North American Waterfowl Management Plan Science Support Team
Technical Report No. 2023-01

North American Waterfowl Management Plan Species Prioritizations — 2023 Revision

Contributing authors:

Tony Roberts
US Fish and Wildlife Service, Division of Bird Habitat Conservation

Joshua Dooley
US Fish and Wildlife Service, Division of Migratory Bird Management

Al Hanson
Canadian Wildlife Service, Eastern Habitat Joint Venture

Kate Martin
Sea Duck Joint Venture

Kyle Spragens
Washington Department of Fish and Wildlife

Greg Yarris
Central Valley Joint Venture

EXECUTIVE SUMMARY

The waterfowl management community has long been committed to restoring waterfowl populations, using periodic updates to the North American Waterfowl Management Plan (NAWMP or the Plan) to identify and communicate changing priorities. The current document builds upon previous iterations of NAWMP by considering several important aspects of the Plan and including contemporary data. The North American Waterfowl Management Plan was developed as a strategy to restore waterfowl populations and through several updates the Plan's focus has remained waterfowl conservation, but the number of waterfowl species and populations (>70) requires strategic thinking in prioritizing management efforts. In 2004, the Plan prioritized waterfowl species in terms of perceived management need given habitat conditions and importance in harvest (NAWMP 2004). Additional biological and social data are now available along with updated goals of the Plan. In particular, the 2012 Plan Update added social values associated with waterfowl as important objectives of the Plan.

The three primary Plan goals were used to identify classification criteria and prioritize species within all ducks and geese and swans combined. The classification criteria are presented in Table 1 and the results of the above methods are presented in tables 3 and 4. High priority was assigned for 12 of 38 duck species (40 populations). For geese/swans, 11 of 35 populations were classified as High priority.

The waterfowl species prioritization was updated to account for a wider range of social values, accommodate additional current data, and achieve Plan goals. This update relies heavily on the Avian Conservation Assessment Database (ACAD) created by Partners in Flight (2021). The primary source for many ACAD criteria included expert opinion of waterfowl managers, including the NAWMP Science Support Team and associated Joint Ventures. For ducks, the waterfowl population objective of the Plan was scored using population trend information from ACAD and the habitat objective was scored using ACAD threats to breeding and non-breeding habitats. To address the human dimensions objectives, two criteria were used for ducks, total harvest from federal harvest surveys and observations by bird watchers using eBird. For geese/swan populations, the population objective used the most recent 10-year trend in relation to population abundance. The ACAD habitat threats scores were used to classify populations for the habitat objectives of the Plan. For the human dimensions objectives of goose/swan prioritization, population objectives defined in flyway management plans were assumed to represent societal goals for management, and scores were based on the qualitative difference between management plan objectives and current population abundance. For each group the scores of the three categories were averaged so the objectives of the Plan were equally weighted. The range of final scores among populations were subdivided approximately equally to obtain 3 levels of prioritization (high, medium, or low) for ducks and geese/swans.

This report focuses solely on the continental scale. Upon completion of this report, work will commence towards updating regional level scores at the appropriate scale. The continental and regional prioritization will then be updated as needed and as additional information is obtained. The NAWMP Science Support Team (NSST) will work directly with ACAD to prioritize updating expert opinion and trend data at time intervals that are relevant to strategic planning and management decisions.

INTRODUCTION

Prioritization of conservation activities can help focus management efforts on areas most in need. The North American Waterfowl Management Plan (NAWMP or the Plan) was developed as a strategy to restore waterfowl populations through habitat protection, restoration, and enhancement. The Plan is an unprecedented recognition of the need for international cooperation to help recover shared waterfowl resources and was signed in 1986 by the United States and Canada and in 1994 by Mexico. Since its creation, the Plan has been updated and revised several times to strengthen its biological foundations, expand and redefine goals, and forge broad alliances with other conservation initiatives.

