Technical Report:

In support of the 2024 Update for the North American Waterfowl Management Plan

Recommended Citation

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Contents

Purpose

Three working groups were assembled in early 2023 to update the North American Waterfowl Management Plan (NAWMP). These working groups were arranged to focus on fundamental NAWMP goals around (1) waterfowl populations, (2) habitats, and (3) people. This report synthesizes the findings and recommendations of the three working groups. It provides details and context beyond what could be included in the more public-facing Update document. Our hope is that this will prove to be a useful reference for waterfowl practitioners and, especially, for teams assigned to future updates.

Population Objectives

A Brief History of NAWMP Population Objectives

For most duck species, population objectives under NAWMP were established in 1986 as the average populations observed during the 1970s in the Traditional Survey Area (TSA) of the annual Waterfowl Breeding Population and Habitat Survey (WBPHS) conducted by the U.S. Fish and Wildlife Service (USFWS) and Canadian Wildlife Service (CWS), plus estimates from 6 states contributing to the annual USFWS Waterfowl Status Reports. These objectives were aspirational at the time as mid-continent waterfowl numbers had dropped substantially during the dry years of the early 1980s, and managers thought that returning those populations to the level of the 1970s would satisfy the desires of waterfowl hunters and others for duck abundance. In that sense, NAWMP population goals had a social motivation from the outset. The planners also thought this improvement might be achievable within the 15-year time horizon of the 1986 Plan and agreed that addressing ongoing habitat loss was essential for arresting further declines.

Those foundational objectives were tweaked in 1994. Objectives henceforth were based on the average of the 1970s for the TSA only (strata 1–50), although a separate table was developed to estimate total "continental" populations by adding various state surveys, eastern Canada surveys, and expert opinion estimates for some unsurveyed areas. Plan goals, thus, were based on the longest time series and most consistently run surveys in the TSA. NAWMP goals remained the same through Updates in 1998 and 2004. After a period of abundance in the late 1990s, the original objectives remained aspirational in the early 2000's, but from about 2011 to 2017, total duck population estimates soared to record levels, well above the original NAWMP goals. Following the 2012 Revision, population objectives were modified in 2014 to be the average populations of the entire timeseries (long-term average, or LTA) (1955–2014), with the addition of a dual aspirational objective to achieve 80th percentile levels during an unspecified subset of those years. Planners concluded that favourable circumstances during much of the 1990s and 2000s, mainly wet conditions with improved upland nesting cover in the mid-continent, had led to increases in populations, and importantly, since the mid-1990s, those populations had supported many continuous years of liberal harvest frameworks in the U.S.,

which was also a desirable outcome for stakeholders. Thus, maintaining populations over the long term at historical average levels, including periodic spikes under particularly favourable conditions, were compelling objectives.

Choosing the long-term average in 2014 also meant that no one sub-period (e.g., the 1970s) was chosen over another, and the full range of uncontrolled environmental conditions was represented. This made sense in 2014 considering then a Plan duration of 28 years and counting, versus the original time horizon of 15 years envisioned in 1986. The dual 80th percentile objective was added in recognition that, for the LTA to be achieved, some periods of extraordinary abundance and productivity were needed to offset inevitable years of scarcity and population declines.

The 2014 Addendum also, for the first time, included explicit population goals for selected species or species groups in the Eastern Survey Area (ESA), while recognizing that some elements of those surveys were still in development and likely to be adjusted in the future by harvest and habitat managers.

The 2014 population objectives were reiterated in the 2018 Update, but with the recognition that greater coherence among public desires, habitat conservation needs, and bird population objectives was desirable and might justify adjustments over time. Thus, while the 2014 objectives were assumed to approximate the present desires of stakeholders, these were expected to evolve with future ecological and social changes.

Forward to the 2024 Update

In approaching the 2024 Update, the view of the Populations Objectives group has been that such foundational matters as population objectives ought not to be changed without compelling reasons for doing so. Still, we viewed this, like every Update event, as an opportunity to ensure that this remarkable Plan, nearly 4 decades in duration, be based on the best information available. Plan stewards have always regarded NAWMP as a living document, and indeed its evolving nature has been a major reason for its durability. Our first step in this process was to conduct a brief survey of the NAWMP Habitat Joint Ventures (JVs) to assess their current approaches to linking habitat objectives to NAWMP population goals, the frequency of conservation planning iterations, their use of dual objectives and more (Appendix A). This provided valuable perspective for the discussions below.

With every Update of the Plan, concern over the effects of climate change on waterfowl habitats and waterfowl biology has been growing. However, other than increasing uncertainty in our management decisions, we cannot yet predict specific impacts of climate change on waterfowl species, habitats, or public attitudes about wetland conservation.

2024 NAWMP Update Recommendations

The modifications we recommend below are the result of reviewing our critical information bases, such as the WBPHS TSA and ESA data, and efforts by the Sea Duck and Arctic Goose JVs to develop the best biological bases for species management. Then, in coordination with the Human Dimensions and Habitat Teams, we will endeavor to offer the best integrated assessment of NAWMP objectives presently available.

Traditional Survey Area for Select Duck Species

First, we propose adjustment to the LTA duck objectives for the WBPHS TSA. A careful analysis of the changing survey design and protocols during the earliest years of the WBPHS TSA concluded that the 1974–2023 time series may be more appropriate for determining LTA objectives. Survey effort increased significantly from 1955 to 1974, transect locations changed (shifted experimentally from roadside to off-road and back again, and were reallocated from high-density waterfowl regions), and stratum boundaries were redrawn over existing transects. For illustration, from 1955 to present, 2,058 TSA survey segments have remained the same, but 279 in use prior to 1970 have been dropped, and 177 added.

Another significant protocol change occurred in 1974 when observers stopped recording unidentified ducks. This change resulted in increases in the numbers of identified birds of some species, suggesting that observers were identifying some birds that would have previously been unidentified, which could affect the comparability of estimates before and after the change. Lack of documentation for many of these changes limits our ability to accommodate the early data using model-based analytical approaches. ***Therefore, we recommend using the 1974–2023 period for long-term averages, adding data from 2015 to 2023 to provide a 50-year time series.*** The 1974–2023 time series represents a consistent period of survey effort and allocation, better documentation of survey design changes, and is sufficiently long (50 years) to represent a wide range of habitat conditions and waterfowl populations.

Using the later start date results in a relatively minor change in the NAWMP LTA objectives for most species, and those species previously below goal levels in 2014 would remain below the new recommended goal levels (Table 1 and Appendix B). In brief, changing the LTA from 1955–2014 to 1974–2023 would result in little change for mallard, American wigeon, and canvasback objectives; and a slight increase in objective levels for gadwall, green-winged teal, blue-winged teal, northern shoveler, redhead, and total ducks. Goal levels would decline for northern pintail and slightly for scaup, although current estimates for both species would remain well below goal (Appendix B).

History of changes to the WBPHS TSA

Survey History: The initial aerial surveys that would become the WBPHS began in the late 1940s amid concerns about declining North American populations of waterfowl. However, 1955 is generally thought to be the operational beginning of the survey, and data are available from that year onward. Changes to protocols and survey effort occurred up until the mid 1970s: bush regions in northern Canada had different survey protocols than the prairies — for example, swans were not counted in the prairies until after 1971. Survey coverage and design also changed during this period; for example, prairie survey transects were initially located along roads, then shifted off roads and back to roads during the period between 1969 and 1975. Some of these changes are difficult to map and document because stratum and transect numbers were different from current numbering, and we have little record of other changes. Survey strata were subdivided or redrawn, and in most cases the new strata were imposed *post hoc* over existing transects. Re-stratification and changes to survey effort allocation resulted in missing data for some strata in earlier years.

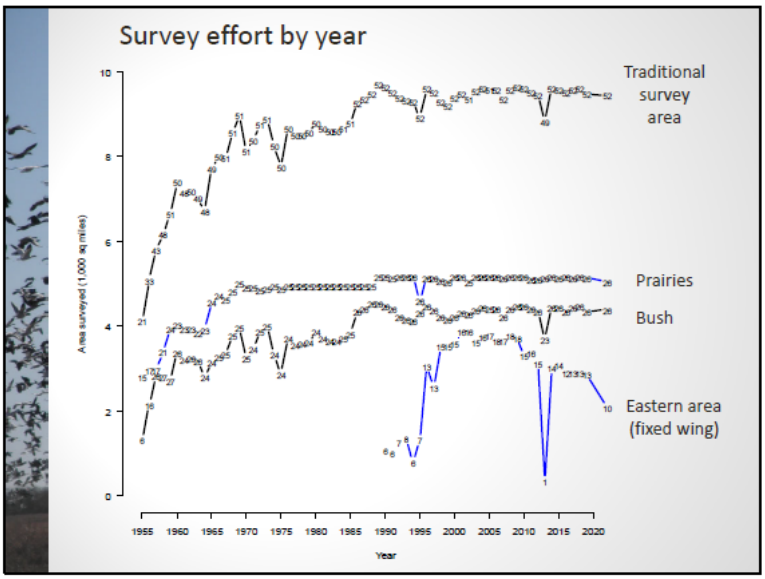

Figure 1. Total surveyed area (miles surveyed x ¼ mi transect width) by year from 1955 to 2022. Plotting symbols are the number of current strata that had some survey effort in that year (e.g., 21 current Traditional Survey Area [TSA] strata had some survey effort in 1955). Plot also includes trajectory of the TSA prairie strata (current strata 26-49, 75, 76), the TSA bush strata (current strata 1-8, 20-25, 50, 77), and the Eastern Survey Area fixed wing survey effort. A number of strata were not surveyed in 2013 due to an aircraft safety problem, and the survey was not conducted in 2020-21 due to the COVID pandemic.

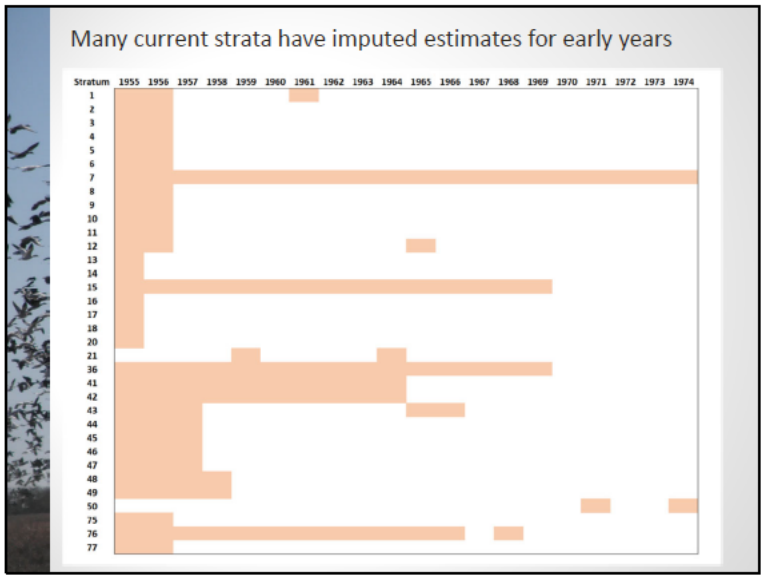

Figure 2. Orange shading indicates the years between 1955–74 that current TSA strata had no survey effort, and for which population estimates were imputed for published time series.

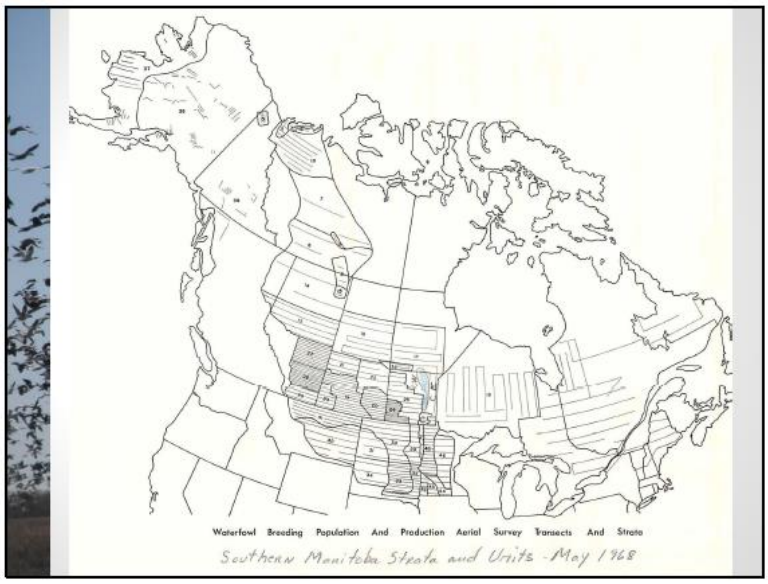

Figure 3. Survey design as illustrated in the 1968 Status Report. Note the difference between the 1968 stratification and the current stratification (compare with Figure 4), as well as differences in coverage (e.g., high intensity transects in southern Alberta and no transects in northern Saskatchewan and Manitoba). There were early surveys conducted in eastern Canada, but the mapping between the survey locations and the data have been lost.

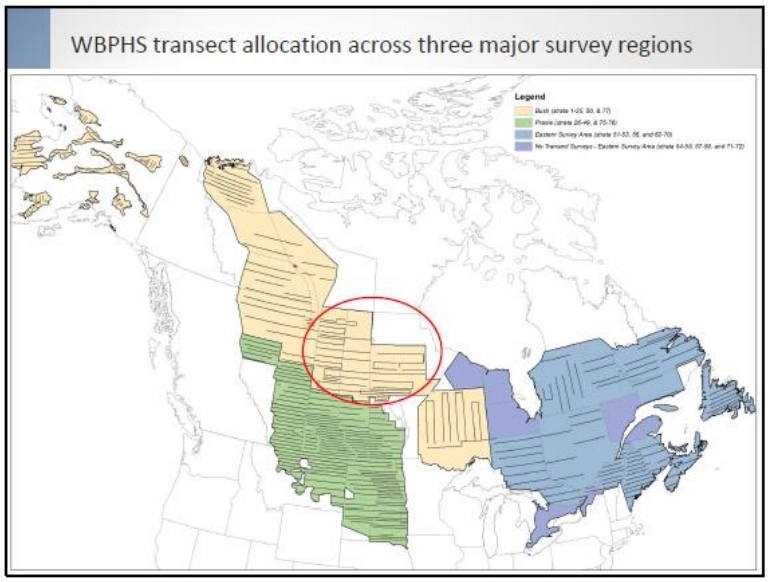

Figure 4. Map of 2023 fixed wing survey transects. Note that several Eastern Survey Area strata are not surveyed at all (contain no transects) or are surveyed only by CWS helicopter plots (71–72). Some points to note: (1) The survey is much more intensive in the prairies, where the survey design approximates a systematic design. (2) Annual Visibility Correction Factors (VCFs) are available for most species. (3) Bias due to location along section roads is possible. (4) In the TSA bush, very few transects per stratum and large areas of strata are not surveyed. (5) There is uncertainty about how representative transects are relative to area of inference. (6) Along with stratum areas, constant VCFs are essentially scaling factors. For species like scoter, primarily in bush regions, stratum area x VCF = complex weighting of transect densities which may affect time series.

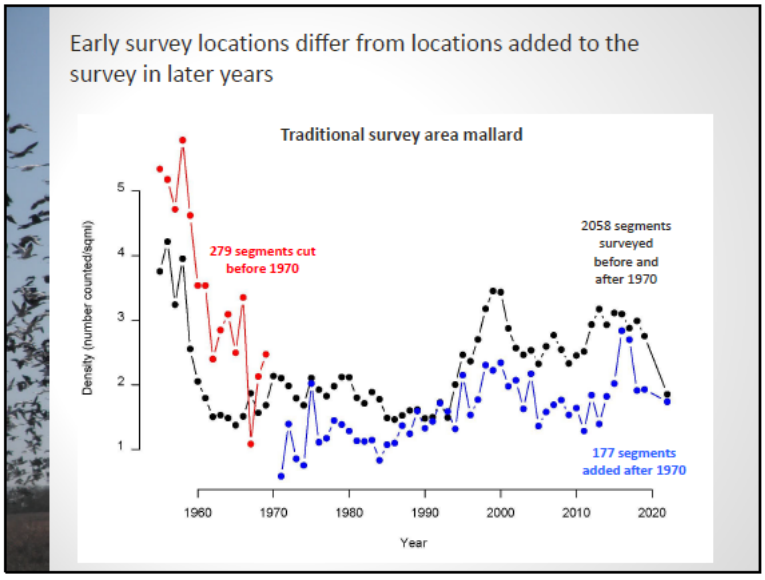

Figure 5. Densities of mallard counted by year for (1) 2,058 segments surveyed before and after 1970 [black], (2) 279 segments surveyed only prior to 1970 [red], and (3) 177 segments added after 1970 (blue). Earlier segments were located in higher density areas. These changes in survey location are likely

to have some effect on the trajectory of the time series, although the overall impact would be weighted by the number of segments and the stratum areas. The primary point to note is that the distribution of the survey locations among higher and lower density areas shifted over time.

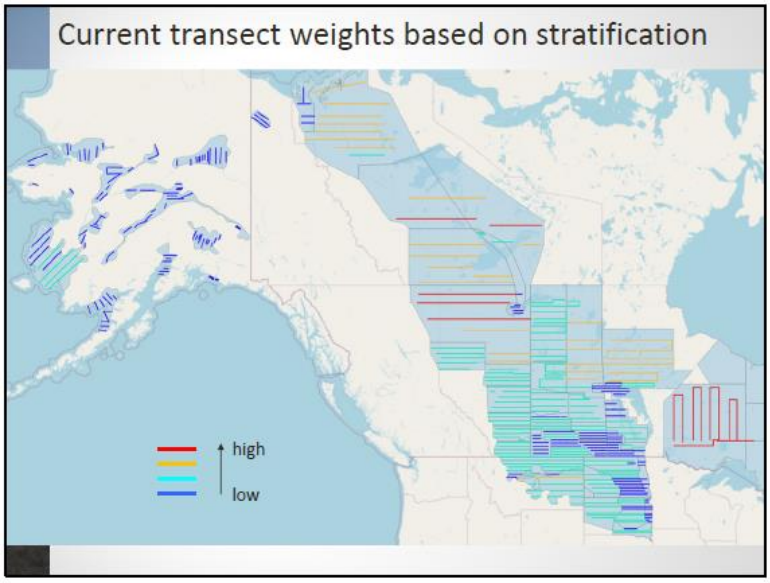

Figure 6. Continental population estimates represent a sum of bird densities measured along transects. Individual transects are weighted by their relative length within the stratum, and the size of the stratum relative to the total transect length. As a result, densities from longer transects in large, sparsely surveyed strata receive higher weighting in continental totals. This figure does not account for VCFs, which vary by species, and by year in the prairies.

