an issue, at least in the current political climate. The same constraints also limit attendance of overseas scientific congresses by large delegations. One first step could be to support and promote at least the travel of a few individuals, as congress participants, interns or post-docs: the training acquired on the other continent can subsequently benefit the domestic scientific community when these people travel back home and share their new knowledge. A good historical example is given by the pioneer post-doc Alain Tamisier who received training in Louisiana in the late 1970s, which let him fine-tune the theory of waterfowl functional units (Tamisier 1976, 1978), including through the introduction of radio-tracking in France which had never before been attempted in ducks (Tamisier and Tamisier 1981).

Aside from scientific journals and papers, which are distributed or at least mostly available in Europe and North America, duck scientists feel they are not so well informed about what happens on the other side of the Pond, as per job opportunities, grant offers, etc. This should be easily correctable in a world where modern technology can make this very simple. For example, waterfowl professionals are encouraged to join listservs and email forums that exist in the United States and Europe, 3 of which are particularly notable: 1) the U.S.-based "Al Afton waterfowl listserv" which distributes waterfowl scientific information, job announcements, and hosts non-political discussions (email aafton@lsu.edu to join); 2) the listserv operated by the U.S. Fish and Wildlife Service targeted at waterfowl and wetland issues relevant to Refuge managers, (join at https://legacy.fws.gov/lists/listinfo/waterfowl); 3) the European-based IUCN Duck Specialist Group (email matthieu.guillemain@ofb.gouv.fr to join).

Finally, the question of funding (of academic chairs, of internships, of attendance to congresses, etc.) is a perennial challenge. Applied research may be less attractive to European funders, whereas purely academic research may garner less support in North America. That being said, there is a clear opportunity for European scientists leveraging existing North American funding opportunities, since some research grants, internships, and training programs in North America may well be open to European researchers and students—especially if co-sponsored by North American colleagues. To the extent that research objectives are aligned or are translatable across continents, funding organizations in North America (especially NGOs which may be more capable of moving funding internationally) should also be open to funding European projects and/or scientists. It certainly became clear during the workshop that much could be learned through joint or comparative studies in North American and Europe. On the other hand, similar organizations should also be developed in Europe, or European chapters of North American organizations be developed, to match the funding of applied research on the

eastern side of the Atlantic. See for example, the success of Ducks Unlimited de México in conducting science and delivering conservation in that country. Beside such private funds, ours is a discipline which may not have taken full advantage of existing public financial sources, such as for example the Fulbright U.S. Student Program or the European Marie Curie postdoctoral fellowships.

The conference symposium we convened was focused on increasing collaboration between North American and European scientists. In addition, we call for better communication and cooperation with colleagues from Central/South America and from Africa. While there are a few exceptions (e.g., Carenton et al. 2024, Atkinson et al. 2026), most collaboration largely rests on the work of volunteers and NGOs in conducting population counts, more than academics developing comprehensive research frameworks or governments coordinating monitoring and policy. The current call for better transatlantic collaboration should not overshadow the need for better north-south scientific collaboration, which is also pressing.

CONCLUSIONS

Waterfowl have been near the forefront of the wildlife science enterprise in both North American and Europe since at least the 1970s: in North America, researchers predominately moved in an applied direction in support of what was emerging as the hunter-driven North American model of wildlife management, whereas in Europe, researchers built from the theoretical foundations developed by field ethologists and behavioral modelers. Over the decades, we argue that these complementary approaches have failed to coalesce to the extent expected by widespread globalization of science and conservation. While the North American and European approaches to waterfowl science and management can likely never be co-replicated on either continent, we believe that greater collaboration among researchers—even by merely calling out the current paucity thereof as we do here—can lead to broader and more holistic advances in our understanding of waterfowl ecology as they face enduring and emerging challenges on both sides of the Pond.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ETHICS STATEMENT

No permitting or animal care protocols were required for the development of this manuscript

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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