The Plan's focus has remained waterfowl conservation, but the number of waterfowl species requires strategic thinking in management efforts. In 2004, the Plan prioritized waterfowl species in terms of perceived management need (NAWMP 2004). Results of that work represented species priorities in terms of habitat conditions and importance to harvest. Prioritization results have been used by other conservation efforts, primarily North American Wetlands Conservation Act delivery and US Fish and Wildlife Service (USFWS) National Wildlife Refuge land acquisition prioritization.

The 2004 prioritization assessed management priority separately for ducks and geese/swans based on differences in management scale and existing population objectives. The two groups (ducks and geese/swans) each had a prioritization scheme established, and data current to the time was used to rank the species or populations at the continental scale and then stepped down to modified Bird Conservation Regions (BCRs). Continental duck prioritization was based on a matrix of population trend and waterfowl harvest components (NAWMP 2004). For geese/swans, continental prioritization was based on a matrix of population trend and deviation from Plan population objectives. The 2012 Plan was updated to include human dimensions objectives for waterfowl, hence 2004 prioritizations became out of step with current Plan goals.

In this update, population trend, proportion of duck harvest, and deviation from goose/swan objectives are still considered important. In addition, we incorporated information on habitat threats and social values such that the three broad objectives of the current Plan (populations, habitat, and people) are explicitly included in the ranking process. Nearly 20 years of additional biological and social science data are now available to contribute to an updated priority species list.

METHODS

This update relies heavily on the Avian Conservation Assessment Database (ACAD) created by Partners in Flight (2021). This database is used in other avian conservation priority schemes by the Plan's government partners (e.g., Birds of Conservation Concern), so the use of this database provides congruence across bird groups and conservation activities. In addition, ACAD uses many of the same surveys from the 2004 prioritization but with updated data. In the absence of data for some species, the developers of ACAD used expert opinion of waterfowl managers, including the NAWMP Science Support Team and associated Joint Ventures, to determine

population trend and the magnitude of habitat threats. Specific criteria and data sources, including ACAD, will be explained in the following sections.

Populations
For ducks, trend scores from ACAD were used, which are based on various surveys and expert opinion, including the WBPHS (species that nest primarily in the Traditional Survey Area), Breeding Bird Survey (whistling ducks, boreal tree-nesting species), and Christmas Bird Count (sea ducks). Some population trend data in ACAD are outdated, but using ACAD allows consistent updating of the prioritization exercise in the future and was less prone to bias compared to picking and choosing from multiple surveys. The NSST is actively involved with the data managers for ACAD in updating estimates at intervals relevant for management.

For geese/swan populations ACAD does not provide information at the management population scale. Therefore, population specific survey data was used to calculate the trend over the past 10 years of primary survey indices reported in the USFWS Status Report (USFWS 2022) or other population-specific source materials. Directional trend for the largest and smallest abundances can mean different things to the long-term viability of a population. For example, a species with a population size of over one million and over management objective, that is declining, means something different to management actions compared to a species that is declining and has a total population size of 10,000. Therefore, total population size was combined with trends when scoring populations of geese/swans (Table 2). To avoid minute changes in population size influencing categorization, order of magnitude differences were used to categorize goose/swan populations. All populations with abundance estimates <100,000 were categorized as 'small', those >1 million as 'large', and all in-between as 'medium'. A matrix of population size categories and 10-year trends was created to score goose/swan population prioritization (see below).

Habitat
The habitat goal was addressed using two criteria from ACAD: threats to breeding and threats to non-breeding habitats. These criteria are standardized in ACAD and add a forward-looking perspective to the prioritization list for most waterfowl species. Habitat threats in ACAD were derived from expert opinion, and for waterfowl scores were elicited primarily from the NAWMP Science Support Team. Mexican duck, Hawaiian duck, and Laysan duck do not have ACAD scores. For those species, ACAD methodology was reviewed, and scores were assigned accordingly.