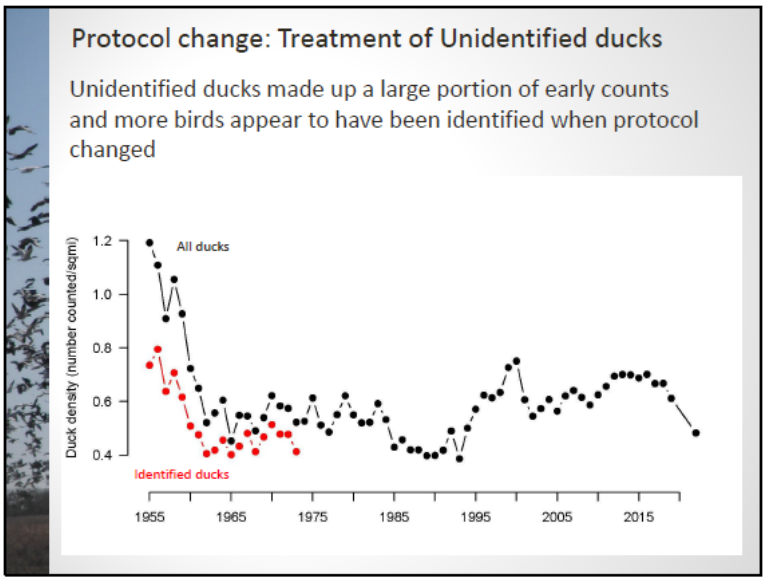

Figure 7. The recording of unidentified ducks was discontinued in 1975, because VCFs should account for unidentified birds. Prior to 1975, a large proportion of some observers' totals were recorded as unidentified. Note that the density of all ducks in 1975+ follows closely the trajectory of all ducks prior

to 1975, suggesting that observers began to identify birds that previously would have been recorded as unidentified. Shifts in species composition may have occurred along with this change in protocol.

Notable changes since 1975: There have also been several notable survey modifications after 1975. Stratum 19 in Alberta was divided into strata 75–77 between 1989 and 1991, with the addition of new transects and dropping of other transects or transect sections. Stratum 50 in western Ontario was not flown from 1974 to 1985, and there were substantial changes to survey transects over the Saskatchewan River delta (stratum 25) in 1998. Ground surveys in strata 75 and 76 which were used to produce visibility corrections for aerial crews began in 1989 and terminated in 2012. Changes in aircraft have occurred as well; specially modified Beaver aircraft were used for survey in Alaska from 1977 to 2011, and Kodiak twin turbine aircraft began flying in 2011.

Reconsidering the historical time series: The impact of changes in the survey design and imposition of the current stratification on top of existing transects (and the inherent re-weighting of continental estimates) have not been explored in depth but are being considered by USFWS staff as part of a broader survey review. Because the survey protocol and layout has been more consistent since 1975, any adjustments to estimates are likely to have less impact on population trends from 1975 to present.

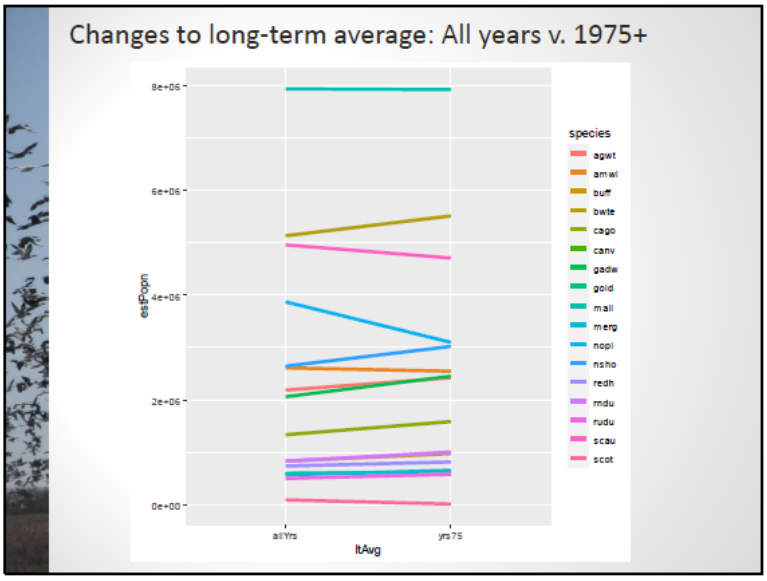

Figure 8. Comparison of long-term average (LTA) population estimates for 1955–2022 versus 1975–2022 by species. Most LTAs based on 1975+ are close to or slightly higher than the 1955+ LTA, with the exception of northern pintail, scaup spp., American wigeon, and scoter spp.

Eastern Survey Area for Select Duck Species

Population objectives for select duck species in eastern North America in the 2018 Update were based on the LTA in the WBPHS Eastern Core Survey Area. ***We recommend two changes to these objectives. First, we propose to include birds from an expanded region beyond the Eastern Core Survey Area.*** The mallard and American black duck objectives will now represent the populations of Eastern North America, including birds from the entire WBPHS ESA (WBPHS strata 51–53, 56, 62–72), as well as CWS and Atlantic Flyway ground-based plot surveys (Figure 9). Revised objectives for the other four species/species groups (American green-winged teal, ring-necked duck, goldeneyes, and mergansers) are based on the entire WBPHS ESA, but CWS and Atlantic Flyway plot survey areas were not included due to insufficient data for those species. This geographical expansion produces higher NAWMP population objectives than the 2014 Addendum and 2018 Update but represents a more comprehensive estimate of the true population size in the eastern continent. In addition, these revised objectives, while not exactly the same, better align with population estimates reported within annual waterfowl population status reports and will usefully incorporate more habitat JV planning areas compared to previous coverage.

The second notable change pertains to methods used to calculate the breeding population of American black ducks, a monomorphic species. Identifying male from female black ducks from an aerial platform can be challenging, and studies have suggested that some black duck pairs (about 1 in 3) were two males rather than a male and a female. This information was previously used to "correct" assumed male–female pairs observed in aerial surveys when calculating total indicated birds. ***More recent data from helicopter surveys indicates that less than 10% of pairs contain 2 males, and based on these findings we recommend using a ratio of 1.0 (i.e., all 'unknown' pairs are treated as a male–female pair), similar to how breeding pair data are analyzed under the black duck adaptive harvest management framework for estimating population size in Eastern North America. For these select duck species in the ESA, the time period 1998–2023 was used to calculate the LTA and 80th percentile objectives.***

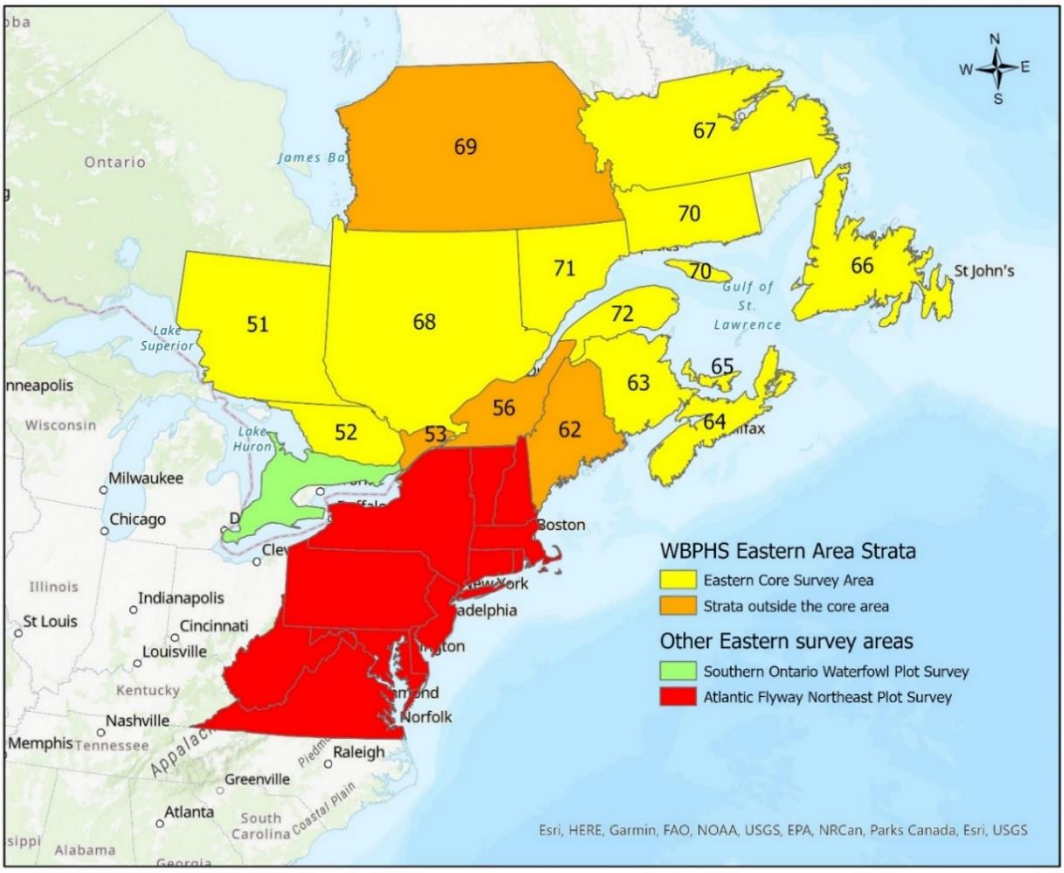

Figure 9. Geographical coverage of the Eastern Survey Area used for updating Population Objectives (LTA) and current population size for select duck species for 2024 NAWMP. Yellow = Waterfowl Breeding Population and Habitat Survey (WBPHS) Eastern Core Survey Area, Yellow + Orange = WBPHS entire Eastern Survey Area, Green = Southern Ontario Waterfowl and Wetlands Plot Survey and Red = Atlantic Flyway Breeding Waterfowl Plot Survey.

Western Mallards

In 2008, for the purpose of harvest management, mallards in the TSA were divided into two populations, western and mid-continent. Western mallards began to be treated separately from mid-continent mallards, and their populations managed under separate harvest strategies. Western mallard abundance was initially estimated from surveys in Alaska/Yukon Territory and California/Oregon, and in 2016 this area was expanded to include birds from British Columbia and Washington (Figure 10A).

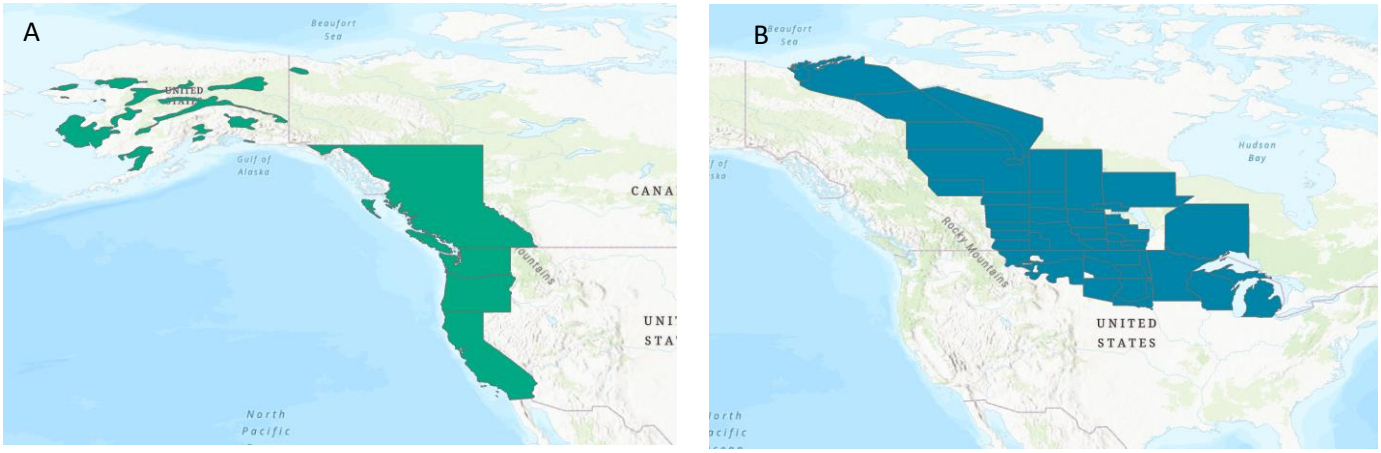

Figure 10. Geographical coverage of breeding surveys used in harvest management models for (A) western mallards and (B) mid-continent mallards.

From 2008-onward, the mid-continent mallard stock was defined as the extent of the TSA (except Alaska) as well as state surveys of Michigan, Wisconsin, and Minnesota (Figure 10B). These extents are currently used in population models to support harvest strategies for the western and mid-continent mallard stocks. The western population estimates are used by at least one (CVJV) western Joint Venture for breeding population objectives for mallards in their planning regions.

Despite evidence suggesting that substantial mixing of these stocks occurs during the hunting season, there are geographic differences in reproduction, survival and migration that justify their treatment under different harvest management frameworks (US Fish and Wildlife Service 2023). These differences also may have consequences for habitat management at regional scales. Therefore, in Table 1, we provide population estimates for these two stocks in addition to a population estimate and objective for mallards in the TSA.

Table 1. Population objectives (long-term average and 80th percentile) and population estimates for select duck species in the WBPHS Traditional Survey Area and Eastern North America.

2024 Update				2018 Update			
Traditional Survey Area				**Traditional Survey Area**			
Species	**Long-term Average[a]**	**80th percentile[a]**	**Population Size[b]**	**Species**	**Long-term Average**	**80th percentile**	**Population Size**
Mallard	7,773,000	9,451,000	9,731,000	Mallard	7,726	9,297	9,965
Western mallards[5]			987,000				
Mid-continent mallards[5]			9,831,000				
Gadwall	2,434,000	3,258,000	3,386,000	Gadwall	1,921	2,977	3,449
American Wigeon	2,523,000	2,888,000	2,678,000	American Wigeon	2,596	3,048	2,660
Green-winged Teal	2,401,000	3,019,000	3,272,000	Green-winged Teal	2,059	2,631	3,473
Blue-winged Teal	5,479,000	6,700,000	7,225,000	Blue-winged Teal	4,949	6,329	7,794
Northern Shoveler	2,994,000	4,095,000	4,149,000	Northern Shoveler	2,515	3,592	4,434
Northern Pintail	3,149,000	3,538,000	2,717,000	Northern Pintail	4,003	5,722	3,235
Redhead	819,000	1,051,000	1,107,000	Redhead	701	918	1,187
Canvasback	605,000	712,000	699,000	Canvasback	581	691	689
Scaup	4,673,000	5,582,000	4,244,000	Scaup	5,026	5,984	4,425
TSA Total	32,850,000	40,294,000	50,026,000	**TSA Total**	32,077	41,189	41,311
Eastern North America				**Eastern Survey Area**			
Species	**Long-term Average[f]**	**80th percentile[f]**	**Population Size[b]**	**Species**	**Long-term Average**	**80th percentile**	**Population Size**
Mallard[c]	1,449,000	1,556,000	1,358,000	Mallard	409	426	1,156
American Black Duck[c,d]	756,000	802,000	722,000	American Black Duck	628	648	701
Green-winged Teal[e]	357,000	394,000	334,000	Green-winged Teal	263	281	382
Ring-necked Duck[e]	699,000	731,000	682,000	Ring-necked Duck	515	529	682
Goldeneyes[e]	665,000	733,000	616,000	Goldeneyes	433	449	559
Mergansers[e]	778,000	832,000	807,000	Mergansers	436	462	594
ESA Total	4,704,000	5,048,000	4,519,000	**ESA Total**	2,685	2,783	4,074

[a] The population objectives in the TSA are represented by the survey time series of 1974-2023. The years 1955-1973 were excluded due to modifications in stratification, survey design, and protocols during this period (E. Silverman, Appendix A)

[b] The population size was calculated as the average of the last 10 survey years, 2012-2023 (due to COVID, the WBPHS was not conducted in 2020-21) in the TSA of the WBPHS, strata 1-18, 20-50, 75-77

[c] The population objectives for mallard and American black duck in the ESA represent the population of the entire eastern area of North America, i.e. the entire WBPHS Eastern Survey Area (USFWS strata 51-53, 56, 62-72, and CWS helicopter strata 71 and 72), the Atlantic Flyway Northeastern Plot Survey, and the Southern Ontario Waterfowl Plot Survey

[d] The American black duck population estimate was calculated assuming an updated 1.0 male:female pair ratio (i.e., all 'unknown' observed pairs are treated as drake-hen pairs).

[e] The population objectives for American green-winged teal, ring-necked duck, goldeneyes, and mergansers represent the population of the entire WBPHS Eastern Survey Area (WBPHS strata 51-53, 56, 62-72 and CWS helicopter strata 71 and 72).

[f] The population objectives for species in the ESA are based on the average of the period 1998-2023.

[5] Population size estimates are provided as the 2012-2023 average for the western mallard stock, consisting of birds from Alaska and the southern Pacific Flyway (WBPHS strata 1-12 and British Columbia, California, Oregon, and Washington surveys), and mid-continent stock, consisting of birds from TSA strata 12-19, 21-50, 75-77 and state surveys of Michigan, Minnesota and Wisconsin (U.S. Fish and Wildlife Service 2023). Combined western and mid-continent stocks does not equal the TSA mallard estimate because it does not include state or provincial surveys.

Looking Beyond 2024: The Utility of NAWMP Duck Population Objectives

From the beginning, NAWMP population objectives have been aspirational, setting the bar for conservation success, and demonstrating our commitment to work together to achieve continental outcomes. They have been based on the best scientific data available, but the quality and quantity of that information have changed markedly over the last four decades. The extent of habitat JVs has also changed, with increasingly more diverse regions and partners than when the first six JVs were formed.

The first duck population objectives were anchored to the TSA, and after 2014, to both the TSA and the ESA of the WBPHS. But growth in the number of operational (and annual) breeding waterfowl surveys, as well as advances in analytical techniques, have provided a much more comprehensive accounting of continental waterfowl populations. In recent updates, NAWMP has included this additional information when referencing current population estimates, but not in its objectives. The Fleming et al. (2019) framework for stepping down NAWMP population objectives recognized a need to plan for continental populations during the nonbreeding season and incorporated steps to expand NAWMP population objectives to a continental scale before allocation to JVs. However, the current NAWMP reliance on TSA and ESA objectives may not be adequate for some JVs that support breeding populations outside the TSA and ESA, and thus, these JVs may not consider current NAWMP objectives alone as wholly applicable to their planning process.

Because interannual environmental variation strongly influences annual waterfowl population dynamics, scaling population estimates for environmental conditions could offer valuable insights about the achievement NAWMP population goals. For example, recent periods of above-average wetness on the prairies have resulted in populations significantly exceeding the long-term average. However, evidence shows that the productive capacity of these landscapes continues to decline. Developing a predictive model of expected population sizes based on current environmental conditions could clarify progress toward habitat goals.

Harvest management frameworks increasingly utilize more population information (e.g., for western mallards, provincial and state surveys) to focus harvest strategies at relevant population scales. Utilizing these same, more inclusive data sources for NAWMP population objectives might improve alignment with JV planning regions and also close the gap between the spatial bases for habitat and harvest management objectives, potentially improving the coherence of these management systems.

To ensure that NAWMP population objectives remain relevant and useful for setting habitat objectives and gauging conservation success, we recommend a reconsideration, between now and the next Plan Update, of how these objectives are formulated. The timing for this work is good, given the recent contributions of the NAWMP Science Support Team (NSST) in stepping

down continental NAWMP objectives and mapping important waterfowl landscapes. These efforts have compiled substantial data on waterfowl distributions which should be useful in assessing the current state of waterfowl abundance information, as well as coverage gaps in areas critical for individual JV planning. ***We urge the Plan Committee to ask the NSST, who are well suited and have the technical capacity to do this work, to form a working group to (1) consider the utility of the current scale of NAWMP objectives for conservation planning, (2) assess the capacity of current monitoring frameworks to provide information needed by the JVs for effective objective setting, and identify gaps that should be filled (e.g. Great Lakes States, Pacific Flyway provinces and states, far eastern Quebec); and (3) undertake the analytical work, if necessary, to derive new population objectives that are useful at local geographies, but that can be integrated to the continental scale.***

The Dual Objective Concept (2014)

Maintaining the utility of population objectives for Habitat JV planning has been an important consideration in each update cycle. One element introduced in the 2014 Addendum and reiterated in the 2018 Update has been a source of difficulty for several JVs. The dual objective (i.e., LTA and 80th percentile) has been challenging to interpret and implement for several. In the 2014 Addendum, the dual objective was defined as follows:

> "Maintain long-term average populations of breeding ducks [1955 to 2014 in traditional survey area (TSA) and 1990 to 2014 in eastern survey area (ESA)] and periodically, 40 million or more total breeding ducks and 2.7 million or more breeding ducks in the TSA and ESA, respectively."

In a recent survey of Habitat JV conservation planners, only four reported that they have formally incorporated these dual objectives in their planning. Six have not, and four others are uncertain if they will do so in their next planning cycle (Appendix A). Part of the reported difficulty has been a lack of clarity about the interpretation and application of dual objectives.

In attempting to clarify this provision after the 2018 Update, Coppen et al. (2019) offered that:

> "These dual objectives were not proposed as an 'either/or' decision for setting regional/local population objectives…Our interpretation is that in general aspirational objectives (80th percentile) are to be strived for as an "upper boundary" for planning purposes as habitat conditions allow, given the habitat base is available. From a management perspective, the LTA objectives generally serve as a reflection of expected long-term variation in habitat; this would vary both continentally and regionally and should be a central aspect of JV planning both within and across JVs."

After our recent discussions with JV planners, we worry that viewing the 80th percentile as an "upper boundary" is not especially useful. In fact, the revised 2014 objective expressed a desire

to periodically support populations at *or above* the 80th percentile. So, despite the effort to clarify, various interpretations remain.

Natural Variation in Habitat Conditions is Expected. Waterfowl populations fluctuate annually based in part on habitat quantity and quality throughout the range of each species. The time series that serves as the basis for NAWMP population objectives includes the highest highs and the lowest lows ever observed. There have always been "good" years and "bad," periods of abundance and scarcity, and that is likely to continue barring long-term directional shifts due to climate change or catastrophic changes in land-use. ***A primary purpose of dual objectives was to encourage conservation planners to recognize the variation inherent in natural systems when envisioning landscape conditions necessary to support long-term average continental waterfowl populations, and that occasional exceptional conditions are needed to offset inevitable periods of poor conditions.***

We recommend that conservation planners not view population or habitat objectives as static values to be achieved annually, but rather regard them as the desirable long-term product of the variation inherent in natural systems plus JV management actions.

For some JVs, interannual variation in habitat quality is driven primarily by precipitation (e.g., wet basins in the Prairie Pothole Region, floodplains of the Lower Mississippi Valley) and this is not subject to short-term management actions. Other JVs (e.g., Central Valley) occur in landscapes so severely altered that the vast majority of waterfowl habitat is provided on managed lands and there remains limited ability for even extraordinary environmental conditions to produce habitat abundance well above average levels. In highly altered landscapes, securing annual habitat for the rare possibility of exceptionally high waterfowl numbers may be prohibitively expensive and likely wasteful in many winters. Such contrasting circumstances affecting interannual variability of waterfowl habitat should prompt thoughtful consideration of the appropriate application of the dual objectives for each individual planning region. In consultation with the NSST, planners should adopt a probabilistic approach to determine the appropriate level of habitat redundancy among neighboring JVs (sensu Dohery et al. 2015). This strategy will help mitigate the opportunity costs of providing more habitat than necessary during peak population periods in any one region.

Various Approaches Might be Informative. In highly variable systems (e.g., the Prairie Pothole Region) where wetland abundance is under little management control and baseline habitat abundance has been declining for decades, planning to increase recruitment rates, such as by enhancing upland cover, and protecting as many wetland basins as possible to allow extraordinary habitat conditions when wetness is exceptional, makes sense. Thinking about either the LTA objective or some other stretch objective, would imply striving to maintain the capacity (e.g., loss of wetland basins) that has historically helped create the booms in wetter years.

Many wintering and migration regions provide waterfowl habitat through both intensive management and annually variable natural conditions. In these landscapes, it may be sensible to view attaining higher objectives via both intensive conservation programs and policy efforts needed to retain landscape conditions to provide unmanaged habitat in the historically observed ranges. Examples may include working lands programs or floodplain protection coupled with wetland restoration policies.

In one example, the adjacent Gulf Coast and Lower Mississippi Valley JVs coordinated their interpretation and application of dual objectives. The group concluded that the dual objectives did not form the bounds of an acceptable range and instead selected the 80th percentile objective as the benchmark for annual planning while recognizing a need to preserve landscape conditions capable of periodically exceeding this level. Planning for the 80th percentile was viewed as providing a balance between habitat requirements at maximum population levels and safeguarding against habitat shortfalls given the unpredictability of environmental conditions both within their regions and adjacent geographies.

Looking Ahead

We concur with Coppen et al. (2019) who concluded that, "Rather than providing firm direction to the JVs, we suggest the Plan Committee invite JV explanation(s) of how …continental objectives were considered, interpreted, and applied within the JV…(and) how management actions will affect the outcome. …We should set the table for continual learning and modification as we learn…".

Based on diverse experiences of the Habitat JVs since 2014, we think that the strict application of dual planning targets is likely to make sense for some JVs but not for all, and that leaving the decision about whether or when to plan for average conditions (LTA population objectives) or exceptional circumstances (e.g., 80th percentile), is best left to the experienced planners in each JV in consultation with the NSST.

In all cases, we encourage JVs to consider the dynamics of their habitat systems in their planning process, and regardless of the strategies chosen, clearly link their waterfowl habitat objectives to NAWMP population goals.

Tracking and Adapting Regional Habitat Capacity[1]

It is vital to evaluate NAWMP success, not just in numbers of acres, but also by building a better understanding of the connections between habitat quantity and quality and waterfowl population dynamics. We believe such discussions of JV strategies and evaluation results should feature in Plan Committee reviews of JV progress and should stand among the continuing priorities for the NSST.

While much focus since 2014 has been on applying dual objectives to conservation planning models and resulting habitat objectives, we suggest there is a similarly important role for their

[1] Note that this idea may fit better within the Update discussion of habitat objectives.

use as metrics in long-term habitat and landscape monitoring. For example, simply assessing JV habitat conditions versus planning targets would enable informative feedback on the ability of JVs to achieve desired habitat abundance over time. This approach would necessitate development of a periodic regional habitat monitoring program but would help JVs understand the combined effects of changing land use, conservation programs, and varying environmental conditions.

Sea Duck and Other Duck Objectives

Population data for sea ducks are limited. There are only a few species or populations with enough monitoring data to warrant a population objective. For species of uncertain status, more resources are needed to acquire such information. We tend to have more data on sea ducks of less conservation interest (bufflehead, mergansers, goldeneyes) that are widely distributed where the WBPHS is conducted each spring. We know much less for many species breeding outside the TSA and ESA. In preparing this Update we consulted with the Sea Duck Joint Venture (SDJV) Continental Technical Team (CTT) and followed their recommendations (Appendix C).

We agree with the SDJV that population objectives seem appropriate only for species with sufficient population delineation information and regularly conducted surveys that can measure progress towards the objective. Such sea duck populations include Pacific black scoter, Eastern harlequin duck, Eastern Barrow's goldeneye, American common eider, and the northern common eider, and the 2018 update included objectives for those species. ***The SDJV CTT considered new information available since the last update that would justify adopting numeric objectives for Hudson Bay common eider and bufflehead***. The CTT recommended establishing an objective (300,000) for Hudson Bay common eiders based on 2006 winter surveys (S. Gilliland, unpublished data), and recommended using the TSA LTA (1974–2023) to establish an objective for bufflehead (984,000). Several other species/population estimates have been updated in Table 2 based on new information since 2018. Consult the table and related footnotes for details.

The USFWS Endangered Species office conducts directed surveys for listed eiders. Their current estimate for the Alaska-breeding populations of spectacled eiders (20,000) is consistent with modeled estimates based on the most recent survey results available (ACP survey, YKD aerial survey; USFWS 2021). A new estimate of the global population (Alaska + Russia breeding populations that winter in the Bering Sea, likely upwards of 300,000) will be available soon but not in time for this Update. The USFWS Endangered Species office recommend keeping the breeding population size estimate the same and continuing to use "recovery from listed status" as the population objective. For Steller's eider, targeted surveys in northern Alaska (Arctic Coastal Plain, foot surveys near Utqiagvik, and aerial surveys in Barrow Triangle) indicate a

breeding population of likely <500 individuals. The recommended breeding population estimate is 500, and like spectacled eider, the recommended objective is "recovery" as specified in the recovery plan.

Sea Duck Issues Deserving Future Attention (SDJV Continental Technical Team):

Satellite telemetry suggests significant breeding range overlap for east/west wintering surf scoters (SUSC), but the SDJV has not yet formally recognized two separate SUSC populations (unlike for black scoters). Pending additional information or a shift to non-breeding objectives, we continue to regard them separately here.

For several sea duck species, it might be more realistic to set future population goals and report sizes for wintering, rather than breeding, populations even if they are not formally considered different populations given intermixing from various breeding areas. This may be particularly helpful for managing species that winter or breed in Russia or Greenland but use North American flyways. Three to consider where this approach may be helpful:

1. Only a small number of **Steller's eiders** nest in North America, but a large portion of the Pacific Steller's eider population uses Alaska during molt, winter, and spring staging periods. Spring staging and molt surveys in southwest Alaska were conducted from 1992 to 2019; while there are many caveats to those survey results, they indicate a fall population of approximately 50,000 Steller's eiders in the primary molting areas in Alaska. This population is likely a better management unit to highlight in NAWMP than the much smaller estimated breeding population given the need to protect key habitats used by Pacific Steller's eiders in Alaska during much of their annual cycle.

2. **Northern common eiders** (NCOEI) are a metapopulation that share common breeding areas in northern Canada but winter separately (~75% of the Canadian breeding birds winter in Greenland). They are difficult to monitor in Greenland but can be monitored in winter in Canada and are an important subsistence harvest resource for Inuit in Canada. It might be reasonable to have two objectives for NCOEI: 1) Canadian winter population (stay with 400,000 objective, with population estimate of 260,000) and Greenlandic wintering population (not yet established objective, population estimate of 440,000 from Merkel et al. 2019). Including both in the Plan would acknowledge the value of the Greenlandic wintering portion in North America.

3. It may also make sense to set two winter population objectives for **Eastern harlequin duck.** Eastern North American wintering population: objective of 3,000, population size

of 7,700 (Gutowski et al. 2022). Greenlandic wintering population: objective not established, population size about 5,000 (COSEWIC 2013).

Sea Duck Monitoring Priorities

In general, while progress has been made, it would be helpful if more resources could be directed towards acquiring information on sea duck population status. Evaluation and improvement of some surveys have been made (e.g., CWS Barren lands experimental scoter survey, Pacific Black Scoter survey), but we still lack robust breeding population estimates for most sea duck species. Related recommendations are:

1. Continue currently operational surveys, including: WBPHS, Central Arctic Canada Pacific Common Eider Breeding Survey, Parts Collection Survey, Puget Sound Assessment and Monitoring Program, Arctic Coastal Plain Survey, and Quebec/Newfoundland Common Eider Winter Survey.

2. Apply the results of CWS's experimental scoter survey work to improve the current WBPHS survey for late-nesting sea ducks through design revisions or augmentation.

3. Continue the Pacific black scoter Breeding Survey, last conducted in 2018. This is one of the few situations where it is logistically feasible to estimate the breeding population size of a sea duck, as the survey covers a large portion of the breeding area for PBLSC (~80%) and is timed appropriately. This information may be of interest to the Alaska Native communities, as these scoters are an important subsistence harvest species in Alaska and could contribute to the development of a management plan. Efforts to estimate detection on this survey have been variable, so revisiting the survey design prior to repeating the survey would be necessary but achievable.

4. There is some indication of unaccounted for error and/or bias in the ESA survey data for mergansers and goldeneyes. Because individual species are not identified during the WBPHS, there are insufficient data for determining species/population objectives. It may be possible to improve these estimates by analyzing/modeling the sources of uncertainty in the existing WBPHS ESA data.

Sea Duck Key Habitat Sites. Incorporation of Sea Duck Key Habitat Sites into coastal habitat JV planning (including the Great Lakes), as well as marine spatial planning and environmental assessments, would help direct habitat conservation to the most important sites for sea duck populations. Elsewhere we urge that communication and coordination between NAWMP habitat and species JVs be given high priority.

Table 2. Population objectives and estimates for duck species other than those included in Table 1.

2024 Update			2018 Update		
Species/Subspecies/Subpopulation	**Objective**	**Population Size**	**Species/Subspecies/Subpopulation**	**Objective**	**Population Size**
Mottled duck, Florida	42,000	53,000[a]	Mottled duck, Florida	42,000	53,000
Mottled duck, Western Gulf Coast	212,000[b]	126,000[c]	Mottled duck, Western Gulf Coast	106,000	68,000
Mexican duck		56,000	Mexican duck		56,000
Hawaiian duck	2,000	947[d]	Hawaiian duck	2,000	900
Laysan duck	Recovery[e]	1,700[f]	Laysan duck	1,800	700
Cinnamon teal		380,000[g]	Cinnamon teal		
Wood duck, Eastern		949,000[h]; 3,882,500[i]	Wood duck, Eastern		
Wood duck, Western		86,700[i]	Wood duck, Western		
Muscovy Duck		30,000	Muscovy Duck		30,000
Fulvous whistling duck			Fulvous whistling duck		
Black-bellied whistling duck			Black-bellied whistling duck		
Ring-necked duck		2,986,000[j]	Ring-necked duck		2,024,000
Ruddy duck		859,000[k]	Ruddy duck		751,000
Masked duck		6,000	Masked duck		6,000
Harlequin duck, Eastern	10,000[l]	5,700[l]	Harlequin duck, Eastern	3,000	4,000
Harlequin duck, Western		[m]	Harlequin duck, Western		250,000
Harlequin duck, total		[m]	Harlequin duck, total		254,000
Long-tailed duck		[m]	Long-tailed duck		1,000,000
King eider, Eastern		200,000[n]	King eider, Eastern		200,000
King eider, Western		400,000[o]	King eider, Western		400,000
King eider, total		[m]	King eider, total		600,000
Common eider, American	105,000 breeding pairs	300,000[p]	Common eider, American	165,000 breeding pairs	250,000
Common eider, Northern	400,000	260,000[q]	Common eider, Northern	400,000	260,000
Common eider, Hudson Bay	300,000[q]	260,000[r]	Common eider, Hudson Bay	275,000	260,000
Common eider, Pacific		150,000[s]	Common eider, Pacific		150,000
Common eider, total		[m]	Common eider, total		1,100,000
Steller's eider[t]	Recovery from threatened status	500	Steller's eider	Recovery from threatened status	1,000
Spectacled eider[u]	Recovery from threatened status	20,000	Spectacled eider	Recovery from threatened status	20,000
Black scoter, Eastern		200,000[v]	Black scoter, Eastern		200,000
Black scoter, Pacific	[m]	220,000[w]	Black scoter, Pacific	160,000	300,000
Black scoter, total		420,000	Black scoter, total		500,000

Table 2 (continued)

Species/Subspecies/Subpopulation	Objective	Population Size	Species/Subspecies/Subpopulation	Objective	Population Size
Surf scoter, east		150,000[x]	Surf scoter		700,000
Surf scoter, west		[m]			
White-winged scoter, east		60,000[x]			
White-winged scoter, west		[m]	White-winged scoter		400,000
Common goldeneye[y]		1,301,000[j]	Goldeneyes		1,239,000
Barrow's goldeneye, Eastern	7,500	8,500	Barrow's goldeneye, Eastern	7,500	8,500
Barrow's goldeneye, Western		[m]	Barrow's goldeneye, Western		260,000
Bufflehead	984,000[z]	1,278,000[j]	Bufflehead		1,306,000
Mergansers		1,601,000[j]	Mergansers		1,331,000
Hooded merganser			Hooded merganser		
Red-breasted merganser			Red-breasted merganser		
Common merganser			Common merganser		

[a] Florida mottled duck population estimate from 2008 aerial survey; Florida Fish and Wildlife Conservation Commission plans a spring 2024 drone survey (A. Fanning, personal communication)

[b] Western Gulf Coast mottled duck population objective represents an aspirational goal consistent with the historic long-term average and stakeholder desires (Wilson 2007, Lancaster et al. 2023)

[c] Western Gulf Coast mottled duck population estimate is the 2011-2021 average estimate from the Western Gulf Coast breeding mottled duck survey (https://fws.gov/library/collections/mottled-duck-population-status-reports).

[d] Hawaiian duck population estimate from 2016 (https://bioone.org/journals/waterbirds/volume-44/issue-4/063.044.0404/Distribution-and-Trends-of-Endemic-Hawaiian-Waterbirds/10.1675/063.044.0404.full)

[e] Laysan duck population objective from USFWS revised recovery plan: recovery for downlisting to threatened, 2,300 birds; recovery for delisting: 3,000 birds (https://ecos.fws.gov/docs/recovery_plan/090922.pdf)

[f] Laysan duck population estimate from 2021-2022 summer and winter surveys on Laysan and Midway atolls (J. Plissner, Midway Atoll NWR, USFWS, personal communication)

[g] Cinnamon teal population estimate from Avian Conservation Assessment Database (ACAD) global estimate (https://pif.birdconservancy.org/avian-conservation-assessment-database)

[h] Eastern wood duck population estimate is the 2014-2023 average from the BBS/northeast U.S. plot survey composite model for the U.S. Atlantic Flyway

[i] Eastern and western population estimates of wood ducks (divided by 106° longitude), 2013-2022 average, from Lincoln estimates based on band recoveries and harvest data (R. Alisauskas, unpublished data)

[j] Continental estimate is the average of the sum of TSA and ESA estimate for the period 2012-2023

[k] Population estimate is the average from the TSA for the period 2012-2023

[l] Updated objective recommended by CTT based on recent Canadian winter surveys. Updated Canadian population estimate projected from Canadian winter surveys (Gutowski et al. 2022); U.S. wintering population estimate may be available in 2 years (SDJV CTT).

[m] Insufficient information currently exists to calculate a reliable population estimate or objective

[n] Population estimate based on Greenland winter survey last conducted in 2017

[o] Population estimate based on index from Point Barrow migration survey (McGuire et al. 2019)

[p] Population estimate is minimum modelled estimate based on the number of birds detected in the CBCs in the USA and the winter eider surveys in Canada

Table 2 (continued)

[q] Population estimate for wintering northern common eiders in Canada. An additional 500,000 birds winter in Greenland; some of these may breed in North America (https://natur.gl/arter/common-eider/?lang=en)

[r] Estimate and objective from winter survey conducted in 2006 (S. Gilliland, unpublished data)

[s] Estimate derived from a compilation of data from different regions (U.S. Fish and Wildlife Service 2006)

[t] Population objective from recovery plan (U.S. Fish and Wildlife Service 2019). Population estimate represents North American breeding population from Arctic Coastal Plain, foot surveys near Utqiagvik, and aerial survey in Barrow Triangle; winter population estimate 50,000.

[u] Population objective from recovery plan (U.S. Fish and Wildlife Service 2021). Population estimate represents global population of spectacled eiders, including breeding populations from Alaska and Russia, which winter in the northern Bering Sea south of St. Lawrence Island. Results from aerial winter survey in March 2023 are not yet available, but based on previous surveys conducted in 2009 and 2010

[v] Winter population estimate from USFWS winter survey 2008-2011 (Silverman et al. 2012). NOTE: James/Hudson Bay Molting survey (Badzinski et al. 2013) reports approx. 300,000 male black scoters, suggesting a much higher value, but it is not clear how this relates to total birds or breeding birds. SDJV CTT recommends revision of this number in the next update using this information and data on sex/age ratios from photo surveys.

[w] Breeding population estimate from USFWS breeding survey (USFWS unpublished data).