Social
To address the social value goal two criteria for ducks were used, percent of total harvest and frequency of observations by bird watchers using eBird. To update harvest estimates, 1999-2020 fall-winter harvest estimates from the USFWS and CWS Federal harvest surveys were used. Contemporary estimates of Mexico fall-winter harvest were not available, so estimates from Kramer et al. (1995) during 1987-1993 were incorporated. In most cases, spring-summer harvest data are also not readily available. For Alaska spring-summer harvest estimates, the mean of the 2016-2019 harvest indices for 5 regions reported in Naves et al. (2021) were used. Canadian subsistence harvest estimates were difficult to find, so internal CWS documents were used to estimate total spring-summer harvest among species. Though it is important to consider all

sources of harvest, the estimates of spring-summer harvest continentally and fall-winter harvest in Mexico are likely unreliable. Also, available harvest data may not represent the true social value of spring-summer harvest in terms of food security, cultural practices, and Indigenous rights, particularly in northern areas of the continent. Focused surveys are recommended to update those estimates, but in the interim available data were used. Observations by bird watchers were obtained from Cornell Laboratory of Ornithology's eBird data (eBird 2021). For each species, the proportion of all checklists submitted that included the species was calculated. Data 1999-2020, year-round, from all of Canada, Mexico, and the United States were used. The proportions of checklists were averaged by week, then averaged over the entire year. This method of linking bird-watcher checklists to people's values makes many assumptions that need to be tested. Raw data are likely a product primarily of the relative abundance of easily detected species at popular birding locations and dates. Preferably the measure of interest is how much value the birding community is getting from seeing individual species, something not easily done at this time that should be revisited in future iterations of prioritization. In the current scheme the assumption is that just seeing waterfowl is important to bird-watchers regardless of species, though there is evidence some bird-watchers are motivated by the desire to see rare species.

The two criteria selected to address the social value goal of the Plan are highly correlated with the relative abundance of duck species in North America. This warrants caution when using this prioritization in a structured decision approach as each data stream is correlated though they are treated as independent. Analysts should be aware of this when working with these results. A product of using these criteria in prioritization is that common species are given more weight. The goals of bird management plans are not just to recover species that are most imperiled but also to preserve the abundance of common species, at least partly because those species often provide opportunities for the widest range and number of people to interact with birds. This objective is often called 'keeping common species common', and though not a stated goal of the Plan, this underlies much of the spirit of Plan partner actions and was a consideration in this prioritization process.

To address the social value goal for goose/swan populations, the assumption is made that Flyway management plan goals reflect social goals. The most recent management plan objectives as developed by Flyways were compiled then compared, when able, to the most recent population abundance estimate. The qualitative difference between objective and current abundance was scored 1-5. Management plans, and their associated objectives, are outdated for some populations. This an opportunity for the management community to update their objectives for use in the next species prioritization update.

Table 1. Criteria (data source) used for prioritizing ducks and geese/swans species and populations.

_____

Ducks:
1. Continental species trend (ACAD)
2. Combined continental harvest data (Canada, Mexico, and US harvest)
3. Observations of the species by bird watchers (eBird)
4. Threats to breeding population (ACAD)
5. Threats to nonbreeding population (ACAD)

Geese/swans:
1. Continental species trend (USFWS Status Report, population-specific source materials)
2. Deviation from Plan population objectives (Current management plans)
3. Threats to breeding population (ACAD)
4. Threats to nonbreeding population (ACAD)

Scoring
Duck species were scored for each of the five criteria (population trend, threats to breeding and non-breeding habitats, harvest, and bird watcher observations) and geese/swans were scored for four criteria (population trend given abundance, threats to breeding and non-breeding habitats, deviation from population objective; Table 1, Figure 1) .