[x] Population estimate from Atlantic winter survey (Silverman et al. 2012)

[y] Combined goldeneye estimate from sum of TSA and ESA is mostly common goldeneye. Population objective based on LTA of sum of TSA and ESA (1998-2023)

[z] Population objective recommended by SDJV CTT is the long-term average of the TSA (1974-2023)

Eastern and Western Wood Duck Populations

Eastern population: two population estimates are available for Eastern wood ducks. An Atlantic Flyway breeding population estimate of 949,000 is the 2014–2023 average from the Breeding Bird Survey (BBS)/northeast U.S. plot survey composite model for the U.S. Atlantic Flyway (Zimmerman et al. 2015). An alternative Lincoln estimate for the fall population of adult eastern wood ducks is based on direct band recoveries (hunter shot birds only) of birds banded June–September in Canada or U.S, east of the 106° longitude line and recovered in Atlantic, Mississippi or Central Flyways (U.S. only) and USFWS harvest estimates using methods described in Alisauskas et al. (2014) (R. Alisauskas, unpublished data). The most recent 10-year average (2013–2022) for this population is 3,882,500.

Western population: Lincoln estimates for the fall population of adult Western wood ducks are also available for the same time period using the same methodology with birds banded west of 106° longitude and recovered in the Pacific Flyway; the 2013–2022 average population size is 86,700 (Ray Alisauskas, unpublished data).

Cinnamon Teal

The cinnamon teal population estimate of 380,000 represents the global estimate from the Avian Conservation Assessment Database (ACAD; Panjabi et al. 2021) derived from a method developed by Partners in Flight using BBS data. Current efforts are underway to increase banding efforts for this species to provide data for Lincoln estimates of abundance.

Mottled Ducks

Western Gulf Coast: In 2004, the Gulf Coast Joint Venture (GCJV) established a population objective of 105,800 Western Gulf Coast mottled ducks using the long-term average (1974–2004) of midwinter waterfowl survey (MWS) estimates from Texas, Louisiana, Mississippi, and Alabama (Wilson 2007). While the MWS was chosen as the basis for the objective, Wilson (2007) advocated for an improved and operational range-wide survey that could be used to revise population objectives once confidence was established in the survey's reliability. The Western Gulf Coast Mottled Duck Breeding Population Survey (WGCMDBPS) was designed and initiated in 2008 before undergoing several years of design improvements. The fixed-wing transect survey along with a helicopter-derived visibility bias correction factor has been flown consistently since 2011 across coastal portions of Texas and Louisiana where most Western Gulf Coast mottled ducks are expected to occur.

During an update to Wilson (2007) in 2021, the GCJV Mottled Duck Working Group devised a strategy to establish new population objectives using the WGCMDBPS. Establishing population objectives using the WGCMDBPS was chosen over a Lincoln estimate for several reasons

(Lancaster et al. 2023). The objectives only pertain to the existing extent of the WGCMDBPS and do not include mottled ducks that may occur in Alabama or Mississippi. GCJV investigations using eBird data suggest that mottled ducks in Mississippi and Alabama account for <3% of the Western Gulf Coast mottled duck population, and there is no survey to track status there. Following several years of declining abundance estimates, in 2021 the group advocated for a triad of population objectives that reflected the urgency of mottled duck conservation over several time periods. The average (of 2011–2021) objective of 125,627 represented a minimal threshold below which the population level is considered undesirable and indicates that habitat conservation should be pursued with the utmost urgency. The 80th percentile objective of 160,352 represents a more desirable population within the range of abundance observed between 2011–2021 but where habitat conservation should remain a very high priority. The aspirational objective of 211,865 exceeds mottled duck abundance witnessed during the WGCMDBPS but is believed consistent with the historic MWS long-term average and stakeholder desires and represents conservation success. While the triad of objectives adopted by the GCJV allows appraisal of conservation status and success, the GCJV intended that the aspirational objective (212,000) be the sole objective that represents conservation success.

The objectives were developed by a sub-team of the GCJV Mottled Duck Working Group that included partners from the Louisiana Department of Wildlife and Fisheries, Texas Parks and Wildlife, and the U.S. Fish and Wildlife Service. The sub-team's objective was endorsed by the full Mottled Duck Working Group and by the GCJV Management Board in 2023 and is presented in Lancaster et al. (2023).

After several years of counting "brown ducks" in the Texas Brush Country during MWS (avg. ~7,000 annually), Texas Parks and Wildlife flew an experimental breeding season survey that also found "brown ducks" during the breeding season. Ongoing genetics work in the region seeks to determine if these ducks are a westward expansion of Western Gulf Coast mottled duck population, hybrid mottled duck x Mexican ducks, or northward expansion of Mexican ducks. Early evidence suggests primarily a westward expansion of Western Gulf Coast mottled ducks across much of the brush country. Future expansion of the WGCMDBPS into parts of the brush country may result in a need to revisit mottled duck population objectives and status during future NAWMP updates. However, given the expanded survey is not yet operational, it will be many years before a reliable estimate is available to include in an updated Western Gulf Coast mottled duck population objective.

Recommendation: Update the NAWMP Western Gulf Coast mottled duck population objective with WGCMDBPS based objective of 212,000 individuals. Future NAWMP updates should consider revising the population objective based on information from surveys in the Texas Brush Country should additional information become available. The current West Gulf Coast mottled

duck population status as it pertains to the recommended objective is 126,000 and is the average of the 2011–2021 surveys.

Florida: Florida mottled ducks have not been comprehensively surveyed since the last update, due to concerns over the ability of observers to distinguish mottled ducks from hybrids. Recent genetics research has contributed to the development of new field keys and correction factors for use in upcoming drone-based surveys in 2024. Pending these results, waterfowl managers will consider new monitoring approaches, and perhaps revised objectives, for Florida mottled ducks.

Goose Population Objectives

In 1986, population objectives for geese were drawn from existing Flyway management plans or were newly established under NAWMP for five species and 18 subspecies that were divided into 27 populations for management purposes: 15 populations of Canada geese, five populations of snow geese, four populations of white-fronted geese, two populations of brant, and Ross's geese. At that time, most of these populations were thought to be increasing or stable, and only cackling (minima) and dusky Canada geese were identified as declining.

Although Aleutian Canada geese were increasing in 1986, they had been listed as endangered since 1967. Among dark goose populations (Canada/cackling geese, white-fronted geese, brant), all but two objectives were based on winter survey data, while those for all light geese except the Western Central Flyway Population of lesser snow geese were based on information from spring surveys or photographic surveys on nesting areas. Additional species/subspecies/populations of geese were not included in the original NAWMP document, either because they were not recognized at the time, were not shared between the USA and Canada, or because no monitoring data were available and therefore no objectives existed.

The Arctic Goose Joint Venture (AGJV) was initiated under NAWMP in 1986, with the goal of improving our understanding and management of North American geese. Inadequate knowledge of population status, demographics, distribution, and mixing of some populations on wintering areas complicated their assessment and management, and thus coordinated research and funding contributions among a broad suite of agencies and partners was needed to improve monitoring and management of northern-nesting goose populations. In the ensuing years, the AGJV embarked on an ambitious research program that changed the focus of goose population management from a wintering ground perspective to one largely aimed at delineation and monitoring of populations on the breeding grounds, where possible.

Most population objectives for geese are derived from management plans prepared and approved by the Flyway Councils. Common elements of these plans include descriptions of

populations based on their shared breeding and wintering ranges, population status and objectives, monitoring and harvest management strategies, and research needs. NAWMP objectives for geese have evolved as knowledge has improved over time, and the AGJV has assisted in communicating changes to management plans, and prioritization and facilitation of studies aimed at filling research needs. Many goose populations have continued to increase in size since the inception of NAWMP, mainly due to increased survival and productivity that has resulted from abundant agricultural food sources on migration and wintering areas. In some cases, population objectives have increased as populations have grown, and there have also been changes to population descriptions/ranges and monitoring approaches.

Through NAWMP updates in 1994, 1998, 2004, 2012, and 2018, several changes in goose population objectives occurred:

1. The number of species/subspecies/populations of geese recognized under NAWMP has increased from 5/18/27 to 8/20/29. Most of this increase resulted from objectives being added for new species, subspecies, and populations (e.g., Vancouver and Mississippi Flyway giant Canada geese; emperor geese [1998]; Taverner's cackling geese; eastern and western high arctic brant; Hawaiian geese [2004]).

2. One population of Canada geese (Atlantic Flyway [AF]) was split into three (AF Resident; North Atlantic Population; and Atlantic Population [AP]) in the 1998 update.

3. Thirteen separate populations were merged to form six larger geographic populations (Western Prairie/Great Plains Canada geese [1994]; midcontinent white-fronted geese [1998]; Southern Hudson Bay Canada geese [2018]; midcontinent cackling geese [2018]; midcontinent lesser snow geese [2018]; Pacific/WHA brant [2018]), resulting in an overall reduction of seven populations.

4. Population objectives and monitoring programs that were largely based on winter surveys in 1986 are now mostly focused on breeding areas. Twenty-three of twenty-eight populations of North American geese for which monitoring programs exist are monitored in spring/summer, mainly on breeding areas; three populations of brant, one population of white-fronted geese, and one population of cackling geese are mainly monitored during fall/winter.

5. Of the two goose populations originally identified under NAWMP (1986) that were declining, minima cackling geese are now above objective, and dusky Canada geese have remained relatively stable. Aleutian cackling geese that were considered endangered in 1986 were downlisted to threatened status in 1990 and were de-listed in 2001.

6. Of the 21 populations for which numerical population objectives existed in 2023, 16 are above objective, including five populations that have been designated as overabundant in at

least one jurisdiction (greater snow geese, midcontinent lesser snow geese, western arctic snow geese, Ross's geese, and Mississippi Flyway giant Canada geese).

7. Of the five goose populations that remain below their objectives (AP Canada geese, dusky Canada geese, Emperor geese, and Atlantic and Pacific brant), four have coastal breeding and wintering distributions, and three of these populations mainly subsist on non-agricultural food sources throughout the year.

In keeping with previous NAWMP updates, population objectives for most geese in this Update (Table 3) conform to those found in the most recent updates of management plans. Since the 2018 update, there have been no additional populations that have fallen below objectives. Hawaiian geese appear to have made some progress towards their goal, as they were downlisted from endangered to threatened status in 2019.

The past decade has seen continued evolution of monitoring programs for geese. In particular, banding data have become more important for monitoring some populations due to their size, widespread distribution, and remoteness of nesting areas, which makes use of traditional survey approaches more challenging. Lincoln estimates of abundance, which are calculated using band recovery and harvest data, are becoming more commonly used to monitor some arctic goose populations, particularly those that winter in the midcontinent region. Recently updated management plans for all four midcontinent (MC) populations of arctic-nesting geese have adopted banding data and Lincoln estimates as their primary means of monitoring population status and abundance: MC cackling geese (2013), MC lesser snow geese (2018), Ross's geese (2021), MC white-fronted geese (2023). Hunting opportunities for these populations have been greatly expanded over time as populations have increased. In these management plans, population objectives represent a 'lower threshold', below which management actions would be considered to reduce harvest. In the meantime, hunting regulations will remain as liberal as possible, because all of these populations have been at record high numbers in recent years following decades of population growth. Lastly, the former Pacific and Rocky Mountain Populations of Canada geese were merged into Pacific Flyway western Canada geese with a new population objective in 2023 – the newly defined population is currently more than double its spring population objective of 200,000 birds.

In summary, most goose populations have increased since NAWMP was established in 1986. Much of this population growth has been attributed to superabundant agricultural food supplies, establishment of sanctuaries and protected areas, and historically conservative harvest management policies. Several goose populations have grown to the point that their numbers cannot be regulated through hunting. Declining hunter numbers are a concern for future management of populations that are overabundant and increasing, and because of the important contributions of hunters to monitoring programs by reporting bands and

participating in harvest surveys. It is important to note that expanded management tools like spring harvesting can be effective for regulating growth of some goose populations, but only if applied while populations are small enough that hunters can increase harvest rates to a level that reduces survival rates.

Most habitat-related concerns surround the impacts of record high numbers of geese on fragile arctic and sub-arctic habitats, where potential habitat management options are limited. Additional concerns have been raised about the potential impacts of large goose populations on sympatric species, including other waterfowl species, through increased risk of disease transmission and interspecific competition for food on wintering areas. Population objectives for geese must continue to provide a balance between maintaining populations that support liberal hunting opportunities for licensed hunters and Indigenous harvesters, while ensuring that populations do not become overabundant, leading to impacts on natural habitats and sympatric species, or conflicts with people and other interests.

In addition, it should be noted that although most temperate-nesting populations of Canada geese continue to grow, several subarctic and arctic populations of geese appear to have either declined or stabilized recently, after many years of overall growth, mainly due to declining recruitment.

Table 3. North American goose population status estimates and objectives

Species and Populations	Survey Description	Population Size		Population Objective	
		Most Recent 10-yr Ave	Last year (or years) included in 10-yr ave	Management Plan	Notes - Objective
Canada Goose					
Atlantic	Ungava spring survey; breeding pairs	152,002	2023	225,000	
Atlantic Flyway Resident	Atlantic Flyway Breeding Waterfowl survey, breeding adults	1,012,314	2023	650,000	
North Atlantic	Eastern composite survey (WBPHS + CWS helicopter), indicated pairs	51,463	2023	50,495	2001-05 survey average (estimated from 2023 survey)
Southern Hudson Bay	West Hudson survey, breeding adults	120,366	2016-2022	Stable population	
Mississippi Flyway Giant	State/Provincial surveys, breeding adults	1,452,167	2023	1,200,000 – 1,400,000	
Western Prairie/Great Plains	WBPHS, spring index	1,360,151	2023	Not yet established	
Hi-Line	WBPHS, spring index	384,330	2023	150,000 – 350,000	
Pacific Flyway Western	WBPHS + State/Provincial, spring index	413,157	2023	200,000	Replaces RMP and Pacific Canada goose 2023
Lesser	WBPHS, spring index	5,710	2022	Not yet established	
Vancouver		No estimate		Not yet established	
Dusky	Copper River Delta survey, spring index	14,003	2023	20,000	
Cackling Goose					
Cackling/minima	YKDCZS with fall expansion, fall index	254,616	2023	250,000	
Aleutian	Mark-resight survey, fall-winter estimate	175,390	2023	60,000	
Midcontinent	Adult Lincoln estimate	3,096,423	2019	1,000,000	
Taverner's	WBPHS+YKDCZS+ACP, spring index	43,124	2023	Not yet established	
Snow Goose					
Greater Snow Goose	Spring staging survey, spring index	775,625	2023	500,000 – 750,000	
Mid-continent	Adult Lincoln estimate	12,519,275	2019	5,000,000	
Wrangel Island	Ground survey, spring index	428,130	2022	120,000	
Western Arctic	Photo-inventory survey (Egg River, Anderson River, Kendall Island)	432,682	2002, 2007, 2009, 2013	200,000	
Ross's Goose	Adult Lincoln estimate	1,781,795	2019	355,000	New Objective/Lower threshold 355,000; MP (MF) updated in 2021
White-fronted Goose					
Mid-continent	Adult Lincoln estimate	2,863,644	2021	1,200,000	New Objective/Lower threshold 1.2 Million; MP updated in 2023
Tule	Mark-resight survey, fall-winter estimate	12,538	2022	10,000	
Pacific Flyway	YKDCZS+WBPHS with fall expansion, fall index	607,629	2023	300,000	
Brant					
Atlantic Brant	Midwinter Survey, winter index	136,037	2023	150,000	
Pacific Brant	Midwinter Survey, winter index	147,199	2023	162,000	
Eastern High Arctic Brant	Fall staging survey, fall index	32,000	2014; CAFF report	Not yet established	
Emperor Goose	YKDCZS, spring index	28,856	2023	34,000	
Hawaiian Goose	Various counts/surveys conducted throughout Hawaiian islands	3,862	2022 estimate (USFWS webpage)	Recovery from T&E status	Downlisted from endangered to threatened in 2019

Swan Population Objectives

After consultation with the Flyways, no changes were recommended to tundra swan objectives, but recent population estimates were updated.

The last range-wide survey of Trumpeter Swans happened in 2015, the survey was not flown in 2020 and has been suspended indefinitely. Thus, data are not available to update trumpeter swan status estimates. It seems clear from a few State surveys that the Interior Population has continued to grow, as have all trumpeter breeding segments other than the U.S. portion of the Rocky Mountain population (Vrtiska et al., in press).

The three eastern Flyways are presently reviewing the Interior Population management plan. The Pacific Flyway trumpeter swan subcommittee is also revising the management plan for the Pacific Coast population incorporating a new monitoring protocol using data from the annual WBPHS in Alaska (Strata 1, 2, 3, 4, 6, and 7). Past coverage in British Columbia would be missing but the Alaska data would enable trend monitoring for most of the Pacific Coast population.

Table 4. Objectives and estimates for North American swan populations.

Species and population	Objective	Population Size
Tundra swan		
Eastern population	80,000 total birds	105,800 total birds
Western population	60,000 total birds	113,000 total birds
Trumpeter swan		
Pacific Coast population	25,000 total birds	31,793 total birds*
Rocky Mountain population	10,000 adults and subadults	11,721 adults and subadults*
Interior population	Pending Flyway Review	27,055 adults and subadults*

*TRUS estimates are from the last range-wide survey conducted in 2015. The Interior Population is believed to have at least doubled since then, based on state surveys.

Future Adjustments to Population Objectives

In consulting the NAWMP habitat JVs for this Update we heard clearly that relative stability in long-term population objectives is desirable for the purpose of planning habitat conservation actions. Thus, we do not recommend that such changes happen frequently or without important reasons. Such reasons might include material changes in human desires for waterfowl abundance (e.g., fewer hunters), better scientific information, enhancing the relevance of specific objectives to JV planning (p. 15), or persistent negative changes in habitat conditions that might render present population goals unattainable. Another consideration is to allow change stemming from new or better survey information (e.g., for sea ducks), or to apply the results of new research as we recommend in this Update (e.g., black duck sex ratio, TSA start date).

The 50-year time series from 1974–2023 is a robust data set, based on largely consistent survey protocols, and reflecting annual variation in the productive capacity of breeding, migration and wintering areas that has supported the observed abundance of waterfowl. Thus, there may be no need to adjust TSA population goals in the near future. We do not recommend, for example, just automatically extending the LTA objectives for the TSA by adding more years to the time series (e.g., extending 1974–2023 to 1974–2033) as that could ultimately result in ever-declining or ever-increasing objectives based on environmental change (e.g., habitat loss). Therefore, we think it wiser to defer such decisions to informed managers at a regular time step.

Inclusion of surveyed areas beyond the TSA deserves further consideration as discussed earlier (p. 15). This has already been done for the ESA with added utility for both JV habitat conservation planning and harvest management. Once that is accomplished a more routine pattern of reviewing objectives may be preferable.

Most JVs update their comprehensive conservation plans every 10 years. A range of 5–15 is most common (Appendix A) and reflects rates of change in landscape conditions, habitat threats, JV technical capacity, and more. ***Therefore, and echoing recommendation number five from the 2018 Update, we urge that the NAWMP Plan Committee commission a routine review of population objectives every 10 years.*** We hasten to add that does NOT imply that objectives need to change that frequently, only that they be thoroughly reviewed and reconsidered at that time interval. Another opportunity presented by such decadal reviews would be to incorporate new insights from human-dimensions and habitat research that might enhance the complementarity of NAWMP population, habitat, and people objectives.

We suggest that these decadal reviews should be done in concert with a regular NAWMP Update, directed by the Plan Committee and overseen by an Update Steering Committee. It should feature involvement of the JVs, the Flyway Councils, and the federal agencies with oversight for migratory birds as well as NAWMP structures like the Human Dimensions Working Group, the NAWMP Science Support Team, the Integration Committee, and similar bodies that may succeed these.

A Framework for Stepping Down NAWMP Population Objectives to Habitat JVs

Sustaining waterfowl populations at Plan goals requires sufficient habitat across the regions used by waterfowl throughout the annual cycle. Since the early 2000s, JV staff and partners have worked to develop consistent frameworks for stepping down NAWMP population objectives to regional scales, with much of the work focused on the nonbreeding period. The 2018 Plan recognized the work of Koneff (2002), Petrie et al. (2011), and Fleming et al. (2017) as

valuable advancements while noting that additional uncertainties remained. Subsequently, the NSST further refined and endorsed a conservation planning framework that established nonbreeding population objectives for 23 duck species during autumn and winter for each JV (Fleming et al. 2019). In brief, the Fleming et al. (2019) framework provides a transparent methodology to allocate the LTA and 80th percentile NAWMP objectives, expanded to a continental scale, proportionally among JVs using contemporary (1999–2014) distributions of autumn (September–November) and winter (December–January) harvest in the U.S. and Canada, and Mid-winter Waterfowl Survey estimates in Mexico. Expansion of NAWMP objectives to a continental scale was intended to account for populations outside the TSA and ESA and ensure waterfowl breeding outside those regions are also supported by conservation planning during the nonbreeding season.

This framework represents the best available approach for JVs to achieve consistency in establishing regional population and habitat objectives that collectively support continental duck populations. Five Habitat JVs have updated population and habitat objectives using the Fleming et al. (2019) framework, while several continue to utilize methods described by Koneff (2002). Still others continue to use alternative frameworks (primarily breeding JVs) or have established objectives that lack explicit connection to the Plan (Appendix A). Despite improvements in Fleming et al. (2019) over earlier methods, there remain several assumptions needing further evaluation. Two of the more notable were assumed survival rates from autumn to spring and the assumption that harvest distribution is a reliable index of duck distribution (e.g., Verheijen et al. 2023).

Another important decision in applying the Fleming et al. (2019) objectives to regional migration chronologies is selecting the appropriate date to which those objectives are assigned on the migration curve. Migration chronologies, or indices of the relative abundance of waterfowl through time, are often used to segment JV-scale objectives into shorter time periods (e.g., weekly, biweekly) across the nonbreeding period (Petrie et al. 2011). Selecting the appropriate date to which those objectives are assigned on the migration curve (i.e., “anchor point”) is important. The GCJV’s waterfowl working group developed a method to estimate the most appropriate species-specific anchor point for use with the Fleming et al. (2019) framework (Lancaster et al. 2021). The result is a consistent and repeatable method for identifying a single anchor point for each duck species that can be universally applied to all JVs during the autumn and winter planning period. Work is ongoing to publish the methodology and anchor point dates as an NSST Technical Report to assist other JVs wishing to apply the Fleming et al. (2019) framework.

Additional research is ongoing to investigate alternative sources of temporally explicit waterfowl abundance information to refine species-specific migration chronologies or possibly temporally allocate continental objectives among JVs across breeding and nonbreeding periods in a more integrated framework. Initial investigations harnessing citizen science data from eBird with the Cornell Lab of Ornithology are ongoing. The waterfowl conservation community has made remarkable strides since the inception of regional-scale planning under the NAWMP. We suggest that commitments to further advancement should be evaluated for the anticipated ability to refine habitat planning and conservation outcomes with the cost and complexity of their development.

We recommend that the NAWMP Habitat JVs embrace Fleming et al. (2019) as the preferred approach for stepping down continental duck population objectives to regional scales, especially JVs supporting nonbreeding waterfowl populations. Should modifications to the Fleming et al. (2019) framework be deemed necessary by individual JVs, we recommend the rationale and methods for doing so be documented in JV implementation plans. For example, the GCJV modified (from 5% to 27%) the proportion of blue-winged teal expected to winter in the U.S. during the winter period after investigating relative abundance information from eBird Status and Trends (Lancaster et al. 2021).

We also recommend that the NSST continue seeking opportunities to refine assumptions inherent in the Fleming et al. (2019) framework and explore other frameworks that may offer increasingly tractable and consistent methods for translating continental population objectives into regional objectives. Lastly, we recommend the NSST continue work with Species JVs, Flyways, and the NAWMP Committee to determine what data would be required to establish robust step-down objectives for additional species of geese, swans, and some species of sea ducks.

Habitat and Species JV Coordination

The Black Duck, Sea Duck, and Arctic Goose JVs have made great strides in addressing concerns about the status of populations and further scientific understanding necessary to manage these species more effectively. For this update, the Species JVs have provided insight into waterfowl population status as well as recommendations for aligning population objectives with current management strategies. The 2007 NAWMP Continental Assessment urged the Species and Habitat JVs to communicate more and better integrate their missions. As they have matured, all three species JVs have been increasingly successful in engaging with other NAWMP partners to generate and share knowledge to inform management decisions involving the four Flyway Councils and the Habitat JVs.

Examples of the latter include: 1) the black duck decision-support tool to estimate black duck habitat needs under current and future landscape conditions to guide strategic habitat conservation by the Atlantic Coast and Eastern Habitat JVs and other partners, 2) the Atlas of Sea Duck Key Habitat Sites in North America and online map viewer providing information on sea duck distribution and key habitats benefiting the conservation work of JVs associated with coastal habitats including the Great Lakes, and 3) identification of habitat use and distribution of geese wintering in the Central Valley of California and Mexico. Long-term research and monitoring work by the AGJV also informs goose management plans of the Flyway Councils, which overlap the geographies of all the Habitat JVs.

The Northern Pintail Action Group and the Scaup Action Team were less formal science teams created after the 2007 Continental Assessment with a similar mission to encourage research and extend what they learned to both habitat and harvest management authorities***. After useful beginnings, both groups have been less active in recent years, and we suggest that an evaluation of their status and future roles might be timely.***

Strong communication and collaboration among all the Species and Habitat JVs remain important priorities. As a science-driven conservation enterprise, NAWMP depends on such adaptive collaboration between scientists and managers both within and among its various administrative parts.

NAWMP Species Prioritizations — 2023 Revision

NAWMP was developed as a strategy to restore waterfowl populations, but the number of waterfowl species and populations (>70) requires strategic thinking in prioritizing management efforts. Strategic priorities also vary regionally as each area's importance to individual species varies. In 2004, for the first time, the Plan prioritized waterfowl species in terms of perceived management need given habitat conditions and importance in harvest (NAWMP 2004). The latest revision (Roberts et al. 2023) builds upon previous iterations by considering additional biological and social data that are now available, along with the broadened goals of the 2012 Plan.

In the latest revision, the three primary Plan goals were used to identify classification criteria and prioritize species among all ducks, geese and swans combined at the continental scale. This update relied 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 NSST and associated JVs. 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 goose and swan populations, the population objectives 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 and 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 ranges of final scores among populations were subdivided approximately equally to obtain 3 levels of prioritization (high, medium, or low) for ducks and geese/swans.

High priority was assigned for 12 of 38 duck species (40 populations), Medium to 17 and Low to 11. For geese/swans, 11 of 35 populations were classified as High priority. (Appendix D). This report focuses solely on the continental scale. Work will soon 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 NSST also 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.

Habitat Working Group Report in support of the 2024 NAWMP Update

Introduction

Loss of grasslands, wetlands, and other habitats is the greatest threat to waterfowl in North America. Ecosystem loss and degradation reduces biodiversity and impacts human populations through the loss of ecosystem services including regulating floods and droughts, limiting the effects of severe weather, improving water quality, supporting groundwater recharge, and offering recreational opportunities. To safeguard these values and help ensure that waterfowl populations remain at NAWMP goals, Migratory Bird JVs have developed specific goals and objectives for their geographies. Continental population objectives (NAWMP 2014) are stepped down to individual JV geographies or subgeographies using a variety of criteria (Fleming et al. 2017, 2019) and articulated in terms of translatable habitat metrics (e.g., acres, energy days).

In this section, we report progress towards habitat goals laid out in support of NAMWP (NAWMP 2012, 2014). Specifically, we review progress of JVs towards:

- "Conserving a habitat system with the capacity to maintain long-term average waterfowl population levels, to periodically support abundant populations, and to consistently support resource users at objective levels."; and;
- "Considering the impact of specific management decisions on all objectives and learning about the effects of those actions on the attainment of multiple objectives through monitoring and evaluation."

Additionally, we review JV-specific progress towards implementing habitat-related recommendations for integrating people-related criteria articulated in the 2018 NAWMP Revision:

- "Focus conservation actions on waterfowl habitat and population management objectives and incorporate social science into planning and program delivery"; and
- "Identify key geographic areas where the best opportunities exist to meet the needs of waterfowl and people."

We also review recent science regarding existing and projected impacts of changing climate and other threats on waterfowl habitat resources and potential inferences for habitat delivery. Finally, we offer recommendations for refinement of NAWMP itself and JVs to expedite accomplishment of NAWMP goals.

Integrating Human Dimensions into JVs:

In 2022, the Unified Science Team and NAWMP Science Support Team reported on the status of integrating human dimensions into JVs. The objectives were to determine the extent to which JVs are engaged in human dimensions work and are integrating people-related goals and objectives into bird conservation planning and bird habitat delivery, explore human dimensions assumptions made by JVs, and identify challenges, barriers, and needs for expanded human dimensions integration. The JVs acknowledged the importance of social science for achieving their goals and objectives, noting that major social and environmental changes are happening across North America and indicated that social science can help them better understand these changes and remain relevant. The future conservation focus of JVs must include birds, habitats, and people.

The JVs recognized social science integration as one of the highest near-term priorities to help:

- identify how stakeholders perceive and support the bird conservation community and stewardship actions; and
- understand the barriers to and motivations that people face when engaging in conservation actions.

Currently, there are different levels of social science engagement across JVs, which range from not using social science; to using available data and literature to target conservation, develop models, or learn about landowner decision-making; to collecting data with existing staff or through support from outside researchers; and using the results in conservation decisions. Social science capacity across the JVs is also highly variable. One JV has dedicated social science staff, another JV recruited a social scientist to their technical committee, and seven JVs have staff with at least some formal social science training. Integration of social science into conservation planning also varied widely across JVs. Some JV plans don't include human dimensions because they are older plans, while other JVs include social science primarily to achieve biological goals. Only one JV included an explicit objective for people (hunter abundance).

There are several perceived barriers to social science engagement and integration, including JV staff capacity; traditions and culture; partnership composition; regional landscape characteristics; and the stage of updating implementation/conservation plans. The report concluded that the review of human dimensions integration provided valuable guidance for further integration and established a baseline to measure progress in the future. JVs can learn by sharing experiences and they believe that a social science community of practice is on the horizon.

The NAWMP Integration Steering Committee has hosted twenty (20) webinars to share knowledge and experience within the waterfowl conservation community on how habitat conservation efforts can identify and address broad-based societal benefits (ecosystem services, natural values, green infrastructure, natural capital, ecological benefits, etc.). Presenters have addressed how they identified natural or societal benefits, how they obtained and applied the scientific information, how they employed an adaptive decision approach or framework, and how they communicated benefits to those impacted or interested.

Progress Towards Habitat Objectives

Progress toward habitat objectives can only be assessed for 10 JVs that have quantified objectives and have sufficient habitat assessment systems to enable reporting on their progress (Appendix 1). Fortunately, most JVs that can report progress are those in regions of most significance to continental waterfowl populations (Hagy et al. 2024). Of the JVs that can report progress, 3 report >90% attainment of objectives, 3 report 75-89% attainment, and 4 report <74% attainment. Variability in progress among JVs is due to many factors, including the degree of habitat degradation, the costs and availability of resources for habitat restoration, the degree of ambition espoused in objectives, metrics of achievement (e.g., protected in perpetuity versus current or recent landscape condition), and scientific uncertainty in development of objectives or measurement of progress.

In most cases, the proportion of habitat objectives achieved (Appendix E) closely mirrors progress as defined by the NAWMP Committee's new metric of "proportion of stepped-down NAWMP population goal that is currently supported by the JV landscape" (Column 9 of Table 1), with 2 significant outliers. In the cases of the Prairie Habitat Joint Venture (PHJV) and the Boreal Area of Interest, they report only 26% and 18% of progress, respectively, toward their NAWMP population-based habitat objectives. However, recent population assessments suggest that they are supporting 97-100% of their stepped-down NAWMP population goal. This implies that (a) a substantial portion of their habitat goals are designed to protect existing productive habitat, and (b) achieving the last few percentage points of their population objective will require a disproportionate investment toward their habitat goals.

Importantly, most acres considered "achieved" toward habitat goals remain at some degree of risk. Portions of the Intermountain West and Gulf Coast JVs offer two extreme examples. In the former situation, some wetlands that have been restored and placed under permanent protection, such as National Wildlife Refuges, are no longer providing reliable habitat for migrating and wintering waterfowl due to water scarcity from drought, climate change, and associated water policy. In the latter situation, high quality wetlands that have been restored and protected in federal and state ownership at the mouth of the Mississippi River are at daily risk of slowly succumbing to coastal erosion and becoming part of the Gulf of Mexico. Most regions of continental significance to waterfowl face varying degrees of continued threat – expansion of invasives, potential market-driven conversion from waterfowl-friendly agricultural practices, potential large-scale policy changes on public lands, political restrictions on conservation easements, changes in water policy, urban expansion, and some aspects of the "clean energy" pursuit that are not always wildlife friendly.

<u>Recommendations:</u>

- **Provide support and guidance to ensure objectives articulated in JV Implementation Plans are linked to NAWMP goals**
- **Develop ability to assess progress toward habitat objectives**

- **The Plan Committee continue to promote information sharing among JVs relative to planning, evaluation, and science, such that the best methods and processes become widely adopted, while also encouraging continual advancement on these fronts.**
- **The Plan Committee reiterate its expectation that JVs be able to populate the PC's new metric of "proportion of the stepped down NAWMP population objective supported by the JV landscape."**

Geographic Targeting

Currently, the scale and resolution of objectives varies substantially among JVs. Overall, most (17/22) JVs have made progress in spatial prioritization of areas for habitat conservation (Appendix E). Many of these step-down objectives are to state or province, bird conservation region, or other sub-regions within the JV geography. We noted few examples where objectives or associated spatial prioritizations were expressed at resolutions sufficient to target restoration, acquisition, or management at local scales (e.g., county, township). Exceptions include fine-scale decision support tools developed by the Habitat and Population Evaluation Team and partners for the PPJV that guide wetland and grassland easement acquisition for waterfowl and other wildlife, spatial tools within the PLJV that identify individual playa wetlands and adjacent buffers for conservation, and spatial tools used by the GCJV to target habitat conservation for breeding Mottled Ducks. Another example of fine scale prioritization includes the UMRGLJV's dynamic tool that can incorporate waterfowl habitat, people, and ecological services through a customizable weighting system. The UMRGLRJV has recently stepped down their integrated planning model to several states within their geography expressing biological, ecological, and human dimensions criteria at a spatial resolution <1km using a dynamic weighting system. Several other JVs indicated that they were on the cusp (i.e., within 1-2 years) of implementing new, high-resolution spatial prioritization criteria and tools that would greatly enhance conservation efforts of partners in their geographies. For example, the LMVJV is completing a wetland complex model that will be integrated with their updated bioenergetics model to identify priority locations for acquisition, enhancement, and management at variable scales, including down to the field or parcel level. This new tool will also incorporate waterfowl sanctuary locations helping to account for the needs of both waterfowl and waterfowl hunters. Another example is the PHJV "hatched-nest model" that incorporates fine-scale information on changing/protecting habitat at the ¼ section-scale (160 acres) to predict changes in hatched nests for that landscape. PHJV has also recently incorporated updated version of the model that incorporates costs and risks of conversion in a spatially explicit way to predict costs/hatched nests so a true ROI model. Since we did not ask JVs for all their examples of geographic prioritization tools, we acknowledge that other examples may exist.

The majority of surveyed JVs (13/22) had conducted some form of geographic prioritization for waterfowl habitat conservation but had not yet structurally incorporated

priorities for people or other societal values into this geographic prioritization effort. These prioritizations were wide ranging in resolution and rigor, with examples including stepdowns to large subgeographies (e.g., initiative areas in the GCJV) and watersheds (e.g., HUC12 watersheds in the ACJV). Many of these prioritizations were based on bioenergetic models (e.g., RBJV), but other JVs used breeding productivity models (e.g., PPJV/PHJV) or wetland basin models (e.g., IWJV). We noted a wide variety of methods, products, and driving priorities across JVs. These differences were likely related to geographic and taxonomical diversity, partnership capacity for spatial planning, missions, and priorities as determined by respective management boards.

Few (4/22) JVs surveyed have explicitly incorporated geographic prioritization for biological- and people-related criteria. Of the four JVs falling into this category, one (PLJV) uses primarily an ecological service metric to drive their prioritization somewhat independent of a separate waterfowl-centric criteria and another (SJV) uses primarily a basic, qualitative criteria to incorporate the geographic needs of people into their planning. By comparison, the EHJV and the UMRGLJV have decision support tools more explicitly based on both biological and sociological considerations related to waterfowl. Five JVs had not pursued geographic prioritization for either waterfowl habitat- or people-related factors, but these JVs were more focused on land birds and had devoted scientific capacity to areas other than waterfowl.

Based on the responses by JVs describing their progress towards incorporating societal and/or people-based objectives into spatial prioritization efforts for waterfowl habitat conservation, progress across North America might be most reasonably described as ongoing. For example, even JVs that answered “yes” to this inquiry had efforts largely in their infancy (e.g., EHJV), lacked fine-scale spatial resolution throughout their entire geography (e.g., UMRGLRJV), or were addressing both people and waterfowl prioritization through an ecological goods and services lens (e.g., PLJV). Several efforts described by JVs were aligned with the visions of the 2012 NAWMP for addressing needs of people in terms of waterfowl hunters (e.g., LMVJV). However, most JVs had not yet wholly incorporated waterfowl habitat and NAWMP people-based criteria into a high-resolution spatial prioritization framework that might be most useful to the widest variety of partner agencies conducting land acquisition, enhancement, restoration, or management. Advancing the spatial resolution of and integration with other objectives for high resolution geographic targeting of conservation actions is clearly an area for continued growth and evolution for a number of JVs, and we noted a large number of them currently pursuing this goal.

<u>Recommendations:</u>

- **Provide support and guidance to JVs to ensure that geographic prioritization is articulated at spatial scales adequate to inform partner actions**

Climate Change Impacts

The Habitat Working Group for this NAWMP Update acknowledges substantial, ongoing, and increasing threats to waterfowl habitats even without considering the exacerbating impacts of climate change. These impacts have been well articulated in earlier NAWMP revisions, updates, and elsewhere (Hagy et al. 2014) so they are not repeated here, but they remain highly relevant.