In ACAD, population trend was ranked 1-5 based on mean change in population size and precision of estimates (e.g., 1 = large increasing trend [>+50% and 90% confidence interval excluding 0]; 5 = large decreasing trend [<-50% and 90% CI excluding 0]; PIF 2021). Threat categories were also ranked 1-5 (1 = future conditions expected to significantly improve/no threat; 5 = future conditions expected to extremely deteriorate/very high threat). The 2004 species prioritization used three levels to characterize duck harvest which results in unequal weighting across metrics. To weight each criterion equally, harvest thresholds were assigned as percent of the total continental duck harvest with five levels as: 0-1%, 1-5%, 5-10%, 10-15%, and >15%. These incorporated levels from the 2004 prioritization, while accounting for the relatively narrow range of proportion of harvest for most species. The same thresholds were used for the eBird data (observations by bird watchers).

Figure 1. Example of how measured values translate to scores and final prioritization for two closely related species. See text for scoring descriptions and breakpoints for translating measures to scores.

	Mallard	American black duck
Population trend (% change/year)	0.7	-1
Population score	**2**	**4**
Threat to breeding habitat	2	3
Threat to nonbreeding habitat	2	3
Habitat score (average)	**2**	**3**
Harvest (% total harvest = score)	34% = 5	1% = 2
Birdwatcher (% total lists = score)	22% = 5	3% = 2
Social score (average)	**5**	**2**
Total score	**9**	**9**
Resulting prioritization	**High**	**High**

For geese/swans, the deviation from plan objective was defined in five categories as: 1 = at objective (within ±20%), 2 = unknown, 3 = below objective 21–75% or above objective >20%, 4 = below objective >75%. At the continental scale for threats to habitat, ACAD rankings were used as above at the species level, meaning all Canada goose populations have the same score regardless of geographic differences. The scores for population size and trend are presented in Table 2.

Table 2 – Goose population size compared to Flyway objective, population trend from relevant data sources, and resultant social value score.

Population size relative to Flyway Objective	10-yr trend	Score
Low	Unknown	4
Low	>1% decrease	5
Low	stable	3
Low	>1% increase	2
Medium	>1% decrease	4
Medium	stable	2
Medium	>1% increase	1
High	>1% decrease	3
High	stable	1
High	>1% increase	3

The list of species and populations that were considered was updated for this prioritization. Geese/swan populations recognized by management agencies have changed since 2004, so the list was updated to reflect current Flyway management plans. For ducks, the 2004 prioritization split Barrow's goldeneye and harlequin ducks into eastern and western populations. This same split could be argued for other species but is justified in this case by the special status of these populations in Canada relative to the US. Both populations are listed as Species of Special Concern in Canada but have no special status in the US. The 2004 prioritization combined blue-winged and cinnamon teal because they are combined in the harvest survey. Those species were split and all Pacific Flyway harvest of blue-winged/cinnamon teal was assigned to cinnamon teal, an assumption that should be tested for future iterations.

Scores were averaged for the 3 categories (populations, habitat, social value) and added together to derive a final, numeric score for each population/species. This was done so the 3 goals of the Plan were equally weighted. The 2 habitat threats categories (breeding and non-breeding habitats) were averaged for each species to represent the habitat goal. For ducks, the harvest and eBird observations scores were averaged to represent the social value goal, while the population trend score alone represented the population goal. The range of final scores among populations was subdivided approximately equally to obtain 3 levels of prioritization (high, medium, or low) for ducks and geese/swans, and each population/species was assigned a prioritization level based on their final score. This system results in the change in one unit score at the NAWMP priority level (populations, habitat, and human dimensions) results in equal changes in priority regardless of category. This results in differences in sensitivity to changes in prioritization within categories, as populations are represented by a single metric, population trend, while habitat and

human dimensions categories are represented by 2 metrics each. So a unit change in harvest has equal weighting to a change in threats to breeding habitat, but half the weight of a change in population trend. This implicitly weights population status higher than any one metric, and is a waterfowl management community value that should be tested in future iterations of this prioritization.