Most major waterfowl regions in North America are likely to face detrimental impacts caused either directly or indirectly by climate change. Increasing temperatures, changes to precipitation patterns, and increasing frequency and intensity of extreme climatic events are predicted to impact habitat availability and quality to waterfowl in North America (McKenna et al. 2019, Zhao et al. 2019, Donnelly et al. 2020, Londe et al. 2023). Increasing temperatures may impact the availability of wetlands for waterfowl and influence the prevalence and distribution of diseases (Fleskes et al. 2012, Donnelly et al. 2022). Warmer temperatures can influence the timing and routes of bird migration, and changes in the availability of suitable stopover sites and feeding areas along migration routes may affect the overall fitness of waterfowl (Sedinger and Alisauskas 2014; Notaro et al. 2016; Donnelly et al. 2020, 2022; Londe et al. 2023). Changing migration phenologies may generate mismatches in timing and location of settling patterns with habitat availability (Drever et al. 2012, Adde et al. 2020). A recent study assessing waterfowl migration found that spring migrations in Central Flyway waterfowl are showing significant advancements, and fall migrations are showing significant delays across years with increasing temperatures (Andersson et al. 2022). While the long-term implications of such shifts are still uncertain, the importance of stopover habitat in regions such as the Intermountain West, Rainwater Basin, Playa Lakes and Southern Great Plains which are all predicted to become hotter, drier, and have reduced connectivity among wetland networks portending significant challenges for waterfowl populations in the Pacific and Central Flyways (Uden et al. 2015, Haig et al. 2019, Verheijen et al. 2020, Londe et al. 2023, Donnelly et al. 2020, Vest et al. 2023). Wetland declines will reduce migratory flexibility, potentially increase the energetic cost of migration and in turn can reduce survival and breeding productivity through cross-seasonal effects (Sedinger and Alisauskas 2014, Xu et al. 2019).

Changes in the timing, intensity, and distribution of rainfall are likely to influence river and stream flow regimes in the Mississippi Alluvial Valley. With more unpredictable flood pulses and elongated flooding into the growing season, changing hydrologic regimes are favoring establishment of tree species that are less desirable for waterfowl in the region (Hagy et al. 2024). Potential decreases in warm season precipitation will likely place additional stress on already limited surface and groundwater resources during the growing season likely impacting waterfowl-friendly agriculture (e.g., rice; DU 2021). The Central Valley of California, a vital wintering area for northern pintail and over half of Pacific Flyway waterfowl, is likely to experience increases in drought due to warming and reduced snowpack. This trend when paired with increased competition for water resources will likely reduce waterfowl habitat availability and quality in the region (Fleskes et al. 2012, CVJV 2020), thereby disrupting vital migratory networks with potential population level impacts (Donnelly et al. 2022, Osnas et al. 2021).

Coastal wetlands, such as the Gulf, and Atlantic Coasts, are experiencing substantial rates of rising sea level, increased tropical storm activity and intensity, and increases in aquatic invasive species, which may reduce capacity to support waterfowl (Moon et al. 2021, ACJV 2022). Although Pacific Coast tidal wetlands have experienced relatively lower impacts from sea level rise so far, moderate and worse-case scenarios of sea level rise will result in increasing impacts to coastal wetlands via shifts in salinity and inundation regimes (Callaway et al. 2012). Additionally, climate change is anticipated to impact adjacent seagrass ecosystems via changes in distribution and interannual variation in cover and density as they respond to rising sea levels, warmer water temperatures, and increased carbon concentrations (Callaway et al. 2012).

Important waterfowl breeding areas such as the Prairie Pothole Region and Western Boreal Forest could experience more variable weather and precipitation patterns, which could result in diminished waterfowl breeding populations in these areas over the long-term. Overall, much of the U.S. Prairie Pothole Region and Canadian Prairies/Parklands are generally expected to trend warmer and wetter in the future with varying changes to wetlands across the region (Bortolotti et al. 2023, McKenna et al. 2021; Zhang et al. 2021). The southern Prairie Pothole Region has experienced a shift from winter to summer and fall precipitation-driven hydrology in recent decades (McKenna et al. 2017). More precipitation may initially seem beneficial in much of the PPR, but wetland productivity and function are likely to decline with less periodic drying (Euliss et al. 2004; McCauley et al. 2015). Under wetter conditions, wetlands may deepen, have more stable water levels and permanence promoting fish persistence and cattail domination (Anteau et al. 2016). Similarly, wetter conditions in portions of the U.S. and Canadian PPR do not necessarily equate to more waterfowl habitat as warmer and wetter climates likely will expand crop production, decreasing natural habitat available for waterfowl (McKenna et al. 2019, Bortolotti et al. 2023). In the Boreal Forest region of Canada and Alaska, dramatic warming is resulting in drier conditions, increasing the frequency and size of wildfires in the region. However, at current rates waterfowl populations appear largely resilient to wildfire, prescribed burning, and fire suppression activities, with relatively limited impacts so far on waterfowl abundance and productivity (Lewis et al. 2016). Throughout the Boreal, waterfowl responses to climate change are likely to vary among species with early nesting species (e.g., mallards) anticipated to expand whereas many late-nesting species such as scaup, scoters, and even some boreal cavity nesters (e.g., Barrow's goldeneye) anticipated to exhibit population declines (Drever et al. 2012, Adde et al. 2020).

Given the wide diversity of life history strategies and geographic range of waterfowl in North America, it is unsurprising that not all climate change effects may be negative for breeding waterfowl. For example, warmer conditions and earlier break-up of sea ice may benefit breeding performance of common eiders in the arctic (Lehikoinen et al. 2006, Love et al. 2010, Chaulk and Mahoney 2012, Mehlum, 2012; Jónsson et al. 2016). Black-bellied whistling ducks appear to benefit from warming trends as their range has expanded in recent decades from the Gulf Coast to throughout the southeastern U.S. with documented breeding as far north as Wisconsin (Cohen et al. 2019, Brady 2020). Warming in the Great Lakes, Alaska, and regions of Canada likely will result in increased melting of snow, ice, and glaciers. Rising water levels due

to warming in these regions may benefit some waterfowl species by expanding available habitat, however it could also lead to the flooding of nesting sites for others.

Climate plays an important role in the health, function, and distribution of wetlands available to waterfowl. Annual precipitation variation and weather extremes are anticipated to increase throughout much of North America, further exacerbating, and complicating effects across the annual cycle of waterfowl. Long-term predictions indicate different intensity, timing, and frequency of climatic and weather events that could affect hydrologic regimes. These interactions are complex and make it difficult to assess how climate factors will impact specific wetlands and species due to uncertainty in current predictive climate modeling capabilities. However, it is likely that additional indirect effects (e.g., proliferation of invasive species, decline of native species) will have impacts on waterfowl. Other synergistic and confounding factors, in addition to aforementioned factors, will make disentangling how climate may or may not be impacting waterfowl difficult to fully assess now and predict into the future.

Finally, warming climates are influencing wintering waterfowl distributions (Notaro et al. 2016). These changes are likely to affect hunting traditions in areas where birds settle less frequently. This could have important and varying socioeconomic ramifications and, hence, support for conservation (Cox et al. 2023). One further possibility is a change in system dynamics that are the bases for all harvest and habitat management. If climate change uncouples the historical relationships between weather, habitat, and waterfowl population dynamics, the models with which we plan habitat interventions and harvest regulations may no longer work as well. For instance, there is concern that the assumption of long-term stationarity (return to the historic mean) may no longer be valid for mid-continent mallards (Nichols et al. 2011).

<u>Recommendations:</u>

- **Continue to track rapidly advancing climate science and incorporate it into planning as appropriate**
- **Ensure wetland protection policies remain in place/are established to maximize system resiliency**
- **Continue to evaluate and integrate waterfowl habitat conservation with natural climate solution strategies and agricultural-based climate adaption strategies**
- **Develop strategies to address human dimension challenges (including hunting-related funding) from waterfowl distributional changes related to climate and land use change**

2024 NAWMP People Team Report

Introduction of NAWMP HD Intent from 2018 Update

In 2012, the waterfowl community included a “people goal” as a key element of the North American Waterfowl Management Plan (NAWMP) noting wetlands and related habitat’s close linkage with the recreation opportunities and the ecological services that benefit society. This goal laid the foundation for numerous initiatives to better understand the needs and desires for wetland and waterfowl conservation among North American hunters, birdwatchers, and the public. In addition to the human dimensions research supported under the auspices of NAWMP, other research projects have been undertaken that are invaluable for creating knowledge about the interactions of people and wildlife. This report provides a brief overview of some of the social science research, NAWMP human dimensions accomplishments, and other lessons learned about what has been done about the "people goal" and offers several recommendations to make further advancements on the people goal.

The people goal of NAWMP is different from the population and habitat goals; it is both a fundamental goal and a means goal. As a fundamental goal, it is critical that NAWMP goals/objectives resonate with, and are supported by, the public. Obtaining a social license for waterfowl and wetland conservation would demonstrate the importance of these social-ecological systems and support government and NGO initiatives that address these issues. The 2014 Addendum established the objective to “increase waterfowl conservation support among various constituencies to at least the levels experienced during the last two decades,” and distributed it among three constituent groups: (1) active waterfowl hunters; (2) North American citizens who appreciate and take action to support wetlands and waterfowl; and (3) landowners participating in habitat conservation programs. Moreover, the 2014 Addendum identified initial quantifiable objectives for these groups based on the average number of hunters in the U.S. and Canada from 1999 to 2013, the average number of waterfowl viewers traveling more than one mile from home from 1996 to 2011, the number of birdwatchers in Canada and the 1999–2013 sales of Migratory Bird Hunting and Conservation Stamp (commonly referred to as the Federal Duck Stamp) in the U.S. and the Migratory Game Bird Hunting Permits in Canada. As a means goal, the NAWMP Committee challenged its sub-committees to develop a better understanding of the social science essential to help the NAWMP community improve its delivery of conservation programs, to reach more diverse audiences, and to affect more active support for wetland conservation by hunters, birdwatchers, decision-makers, and other members of the public.

While there has been limited large-scale progress on integrating habitat objectives with NAWMP people objectives (see Integration section, Appendix E), interviews with JVs suggest significant advancement in the utilization of social sciences to inform decision making. Many interviewees noted that they are deeply cognizant of people goals, are aware of social science resources, and aspire to integrate human well-being into planning and approaches. Explicit

fundamental objectives related to recreation, EGS, or other human-linked outcomes are lacking however. For example, PHJV reports HD considerations (influenced by substantial social science investments) are heavily deployed in delivery of PHJV objectives, but people considerations are not explicitly incorporated in any map or spatial decision-support tool. Soulierre et al. 2022 note "…the JV community is keenly aware of the social and environmental change occurring in North America and the importance of using social science expertise to understand humans within the landscapes where they work. JVs largely recognized that future conservation focus must include birds, habitats, and people….". Although focus on people objectives is highlighted in the 2012 and 2018 NAWMP, JVs at this point are using HD science primarily to help achieve biological goals."

The 2012 NAWMP vision to include human well-being considerations has been heeded and is top of mind in most JVs. Nevertheless, we have learned that the fundamental elements of the people objectives could be improved to provide greater clarity. It is expensive and resource-intensive to develop new metrics/data sources, but we also don't want to be limited by what is currently available. Measuring what is important to NAWMP, and not necessarily limited to what is currently measured, is needed. For example, the quantifiable elements around duck stamp sales could be changed or eliminated as it is redundant to the number of hunters in each country. The target numbers for hunters and wildlife viewers in the US, and the birdwatcher numbers in Canada are relevant but should be revised for the 2024 NAWMP Update. A new objective could be "to increase the number of bird watchers/wildlife viewers by "X" percent and potentially identify new metrics that could be tracked regularly (see Appendix D for potential ideas). Another example could be landowners (private and public) who have been identified by many JVs and NAWMP partner organizations to be one of the most important constituent groups to be involved to support and conserve wetlands. Therefore, it would be advantageous to identify particular typologies of landowners based on management motivations (e.g., agricultural, commercial, recreational) and establish clear and attainable objectives/metrics for different types of landowner participation in NAWMP initiatives.

<u>Recommendations:</u>

- **Clarify the nature of NAWMP people goals as both fundamental and means**
- **Provide guidance and support for habitat planning that incorporates fundamental NAWMP people goals**
- **Provide guidance and support for JVs to integrate habitat planning with people goals and metrics, including processes for weighting potentially competing criteria**

The path forward to achieve the fundamental goals for waterfowl populations, habitat, and people, requires that the NAWMP community better understand what motivates people or communities to participate (or what barriers exist) in wetland conservation, outdoor recreation, and to support the policies to facilitate conservation of the natural benefits (i.e., EG&S) of wetlands and the associated uplands. Learning how to use social science to assist in conservation program delivery and to promote positive conservation attitudes and behaviors is critical to the success of the NAWMP. Ultimately it needs to go beyond learning to investing in resources and governance processes to ensure social science and people/community priorities are embedded in our ways of working together. Collectively, the NAWMP community must develop, expand, and in some cases, reimagine conservation and communication initiatives and tools to successfully engage more diverse participants to support conservation policy and to implement conservation actions. NAWMP should identify means to directly support the different constituencies, partially through capacity building for human dimensions/social science at the partner level.

Human Dimensions Activities Since 2018

In general, Canadians and Americans are similar in their perceptions of wetland environments. The NAWMP waterfowl hunter and birdwatcher surveys highlighted similarities between these groups, in terms of identity as conservationists, and being immersed in the sounds and smells of nature. A US public survey indicated that people were familiar with wetlands, live in reasonable proximity to them, and the majority had visited them in the past year. However, this familiarity does not appear to transfer into engagement in pro-environmental behaviors, particularly in terms of the more altruistic, less self-serving behaviors. Additionally, indications are that the more traditional supporters, particularly waterfowl hunters, remain a relatively small portion of the population and numbers are still declining. Other data suggest that wetland-associated recreation activities are important for connecting people with nature overall (and maintaining these connections) and specifically wetlands. These findings reinforce the need to continue to build and diversify the spectrum of people/communities who support and are actively engaged in NAWMP's conservation goals.

<u>Human Dimensions Working Group – Public Engagement Team (HDWG-PET)</u>

The Human Dimensions Working Group (HDWG) and Public Engagement Team (PET) were formed after the 2012 Revision as a forum to coordinate human dimensions, social science, and public engagement efforts. Since the 2018 Update and a joint Human Dimensions Working Group and Public Engagement Team workshop in January 2018, the group members have spent significant time analyzing, reporting results (by Flyway) and distributing numerous publications based on the 2017 US and Canadian surveys (U.S. General Public Survey, U.S. and Canadian Waterfowl Hunter Surveys, and the North American (US and CAN) Birdwatcher Survey). The two groups (HDWG and PET) almost always operated jointly; in 2022 the Human Dimensions Working Group formally merged with the Public Engagement Team to form a merged HDPET - Human Dimensions Public Engagement Team (with PC blessing, along with an updated Terms of Reference to reflect the updated group structure).

A key hallmark to the HDPET is its place as an ongoing forum for members to share new publications and social science efforts or project information as well as progress on NAWMP-related human dimensions and public engagement efforts. Also stemming from HDPET workshops in 2014, 2018 and 2019, the group continues to discuss and develop approaches and possible engagement plans around three target audiences: (1) hunters (recruitment, retention, and reactivation) R3, (2) birders, and (3) landowners. This has led to a collaboratively developed research framework to look at whether recreation experiences in wetlands can encourage birders and wildlife viewers to engage in wetland conservation behavior (lead investigators are seeking funding to implement). Additionally, group members have also collaborated with the Bird Plans' Unified Science Team/NAWMP Science Support Team (UST/NSST) over the past few years to develop and release a report on the HD integration of JVs (human dimensions in population management, habitat management, and public engagement decisions). The group is also involved in collaborative efforts with the Joint Venture Coordinators to better understand landowner conservation engagement. More recently, the HDPET developed updated NAWMP people metrics for tracking NAWMP success that were adopted by the PC.

Recent Accomplishments of the HDPET

- Effective, ongoing forum for members to share new publications and social science efforts as well as progress on human dimensions and public engagement efforts,
- US and Canadian 2017 National Survey results released by Flyway, published numerous papers over the past 5 years with several additional analyses still under way. The key surveys were:
    - U.S. General Public Survey
    - Waterfowl Hunter Survey (US)
    - Waterfowl Hunter Survey (CAN)
    - North American (US and CAN) Birdwatcher Survey
- Continued to discuss and develop approaches and possible engagement plans around 3 target audiences: hunters, birders, and landowners.
- Collaboratively developed a research framework to look at the variables that predict how people become birders and use this information to encourage members of the public to develop into birders (seeking funding to implement).
- Collaborated with UST/NSST to develop and release a report on current human dimensions integration within JVs and future human dimensions priorities and integration plans.
- Updated Terms of Reference to reflect new HDPET group structure.
- Developed updated NAWMP people metrics for tracking NAWMP success.
- Engaged on the theme and people-related materials in development by the 2024 Update.

<u>US and Canada Hunter Surveys</u>

Waterfowl hunters have a strong identity as conservationists and prefer being in and experiencing nature. Recent information suggests that overall, waterfowl hunter satisfaction is relatively high, but satisfaction with ducks seen and harvested could have been higher.

Crowding and hunting pressure appeared to be at least somewhat of a problem to many hunters. About 40% of hunters took someone new to waterfowl hunting with them. Current waterfowl hunters identified few constraints to participation, but travel time, number of birds harvested, and competition are important aspects of their hunting experiences. Further analysis identified different typologies of hunters (i.e., harvest-oriented, selective, devoted, and local) that differ regarding what they desire from a waterfowl hunting experience. These different experiences suggest that a “one size fits all” for hunter satisfaction does not exist in terms of location of habitat, accessibility, and ability to harvest or see waterfowl among hunters. There are diminishing returns associated with the number of waterfowl harvested and some groups did not perceive appreciable benefits from harvesting more than one bird.

In addition to NAWMP-directed surveys and research, there have been numerous, recent projects or studies involving social science data to change or better understand existing paradigms related to waterfowl hunters. These have ranged from those related to regulations (e.g., Stiller et al 2021, Gruntorad et al. 2023), hunter satisfaction (e.g., Bradshaw et al. 2019, Schroeder et al. 2019) to recruitment, retention, and reactivation (e.g., Price Tack et al. 2018, Hinrichs et al. 2021) and beyond. Advancements to increase our understanding of waterfowl hunters have been made and should assist in directing various NAWMP activities and objectives. Sainsbury, et. al., (2023 in press) identified four latent classes of waterfowl hunters: 'devoted’, ‘local’, ‘harvest-oriented’, and ‘selective’. The results highlight that increasing harvest is a key element in determining hunter well-being, but it is not the only influence, and its importance varies among hunters. Things like on-site access, number of users, travel time, and geographic distribution of hunting opportunities are also important to consider.

There also has been development of a major project as part of the Harvest Management Working Group’s (HMWG) effort to develop a new model of integrating hunter regulations into existing population and habitat models. The goals of this effort are to create a foundation for understanding hunter dynamics and integrate them into existing frameworks. The project is also attempting to reduce uncertainties and help move from a descriptive mode to predictive utility. Understanding changing hunter behavior is a key question as the research team examines what affects R3 efforts. For example: regulatory limits, duck populations, regulatory perceptions, hunter density, and local values (social carrying capacity). The research team is developing models that key in on factors within the various regulatory packages and examine regulatory effects on R3 and effects on hunter participation.

US and Canada Birdwatcher Survey

Birdwatchers have emerged as an important constituency for conservation. Because birdwatching is dependent on healthy bird populations and habitats (Cooper et al. 2015), birders have a vested interest in seeing communities of species and habitats conserved. Birdwatchers are more likely to engage in conservation behaviors, such as supporting local conservation efforts, improving habitat, advocating for wildlife recreation, and participating in local environmental groups compared to non-recreationists (Cooper et al. 2015). Many birders are also active participants in community science through initiatives like the Cornell Lab of Ornithology's eBird platform for documenting bird sightings. A common challenge across

community science projects, like eBird, is to maintain participation. To understand what influences contribution rates, Rosenblatt et al. (2022) found that eBird members who contributed most to eBird were more specialized (e.g., skilled and with higher levels of birdwatching participation) than those with lower levels of contributions. An implication of this is that community science initiatives that collect data for conservation programs could foster increased participation of recreationists, like birders, by appealing to a broader range of motivations that includes appreciative and achievement elements.