For ducks, species with total scores 9-10 were categorized as 'High priority', scores greater than 6 but less than 9 were 'Medium priority', while the remainder were 'Low priority'. For geese/swans, prioritization categories were: 'Low priority' (4–6), 'Medium priority' (6.5–8.5), and 'High priority' (9–12). There is no recognition of differences within categories, and scores are presented for illustration only. For example, despite cinnamon teal having a score of 9 and king eider a 10, they are considered equal in categorization of 'High priority'.

The results of the above methods are presented in Tables 3 and 4 at the continental scale. High priority was assigned for 12 of 38 duck species (40 populations) and 11 of 35 goose/swan populations. High priority duck species included all species listed on the US Endangered Species List. The entire scoring sheet is available as an appendix. In addition, source material can be provided upon request.

DISCUSSION AND NEXT STEPS

There are large differences in distribution of each species/population, and the utilization of each species by people across the continent. Hence this report focuses solely on prioritization at the continental scale, but the NSST will continue work towards updates for regional scores immediately following the release of this report. The regional prioritization scheme is not yet finalized, but the ACAD and other existing sources allow repeatability through time and congruence with other conservation plans. Regional prioritization may occur at the scale of BCRs or habitat joint ventures within North America.

Continental and regional prioritization will be updated as needed and as additional information is obtained. Currently there is no set schedule for updates, but the NSST hopes to complete these at least at decadal intervals to contribute to the NAWMP update/revision cycle. This process should be made easier by using data that are accessible and regularly updated such as ACAD. The NSST will work directly with ACAD to prioritize updating expert opinion and trend data at time intervals that are relevant to NAWMP planning cycles. In addition, the USFWS has committed funds to ACAD for database upkeep and updating, which will speed the process of including new information.

LITERATURE CITED

eBird. 2021. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available: http://www.ebird.org. (Accessed: Date [e.g., April 26, 2023]).

Kramer, G.W., E. Carrera, and D. Zaveleta. 1995. Waterfowl harvest and hunter activity in Mexico. North American Wildlife and Natural Resources Conference.

Naves, L.C., A.J. Knight, and L.F. Mengak. 2021. Alaska subsistence harvest of birds and eggs, 2004-2020 data book, Alaska Migratory Bird Co-Management Council. Alaska Department of Fish and Game Division of Subsistence, Special Publication No. 2021-05, Anchorage.

North American Waterfowl Management Plan. 2004. Implementation Framework: Strengthening the Biological Foundation. Canadian Wildlife Service, U.S. Fish and Wildlife Service, Secretary of Environment and Natural Resources, Mexico City, Mexico, 106 pp.

North American Waterfowl Management Plan. 2018. U.S. Department of the Interior, Washington, D.C., USA; Environment Canada, Ottawa, Ontario, Canada; Secretary of Environment and Natural Resources, Mexico City, Mexico.

Partners in Flight. 2021. Avian Conservation Assessment Database, version 2021. Available at https://pif.birdconservancy.org/avian-conservation-assessment-database/. Accessed 26 September 2023.

U.S. Fish and Wildlife Service. 2022. Waterfowl population status, 2022. U.S. Department of the Interior, Washington, D.C. USA.