The NAWMP survey of Canadian and American birders found that although rarity, diversity, and number of birds are important trip attributes for birdwatchers, they are not the only ones (Sainsbury et al., in prep.). Characteristics of birdwatching sites are also relevant to birdwatchers' preferences. Travel distance is an important attribute for birdwatchers when deciding whether to participate in a birdwatching trip: generally, trip preference decreased for scenarios that included travel distances greater than 50 miles. This suggests a challenging, but not uncommon, situation for outdoor recreation and wildlife managers: providing opportunities for birdwatching in locations that are not far from birdwatchers' homes that attract rare and unusual species of birds, a diversity of bird species, and large numbers of birds. Five "birder types" were identified that had different preferences for trip attributes [*names of types to be confirmed early 2024 by K. Sainsbury*]. Identifying and understanding these different preferred trip preferences can help outdoor recreation and wildlife managers focus and direct their messaging and programming to relevant birdwatchers, and where feasible, provide preferred on-site features and resources.

Although the heterogeneity of birder trip preferences suggests that there is diversity in priorities among the birdwatching community, an investigation of American birdwatchers found the ethno-racial composition of birdwatchers was significantly less diverse than that of the American public (Rutter et al., 2021): among American eBird members that responded to the survey, 5.2% were Black, Indigenous, or People of Color (including Native American, Black, Asian, Pacific Islander, Hispanic/Latino, or multiracial), and 94.8% were non-Hispanic White. Efforts to build a more diverse birdwatching community should focus on increasing participation from, and developing opportunities that are inclusive of, underrepresented ethno-racial groups.

Public Survey – United States

Most survey respondents knew of wetlands, and more than half had visited a wetland in the preceding 12 months. The most common reason for visiting a wetland was to pursue outdoor recreation (e.g., walking/hiking/ biking and enjoying nature/picnicking). Most respondents were concerned about wetland benefits, although they were less concerned about the provision of hunting opportunities. Respondents did not appear to participate in many waterfowl or wetland conservation-related activities. Among the respondents, there was low interest in hunting for moral, practical, and personal reasons. Additionally, people had less interest in viewing waterfowl and other gamebirds than in seeing hummingbirds, birds of prey, and other species.

Survey respondents indicated that when receiving information, the three most trusted sources were scientific organizations, universities, and friends and family. The three least trusted

organizations were religious organizations, national media/news, and local media/news. Respondents also indicated that their preference for receiving information is through personal media. Simply stated, conservation efforts and information products that extend beyond waterfowl and include other species that benefit from wetlands would assist in achieving NAWMP objectives.

America's Wildlife Values

The America's Wildlife Values Project, undertaken by Colorado State University (CSU), was not part of the NAWMP research, however, it is an important contribution to our understanding of human dimensions of wildlife. The purpose of America's Wildlife Values Project was to assess the social context of wildlife management in the U.S. to understand the growing conflict around wildlife management. Findings from this project build on three sources of data: 2004 data on public values from the 19 western states in the Wildlife Values in the West study (n = 12,673); 2018 data on public values from all 50 U.S. states (n = 43,949); and 2018 data on fish and wildlife agency culture from 28 states (n = 9,770).

Definitions
Wildlife value orientations are an expression of fundamental values revealed through a pattern of basic beliefs. From two predominant orientations four typologies of wildlife values are classified. People are classified by scoring responses to survey item scales representing utilitarian and mutualist wildlife value orientations.

- Traditionalists (or Utilitarians) – score high (above the midpoint) on the domination scale and low (at or below) the midpoint on the mutualism scale; i.e., they are the most extreme in beliefs that wildlife should be used and managed for the benefit of people
- Mutualists – score high on the mutualism scale and low on the domination scale; i.e., they are the most extreme in seeing wildlife as part of their extended social network.
- Pluralists – score high on both mutualism and domination scales; i.e., different situations or contexts result in this group emphasizing one orientation over the other.
- Distanced – score low on both mutualism and domination scales; i.e., they exhibit low levels of thinking about and interest in wildlife.

Across the U.S., Traditionalists make up 28% of the population, Mutualists make up 35% of the population, Pluralists make up 21% of the population, and Distanced individuals make up 15% of the population. Data illustrate that those with mutualist values are more likely to exhibit anthropomorphic tendencies toward wildlife, which is likely stimulated by processes of modernization. Wildlife value orientations differ by racial/ethnic groups, with Whites having a higher proportion of Traditionalists, Hispanics/Latinos and Asians having higher proportions of Mutualists, and Native Americans having a higher proportion of Pluralists. It is interesting to note that from 2004 to 2018, western U.S. states on average had a 5.7% decrease in Traditionalists and a 4.7% increase in Mutualists. CSU researchers propose that the rise in mutualism is driven by modernization as indicated by urbanization, education, and income at the state level. This research suggests that there is a need to develop diverse initiatives to

effectively engage participants to a degree that will influence conservation policy and on-the-ground conservation activities.

Survey responses about future participation in wildlife-related recreation indicate that the percentage of people expressing interest in future hunting (16%) is lower than the rate of past participation (people who have ever participated in hunting is 23%) but much higher than the 6% of the US population that currently hunt (reported by the 2022 National Survey on Fishing, Hunting and Wildlife-Associated Recreation (USFWS 2022). Meanwhile, future interest in wildlife viewing (52%) is higher than past participation (43%). Engagement in hunting and fishing is higher among Traditionalists and Pluralists compared to Mutualists and Distanced individuals, with rates varying considerably by state. Like the NAWMP public survey, the Wildlife Values research team explored public trust in State Fish and Wildlife Agencies and found that members of the public are much more trusting of their state fish and wildlife agencies (60%) than their state (36%) or federal (25%) governments. States with a higher percentage of Mutualists have lower rates of trust in these agencies, but the difference across states is in large part driven by those with more traditional values, indicating a “cultural backlash” to perceived change.

Across state fish and wildlife agencies, employees have strong agreement in their institution's unifying principles: being experts and protectors of natural resources, being compassionate toward wildlife, and advancing stewardship; there is evidence of strong normative pressure to be a model employee and uphold the values of the agency. Agencies differ in which management models they prioritize, with some agencies focusing on an expert model (staff being the experts in their respective fields) and others focusing on a clientele model (staff responding more to the desires of clients). Agencies with higher levels of mutualism among their employees are more likely to perceive the agency as prioritizing an expert model. The value composition of a state's public seems to have little impact on the value composition of the agencies that are likely changing at a slower pace.

While 34% of the public in participating states are Mutualists, only 8% of agency employees are, which suggests that the NAWMP community needs to consider the views of the participants and recognize that they may not match those of the agencies/people responsible for waterfowl or wetland conservation.

Canadian Wildlife Values

As an extension of the America’s Wildlife Values project in the US, researchers at CSU, in partnership with investigators and organizations in multiple countries around the world, began leading a global assessment of values toward wildlife in 2020. The long-term goals of the study are to collect wildlife values data for nations around the world to define the social context of wildlife management and further our understanding of the processes of value formation and shift. Canada and Mexico were participating countries in this Global Wildlife Values effort [*CSU can provide URL in early 2024*]. Information provided by this effort will help address the growing social conflict over wildlife-related issues, inform policy solutions, facilitate collaborative conservation efforts, and aid in the overall planning for the future of wildlife conservation and management within and across nations.

Data for Canada were collected in the following provinces in 2021: Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Prince Edward Island, Ontario, Quebec, and Saskatchewan (n = 3,733). Across Canada, Mutualists make up 50% of the population, followed by Pluralists who account for 26%. Traditionalists (11%) and Distanced individuals (14%) comprise a smaller proportion of the population. The distribution of these value types across provinces is relatively homogeneous, although there are some notable differences. Nova Scotia, Quebec, and British Columbia, for example, have the highest percentages of Mutualists, while Saskatchewan, Alberta, and Manitoba have the greatest representation of Traditionalists.

Consistent with the long-term wildlife values, CSU found that provinces with higher proportions of residents with a college degree have higher percentages of Mutualists and lower percentages of Traditionalists. However, findings for other indicators of modernization are mixed, suggesting the need for further exploration of the role of modernization in wildlife values in Canada. The wildlife values research in Canada measured the public's perceptions of the environment, and overall, 75% of Canadians believe that protecting the environment should be given priority, even if it causes slower economic growth and some loss of jobs. This prioritization of the environment is most common among Mutualists (87%) and least common among Traditionalists (40%). The tendency to prioritize the environment over the economy is most prevalent among residents of Manitoba, Nova Scotia, New Brunswick, and Quebec.

The CSU research also examined participation in wildlife-related recreation and found that passive engagement activities such as watching television shows about wildlife are the most common activities, with over 60% of Canadians reporting participation in the last five years. Over 60% of Canadians also report spending time outdoors with the intention of seeing wildlife, which is more common among Mutualists and Pluralists. Hunting (5%) and fishing (26%) are less common among Canadians as a whole, though participation in these activities is highest among Traditionalists and Pluralists. Hunters make up only 2% of Mutualists and Distanced individuals. Across provinces, New Brunswick, Alberta, and Saskatchewan have the largest proportions of hunters, while Ontario, Quebec, and British Columbia have the lowest. Provinces with a greater proportion of hunters have a greater proportion of Traditionalists and a lower proportion of Mutualists. The most popular reason for hunting cited by hunters (79%) is for food. Hunting for sport or recreation is the second most popular reason (31%).

Trust in Canadian government authorities was also measured, and overall, 48% of Canadians trust government authorities to care for the well-being of fish and wildlife in Canada. Pluralists have the highest levels of trust (68%), and Distanced individuals have the lowest (38%). Consistent with previous findings in the U.S., Traditionalists (49%) are more trusting compared to Mutualists (41%) and residents of Ontario and Quebec are most trusting of government authorities, while residents of Nova Scotia and Alberta are least trusting.

Wildlife Viewer Survey

Wildlife viewing is one of the fastest growing wildlife-related recreation activities and there is a need to better understand viewers' perspectives and expectations. During the summer of 2021, the Association of Fish and Wildlife Agencies' (AFWA) Wildlife Viewing and Nature Tourism Working Group conducted a multi-state survey of approximately 4,000 wildlife viewers in the

US—about 1,000 each from the four AFWA regions (West, Midwest, Northeast, and Southeast). The respondents included “consumptive viewers” and “non-consumptive viewers,” whereby 46% of wildlife viewers participated in at least one consumptive activity: hunting (4%), angling (29%), or both (13%). However, the most popular form of outdoor recreation for viewers was running, walking, or jogging (49%) followed by camping, swimming, hiking, and backpacking, and the most common participation types were feeding birds, visiting parks and natural areas, and photography.

Camping was most popular in the West; fishing was least popular in the Northeast; horseback riding, hunting, and swimming was most popular in the Southeast; and motorized boating was most popular in the Midwest. Over half of viewers used state or locally managed areas, while viewing at home was most common and 75% reported wildlife viewing in more than one type of location. Respondents from the West were less likely to view wildlife around their own homes or property or on the property of friends or family. Conversely, respondents from the West were more likely to participate in wildlife viewing on federally managed areas and tribal lands. Respondents from the West and Midwest were more likely to report viewing on locally managed areas than those from the Northeast and Southeast.

Approximately 30% of viewers lived in a major city; 20% in a rural area; 50% in a small city or suburban area. Most respondents identified as beginner, novice, or intermediate and a little over half of respondents viewed for 30 days or fewer per year. Respondents indicated they strongly identified as a wildlife viewer (71% “I think of myself as a wildlife viewer.”) Most respondents were white and non-Hispanic. Wildlife viewers who were Black, Indigenous, and People of Color identified less strongly as wildlife viewers than their White counterparts, yet on average, they reported wildlife viewing as an important part of their lives. White and multi-racial respondents most strongly identified as wildlife viewers. About 40% of viewers reported accessibility challenges (mobility, vision, disabilities, etc.) and they identified (in order) barriers to participation to be distance, financial costs, and lack of free time.

Wildlife viewers have limited familiarity with state wildlife agencies with 44% not being familiar, and most viewers in the northeast are not at all familiar with agencies. Many viewers do not contribute directly to supporting state wildlife agencies, however, consumptive viewers had greater levels of familiarity, likelihood to contribute financially to, and experience with state agencies than non-consumptive viewers. Consumptive viewers also had slightly higher levels of trust in state agencies than non-consumptive viewers. Consumptive and non-consumptive viewers were most likely to contribute financially to state wildlife agencies through the purchase of fishing licenses (38%), a hunting license (21%), or an access fee (20%), although consumptive wildlife viewers were more likely to contribute through all financial mechanisms. Habitat or conservation stamp and program fees were the lowest means of contributing, but wildlife viewers would likely increase contributions to state wildlife agencies if they knew their funds would be used for habitat conservation, conservation of rare and vulnerable species, wildlife research, education or outreach, opportunities or resources for wildlife viewing, conservation of preferred viewing species, or were matched by an external source (similar response for both consumptive and non-consumptive).

To support them in their viewing, respondents reported state wildlife agencies could provide viewers with more information about wildlife in their state, how to view wildlife, and viewing locations. Respondents were least interested in more opportunities to be involved in other volunteer activities not related to research or data collection. Seventy-five percent reported satisfaction with agency visitor centers, information about wildlife in the state, agency lands, volunteer data collection opportunities, and live stream wildlife cameras. Visitors were least satisfied with programs for groups or clubs and technical assistance or information about maintaining plantings in the state, however 50% satisfaction or higher was reported with all listed programs and services. Overall, wildlife viewers indicated high trust in state agencies and state agency staff.

Facilitated discussions at the 2022 Wildlife Viewing and Nature Tourism Academy resulted in the following recommendations:

1. State wildlife agencies should develop programs and engage viewers by providing increased information about where, how, and what wildlife to view, and additional programs and support for wildlife viewers.
2. Agencies should broaden their constituencies by supporting the viewing experiences of underserved groups including Black, Indigenous, and wildlife viewers of Color, and/or disabled wildlife viewers, and by increased representation and connection with these groups.
3. Agencies should develop opportunities for non-consumptive viewers to financially support their agencies.
4. AFWA and state agencies should conduct additional research to fill information gaps about wildlife viewing.

The conservation behaviors of wildlife viewers were measured as part of the survey, and most often viewers reported being likely to clean up trash or litter. They had a much lower likelihood (<25% very or extremely likely) to participate in civic engagement, purchase environmentally friendly products in collaboration with their state agencies, to collect data on wildlife or habitat to contribute to science or management, or inform/teach others about wildlife conservation. Other studies indicated that more than two-thirds of waterfowl hunters, bird watchers, and members of the American public have not contacted elected officials or government agencies about wetlands or waterfowl conservation. Almost eighty percent (79.8%) of American public respondents reported that they had never contacted elected officials or government agencies about wetlands or waterfowl conservation (Wilkins & Miller, 2018).

There is no comparable data about the public in Canada, however, 73.9% of Canadian e-Bird respondents reported that they had never contacted elected officials or government agencies about wetlands or waterfowl conservation (Harshaw, 2018a). An average of 68.0% of American e-Bird respondents reported that they had never contacted elected officials or government agencies about wetlands or waterfowl conservation (Slagle & Dietsch, 2018e; Slagle & Dietsch, 2018f; Slagle & Dietsch, 2018g; Slagle & Dietsch, 2018h). Eight two percent (82.4%) of Canadian waterfowl hunter respondents reported that they had never contacted elected officials or government agencies about wetlands or waterfowl conservation (Harshaw, 2018b). and an average of 74.4% of American waterfowl hunter respondents reported that they had never

contacted elected officials or government agencies about wetlands or waterfowl conservation (Slagle & Dietsch, 2018e; Slagle & Dietsch, 2018f; Slagle & Dietsch, 2018g; Slagle & Dietsch, 2018h).

A 2022 survey of Canadians (n = 2,721) found that approximately one third (30.6%) were willing to donate to NAWMP, with 85% of respondents confident in their donation decision (Sainsbury et al. in prep.). Average willingness to pay levels were broadly consistent with other studies of willingness to pay for duck habitat conservation among Canadians (Haefele et al. 2019). There was not a single preferred option for donation mechanisms; preferences were split between payments to NGOs (26%), voluntary donations made when filing taxes (24%), buying a collectible item such as a stamp (18%) and buying a lottery ticket (17%). Almost a third of respondents preferred to target the purchase of new conservation lands with their donation (29%). Other options such as funding conservation on public land (18%), outreach/education about bird habitat conservation (18%), and funding conservation science (17%) were also popular.

Current Human Dimensions Initiatives

North American Waterfowl Professional Education Plan (NAWPEP)

It is critical to recognize that waterfowl and wetlands management and conservation efforts need trained professionals to study and steward natural resources. The 2018 NAWMP Update identified the critical need to maintain and expand educational capacity to ensure the existence of an appropriately skilled workforce to meet the conservation goals of the NAWMP. The loss of university-based waterfowl/wetland programs in North America necessitates that efforts be established to provide programs that would educate and produce skilled waterfowl/wetland scientists and stewards to sustain waterfowl populations in the future. As such, the North American Waterfowl Professional Education Plan (NAWPEP) was created. The goal of NAWPEP is to:

> "***e****ngage and assist universities, colleges, and all NAWMP partners with establishing, sustaining, and enhancing academic and experiential programs in waterfowl science and management so that sufficient numbers of professionals representing human diversity from across North America are supported, available, and employed to sustain professional capacity and excellence of future waterfowl science and management."*

The plan identifies four objectives (abbreviated listed below), along with several action items for each objective.

1. Obtain information on academic and practical credentials perceived as necessary by waterfowl professionals.
2. Determine the number of graduates with baccalaureate and post-graduate degrees required to fill anticipated employment needs in 2025, and update projections on 5-year intervals.
3. In collaboration with others, engage with and implement efforts to train, recruit, and hire an inclusively diverse group of waterfowl science and management people in the administrative Flyways by 2025.
4. Promote and facilitate institutional educational and skills capacity to meet projected needs.

Diversity, Equity, and Inclusion (DEI)

Organizations have focused more discussion and action on DEI issues in recent years, although equal employment laws and affirmative action first emerged in the 1960s. Recent events and movements have compelled organizations to reflect on the social injustices that exist today. This has led to the rapid expansion of corporate diversity, equity, and inclusion (DEI) programs. Although much progress has been made over the past few years, more needs to be done to eliminate harmful social biases and promote equity in society. All workplaces should strive to foster an environment where all employees feel valued and heard. Diversity, equity, and inclusion discussions begin with a recognition that across the continent there is a range of issues, opportunities, regional contexts, and potential partners with which to engage. It should be recognized that the NAWMP cannot prescribe who should be engaged but can set expectations that engagement should occur and new DEI initiatives should be implemented at all levels within NAWMP organizations.

It is helpful to consider definitions for the key components of DEI[2]*:*

> ***Diversity****: The range of human differences, including, but not limited to race ethnicity, gender, gender identity, sexual orientation, age, social class, physical ability or attributes, religious or ethical values system, national origin, and political beliefs.*
>
> ***Equity****: A measure of fair treatment, opportunities, and outcomes across race, gender, class, and other dynamics.*
>
> ***Inclusion****: Refers to the intentional ongoing effort to ensure that diverse individuals fully participate in all aspects of organization work, including decision-making processes. It also refers to the ways that diverse participants are valued and respected members of an organization and/or community.*

Like the AFWA's Diversity and Inclusion Working Group, the NAWMP can inspire, guide, and support the conservation community in embracing the richness of diverse cultures, individuals, experiences, and perspectives. Furthermore, the NAWMP can encourage proactive actions that enhance diversity in the workplace, create welcoming cultures, and increase the NAWMP's relevance to the broader conservation community by being inclusive and intentional in its actions.