Table 3. Continental prioritization of ducks

Duck Species	Listed species	Combined score for goal			Total	Rank
		Social	Habitat	Population		
Steller's Eider	x	1	5	5	11	High
Spectacled Eider	x	1	4.5	5	10.5	High
Hawaiian Duck	x	1	4	5	10	High
Laysan Duck	x	1	4	5	10	High
Northern Pintail		2	3.5	5	10.5	High
Mottled Duck		1	4	5	10	High
King Eider		1	4	5	10	High
Cinnamon Teal		2	3	4	9	High
American Black Duck		2	3	4	9	High
Lesser Scaup		2	3	4	9	High
Long-tailed Duck		1	3	5	9	High
Mallard		5	2	2	9	High
American Wigeon		2.5	2.5	3	8	Med
Black Scoter		1	3	4	8	Med
Eastern Barrow's Goldeneye		1	4	3	8	Med
Western Barrow's Goldeneye		1	4	3	8	Med
Common Eider		1	3.5	3	7.5	Med
Greater Scaup		1.5	3	3	7.5	Med
White-winged Scoter		1	3.5	3	7.5	Med
Gadwall		3	3	1	7	Med
Masked Duck		1	3	3	7	Med
Blue-winged Teal		2.5	2.5	2	7	Med
Green-winged Teal		2.5	2.5	2	7	Med
Surf Scoter		1.5	3.5	2	7	Med
Common Merganser		1.5	2.5	3	7	Med
Red-breasted Merganser		1.5	2.5	3	7	Med
Canvasback		1.5	3	2	6.5	Med
Bufflehead		2.5	3	1	6.5	Med
Common Goldeneye		1.5	3	2	6.5	Med
Eastern Harlequin Duck		1	3	2	6	Low
Western Harlequin Duck		1	3	2	6	Low
Redhead		2	3	1	6	Low
Fulvous Whistling Duck		1	3	2	6	Low
Mexican Duck		1	3	2	6	Low
Wood Duck		3	2	1	6	Low
Northern Shoveler		2	2.5	1	5.5	Low
Ring-necked Duck		2	2.5	1	5.5	Low
Black-bellied Whistling Duck		1.5	3	1	5.5	Low
Hooded Merganser		1.5	2.5	1	5	Low

Ruddy Duck	1.5	2.5	1	5	Low

Table 4. Continental prioritization of goose and swan species/populations

	Plan Objective	Population Trend/Size	ACAD ThreatBreeding	ACAD ThreatNonbreeding	Total	Rank
Canada Goose Populations						
Atlantic	3	4	2	2	9	High
Lesser	2	2	2	2	6	Low
Dusky	3	5	2	2	10	High
Southern Hudson Bay	1	2	2	2	5	Low
North Atlantic	1	3	2	2	6	Low
Vancouver	2	4	2	2	8	Med
Pacific	3	1	2	2	6	Low
Rocky Mountain	3	1	2	2	6	Low
Atlantic Flyway Resident	3	1	2	2	6	Low
Mississippi Flyway Giant	1	1	2	2	4	Low
Western Prairie/Great Plains	3	3	2	2	8	Med
Hi-Line	1	1	2	2	4	Low
Cackling Goose Populations						
Cackling	1	4	2	2	7	Med
Aleutian Cackling	3	2	2	2	7	Med
Taverner's Cackling	2	2	2	2	6	Low
Midcontinent Cackling	3	3	2	2	8	Med
Lesser Snow Goose Populations						
Wrangel Island	3	1	4	2	7	Med
Mid-continent	3	3	4	2	9	High
Western Arctic	3	1	4	2	7	Med
Greater Snow Goose	1	4	4	2	8	Med
Ross's Goose	3	3	4	2	9	High
Greater White-fronted Goose						
Mid-continent	3	3	3	2	8.5	Med
Pacific Flyway	3	4	3	2	9.5	High
Tule White-fronted Goose	3	3	3	2	8.5	Med

Brant Populations						
Pacific Brant	1	2	4	3	6.5	Med
Western High Arctic Brant	1	2	4	3	6.5	Med
Eastern High Arctic Brant	2	4	4	3	9.5	High
Atlantic Brant	1	2	4	3	6.5	Med
Emperor Goose	1	5	4	3	9.5	High
Hawaiian Goose	4	4	4	4	12	High
Tundra Swan Populations						
Eastern	3	4	3	2	9.5	High
Western	3	2	3	2	7.5	Med
Trumpeter Swan Populations						
Rocky Mountain	1	4	4	3	8.5	Med
Interior	3	4	4	3	10.5	High
Pacific Coast	3	4	4	3	10.5	High