DEI initiatives can help organizations build community awareness, increase community engagement, utilize community resources and linkages, improve staff development and policy, and advance community outreach. There are significant opportunities for the NAWMP community to learn where culturally diverse communities turn to for reliable information, how to engage volunteers and leaders, and how to create messages and provide better services to these culturally diverse communities.

There is an opportunity for growth by expanding engagement with underserved populations by attending ceremonial or cultural events, focusing on cultural diversity, and attending

[2] Anti-Racism Toolkit, Georgetown University, viewed: https://guides.library.georgetown.edu/antiracism/glossary viewed December 10, 2023)

celebrations to distribute information and meet the current and prospective supporters of wetland conservation. Community linkages can be strengthened by including representatives from culturally diverse communities in policy and decision-making and through collaboration with community-based organizations. NAWMP partner organizations can improve staff development and policy by hiring culturally diverse staff, reviewing mission, vision, and goal statements to include DEI considerations, and by identification of conservation or outdoor issues that are important to culturally diverse and underrepresented communities. Access to green space and wetlands can be an issue for some cultural groups; ride shares and the deliberate siting of public-accessible wetlands (e.g., restoration, stormwater retention ponds) closer to urban communities could help to engage, support, and diversify people who enjoy and actively support waterfowl and wetlands conservation.

Additionally, community outreach can be expanded to groups outside the traditional conservation community by developing materials through engagement with Indigenous peoples to bring more Indigenous knowledge into decision-making. Efforts can also be made to provide interpretative materials in multiple languages.

2018 Update – People-Related Recommendations Revisited

Recommendation 2: Help people understand the opportunities for outdoor recreation resulting from NAWMP activities and how society benefits from waterfowl habitat conservation. This included an objective to acquire and develop the knowledge and capacity to integrate social science into the conservation planning and decision-making processes.

Actions Undertaken: Since the completion of the 2016 surveys and subsequent release of the summary reports on hunters, birdwatchers, and the public in 2018, numerous analyses and papers have been published and formal presentations have been made by the researchers (see Appendix G). The information from the surveys has been used in many different forums, including training on the use of human dimensions information by JV and in JV implementation planning processes. The degree to which the data has been integrated into NAWMP efforts varies greatly by JV, as described in the Unified Science Team and NAWMP Science Support Team report noted above. Use of the survey information and other human dimensions research often depends on the resources available within the JVs to hire or contract human dimensions expertise.

Information about outdoor recreation opportunities and societal benefits of NAWMP has not been widely communicated by the core NAWMP community due to the lack of a proactive communications plan. Many of the JVs and NAWMP partner organizations have done extensive communications to decision-makers and the public about their conservation projects, but seldom mention NAWMP as the driver for their conservation efforts. The Plan Committee is addressing this issue and recently developed a NAWMP Marketing and Communications Plan. Additionally, the Max McGraw Wildlife Foundation, Ducks Unlimited, Ducks Unlimited Canada, and Audubon produced the award-winning IMAX film, *Wings Over Water*, which has reached hundreds of thousands of viewers in the US and Canada, as well as in Ecuador), Kuwait, Taiwan and soon it will be in China. In addition, "Wings" content is reaching 7 million US schoolchildren per week via related curriculums built by education professionals.

Recommendation 3: Compel people to act to conserve waterfowl habitat. This included two objectives: (a) to use stakeholder survey results and other social and biological science evidence to inform efforts to develop an actively engaged community of hunters, birdwatchers, landowners, and the public in support of waterfowl conservation and (b) to use social science to inform decision-making processes to help achieve the NAWMP goals.

Actions Undertaken: There is little evidence to illustrate how the hunter, birdwatcher, or public survey data has been used to directly inform or influence people to support waterfowl conservation. The NAWMP Communications Committee undertook a Marketing Assets Inventory that indicated less than 10 percent of the identified marketing assets directly message about NAWMP. Most were promoting other topics with mentions or links to NAWMP, historical background on NAWMP, or NAWMP as a partner in their work. The NAWMP assets identified through social media channels were predominantly focused on events and products that mentioned NAWMP but didn't provide specific NAWMP messaging. Finally, most of the identified marketing or communication assets were not "owned" by NAWMP, thus delivery of consistent messaging is difficult. Most assets identified in the study were informational, did not use persuasive language, and were often limited to background information on the creation and adoption of NAWMP. (Note: this study broadly examined NAWMP and was not focused on the stakeholder surveys.)

In contrast, JVs have begun to use social science to inform their decision-making, as described in the Unified Science Team and NAWMP Science Support Team report. For example, one JV has dedicated social science staff, another JV recruited a social scientist to their technical committee, and seven JVs have staff with at least some formal social science training. Some JVs incorporate social science primarily to achieve biological goals, such as considering how landowners make decisions about conservation. Only one JV included an explicit objective for people which is focused on hunter abundance.

Outside of JV activities, there has not been much application of social science data at regional or national scales. Assessment of the two-tier hunting regulations in the Central Flyway is one example of the use of social science information to assist with decision-making. However, state and provincial agencies have probably increased their reliance on social science data into their decision-making (e.g., Stiller et al. 2022).

Recommendation 7: Bolster training programs for future waterfowl management professionals. This included an objective to encourage universities and colleges to maintain and build waterfowl management training programs.

Actions Undertaken: The North American Waterfowl Professional Education Plan (NAWPEP) has been created and is now part of NAWMP, intending to engage universities, colleges, and NAWMP partners to establish, sustain, and enhance academic and experiential programs in waterfowl science and management. The NAWPEP encourages the development of professionals representing human diversity from across North America to sustain professional capacity and excellence of future waterfowl science and management (details above). NAWPEP assessed the supply of graduates with waterfowl-related training from college and university programs and the demand for such graduates by employers (agencies and organizations). In

addition, a recent survey of university administrators provided estimates of the current and future capacity of university faculty and departments to train waterfowl professionals and sustain departmental programs. To inform education and training programs, NAWPEP developed a summary of professional qualifications and attributes desired by employers, inventoried related job opportunities, and created a list of waterfowl-related scholarships, fellowships, and internship opportunities. The NAWPEP steering committee engaged waterfowl professors in ongoing communication to better understand needs and provide information and support.

Future Social Science Issues and Needs

The objectives of NAWMP's people goal—Increase waterfowl conservation support among various constituencies to at least the levels experienced during the last two decades—are distributed among three constituent groups: (a) active waterfowl hunters; (b) North American citizens who appreciate and take action to support wetlands and waterfowl conservation; and (c) landowners participating in habitat conservation programs. The metric for waterfowl hunters is centered on the number of duck stamps sold. However, this metric is redundant to the actual number of hunters in each country as measured by license sales or national surveys. There is no distinction between duck stamps purchased by collectors (i.e., a kind of supporter) or as a means of contributing to conservation (i.e., second or third stamps purchased by a hunter). The 2024 update should report new baseline numbers for hunters and viewers in the US, and birdwatchers in Canada, based on current reliable data sources.

In the 2022 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, the number of waterfowl hunters is not identified, as it was in previous surveys. However, annual estimates of waterfowl hunters may be available from the U.S. Fish and Wildlife Service. Collection of birdwatcher data in 2022 appears to be significantly impacted by changes in the survey methodology or how the question was asked, and the report cautions against comparing numbers to previous years. The 2022 report, as in previous national surveys, categorizes migratory bird hunters to include waterfowl hunters and others, and birdwatchers are reported as individuals watching birds more than 1 mile from home.

Migratory bird hunters (ducks, geese, doves, etc.)

Year	2006	2011	2016	2022
Mig. Bird hunters (millions)	2.3	2.6	2.35	2.8

Birdwatchers traveling more than 1 mile from home

Year	2006	2011	2016	2022
Birdwatchers (millions)	20	18.9	17	42.6*

* Several survey design changes likely contributed to the increased estimate of birdwatchers: overall methodology changes; questionnaire changes related to wildlife watching; and questionnaire changes related to birding. The effect of each of these individually is unknown but taken together they likely contributed to the sizable change in wildlife watching and birding specifically. **Birdwatchers as a percentage of wildlife watchers in 2022, is the same as reported in previous national surveys (~65%).**

The Update Steering Committee should contemplate changes to the objectives for goal 3. A specific, time-bound target to increase of the number of birdwatchers/wildlife viewers by "X" percent and associated new metrics should be considered. In 2021, the HDPET created a table of potential metrics and there are some good ideas for consideration (see Appendix H). Similarly, a more specific target for landowners should be contemplated—do we want a 10% increase in landowner participation across JVs or should NAWMP use the number of acres conserved by private landowners? It may not be possible to identify baseline information to quantify the number of landowners currently involved in NAWMP, but it could be recommended that this be an objective for the future. Alternatively, it isn't well understood what motivates landowners to participate in conservation, thus an objective and metric around how many landowners are contacted by JV partners or changes to what motivates landowners could be considered.

The 2023 NAWMP assessments of organizations and waterfowl professionals indicated there needs to be greater leadership to implement some of the past recommendations. For example, the integration of human dimensions is a necessity, but there is a lack of knowledge and clarity about how this should be done and perhaps a lack of expertise. Waterfowl professionals suggested that the 2024 NAWMP Update should confront assumptions about what it might mean for integrating public sentiment through the application of social science data. In other words, the NAWMP should address whether social science is a means to an end or an end in and of itself. Is the role of social science expected to serve the accomplishment of growing waterfowl, increasing habitats, and touting their recreational benefits (the old paradigm), or is the community open to adapting a new paradigm based on what social science may tell us about people's values and desired benefits?

The "traditional paradigm" has worked well in the past, but possibly has not enabled more rapid success towards increasing conservation accomplishments (mainly wetlands and associated uplands) at the JV scale and larger. This is in part because the paradigm emphasizes benefits to hunters, birdwatchers, etc. The "new paradigm" seeks to add messaging/information to engage a more diverse community of supporters or partners by using science to promote conservation outcomes that go beyond waterfowl and include natural benefits that address

community/people values for ecological goods and services . The 2024 NAWMP Update should address the entire suite of wetland conservation outcomes to strengthen, diversify, and increase the number of NAWMP supporters and partners. The NAWMP should remain focused on waterfowl, and the direct benefits to hunters, but it should expand efforts to plan for, implement initiatives, measure outputs, and communicate about the natural benefits wetlands provide to society. Gaining broader support among diverse communities, including businesses, corporations, foundations, and individual community members, may bring increased financial support, and increased influence on public policy.

Ideas for Recommendations

1. **Baseline and Trend Information about Hunters, Birdwatchers, and Conservation Supporters:**

   1.1. The NAWMP Update Steering Committee should discuss and incorporate updated objectives for Goal 3 of the NAWMP and or how the objectives currently serve us, considering what we've learned since 2012. Should what we are measuring for the people goal still be the # of participants/supporters? Can we think about new objectives that might be more effectively linked to how we think about people in NAWMP now – beyond hunters and birdwatchers?

   1.2. The NAWMP Committee should secure professional and financial resources to repeat the hunter, birdwatcher, and public surveys that were done in 2015-2016. Such surveys may provide one of the few metrics in measuring NAWMP Human Dimensions objectives or identifying trends at a national scale. To achieve this end, a strategy should be developed, and a clear process defined for how to repeat these surveys, and the frequency to repeat.[3]

   Discussion is warranted to identify what the NAWMP community needs to know, and from which supporters or potential supporters. A well-planned strategy for the surveys would help bring clarity to the survey targets, questions, etc. For example, we would benefit from an understanding of how well-existing partners and supporters, or prospective partners and supporters, understand the importance of wetlands to quality-of-life issues - water quality and quantity, clean air, flood attenuation, waterfowl, bird, or other wildlife/fish habitat and populations, etc. An iterative survey is the approach NAWMP has taken to improve habitat management alternatives and would help track how general attitudes may be changing through time. Managerial inferences will be much stronger if these are designed to measure the change in response to specific actions taken by the NAWMP community in an adaptive framework (i.e., "Based on previous surveys we predict that if we take action 'A', the response by

[3] It may be advantageous to repeat the NAWMP surveys within a reasonable time of the CSU America's Wildlife Values Survey (likely in 2026) however, caution should be exercised to avoid overlap, depending on the approach taken for respondent recruitment for the public survey.

the target audience ‘T’ will be ‘R’. Then take action ‘A’, monitor response ‘R’ and adapt predictions).

1.3. A comprehensive review of the legal and regulatory mechanisms for the conservation of wetlands across the Canadian prairies was developed and distributed among PHJV partners; Farnese, 2023. In Canada, recent studies have identified wetland visitation habits among the public, bird habitat values orientations, pro-environmental behaviors, willingness to donate to NAWMP, and conservation preferences. A systematic review on landowner engagement in wetland conservation practices is currently in progress in Canada and a more comprehensive landowner survey will be conducted in 2024. A more comprehensive landowner survey—perhaps at the JV—in the US would be beneficial. Some data on landowner behaviors may be identified via the above-noted literature review or it may be available from the Natural Resource Conservation Service, the National Agriculture Statistical Survey, or other sources. However, a focused and consistent approach for sharing the resultant information should also be designed to meet the end user needs (i.e., JVs and NGOs delivering private lands programs).

2. Identification of Needs and Barriers to Effectively Implement Programs:

2.1. The NAWMP Committee should undertake a human dimensions literature review(s) to identify the highest priority for future social science research needed to advance wetland and waterfowl conservation. The options include but are not limited to a systematic review that characterizes what has been done and what hasn’t (e.g., identify particular research outcomes/information needed by NAWMP and then systematically review the literature to investigate whether this information is available and the degree to which this information is ‘complete’). A second option could be a more focused literature review done with a specific purpose related to NAWMP (e.g., private landowner motivations to participate in wetland conservation, migratory bird hunter support of conservation, or segmenting the literature by landowners, birders, or other emphases). Such a literature review could take on deliberative elements to persuade and/or support a position/argument. Ultimately, both types of literature reviews may be needed; literature to make the case for the application of social science and why it is important (sort of normative), and a systematic review to identify what is known, and what the gaps are. Depending on the quality, extent, and diversity of approaches used, in the social science literature on waterfowl/wetlands conservation, there may be an opportunity to conduct a meta-analysis of studies. When designing a literature review, consideration should be given to the intended audience and how this information would be provided to end users, such as JVs (e.g., specific workshops, the North American Duck Symposium, or the annual meeting of The Wildlife Society.)

2.2. The NAWMP Committee should undertake a comprehensive gap analysis to determine the needs of JVs and key NAWMP partners to improve conservation delivery. JVs have called for additional resources, tools, and information (guidance and communication products) to be able to deliver more on-the-ground conservation. JVs have also asked for more guidance and resources on how to integrate social science into their planning

and activities. This is especially important and urgent today given the large amount of conservation funding available from a multitude of sources.

2.3. There is a significant need to better understand what motivates people to participate in and/or support conservation, and a need to identify what the barriers are for them to participate in conservation. This needs to be addressed for both consumptive and non-consumptive users. Identification of the obstacles, challenges, information gaps, etc. would greatly improve the ability of the NAWMP community to grow support for wetland conservation. Removal of barriers should be ground-truthed to know if removing barriers results in greater participation. Such an effort would help to inform the NAWMP community about how we could increase support for wetland/waterfowl conservation across the hunter community, birdwatchers, and current or prospective supporters.

3. Evaluation of Program/Initiative Effectiveness:

3.1. The NAWMP community requires a means to measure the effectiveness of habitat initiatives delivered by the conservation community, and new NAWMP marketing activities that have been proposed. For example, NAWMP should be communicating to many different audiences about the importance of conservation and the impact of the NAWMP community's collective on-the-ground conservation. It would also be useful to know if our investment in social science initiatives is helping professionals and benefitting organizations involved in conservation delivery. Additionally, as new marketing initiatives are deployed, an evaluation strategy should be implemented to measure if the messages being communicated are changing attitudes and behaviors.

3.2. Assess NAWMP's current guidance on increasing participant (hunter and birdwatcher) numbers and consider updating guidance regarding NAWMP's role or niche in these efforts relative to other partners (i.e., states, provinces, NGOs,). However, NAWMP should retain a strong message of the importance of supporting recreation opportunities and involvement. Additionally, the NAWMP community should explore how recreationists and supporters (e.g., hunters, and birdwatchers), through NAWMP partnerships, can engage in advancing the concepts of multiple benefit conservation and how this broader set of benefits will help achieve the NAWMP goals.

4. Financial Resources to Support Key NAWMP Initiatives:

4.1. Identification, development, and implementation of appropriate waterfowl and wetland conservation messages, programs, or campaigns intended to alter behaviors, attitudes, or opinions regarding waterfowl and wetland conservation (or wildlife conservation in general) and the natural benefits (i.e., EG&S) are required at the JV scale. Such messages, programs, or campaigns would hopefully assist or alter actions on important conservation policies that would benefit NAWMP objectives. Science-based messages can work to engage and increase our partners and supporters and result in an increased scale of conservation on the ground. Financial resources for the development of these

conservation messages or initiatives and implementing the NAWMP Marketing Plan should be identified and secured immediately.

4.2. The need for well-trained professional staff to continue NAWMP efforts remains critical. New challenges have become evident in the gap between university graduate programs and employers of waterfowl professionals. At the foundation, a broader understanding is needed within the NAWMP community, and particularly among decision-makers, of the critical need for the training of the next generation of waterfowl and wetland scientists to ensure the long-term success and viability of NAWMP. This requires effective ways to promote training, recruiting, and hiring of an inclusively diverse group of North Americans working in waterfowl science and management programs. To address these needs, NAWMP should continue the NAWPEP effort through awareness, leadership, and support for coordinating and implementing its strategic plan.

4.3. Identify and implement ways to help the NAWMP enterprise connect with new partnerships that focus on community-scale EG&S benefits in a way that also moves waterfowl and wetland conservation forward. Initial work needs to invest resources in quantifying the relevant specific EG&S benefits at different communities or scales, especially in economic or other terms from typical, broadly used, or critically important conservation techniques for waterfowl habitat. Such actions would represent new partnership and funding opportunities. Efforts should be inclusive of diverse participants, include the development of a human dimensions community of practice, and identification of mechanisms for the dissemination of information and best practices. It may also include intentional engagement of marginalized communities in the review and development of NAWMP initiatives to better inform and garner support.

Multiple Benefits

The 2018 NAWMP Update, entitled “Connecting People, Waterfowl and Wetlands”, advanced efforts towards integration of goals for waterfowl populations, habitat, and people (NAWMP Committee 2018). Waterfowl hunters have traditionally been the primary funders of waterfowl conservation and this funding remains vitally important. However, there are insufficient numbers of waterfowl hunters to secure and sustain waterfowl habitat and populations in the face of the increasing threats and risks to important landscapes that support birds. Therefore, it is imperative to recruit and retain more waterfowl hunters and more members of society that value multiple ecological goods and services conferred from NAWMP conservation efforts.

Survey data used to inform the 2018 update suggest most respondents (hunters and nonhunters alike) place high value on clean water, places to enjoy outdoor recreational opportunities, and other non-waterfowl benefits provided by wetland conservation for waterfowl (Responsive Management/National Shooting Sports Foundation 2017). These values

pose an opportunity for the NAWMP community to quantify additional benefits provided by wetland conservation targeted as duck habitat. Not only has this already led to increased funding and a diversified set of supporters in certain jurisdictions, but also has been critical for informing policy debates and decisions that affect important waterfowl habitats (e.g., provincial wetland protection policies in Canada, US Farm Bill).

Wetlands are among the most productive ecosystems globally and provide a host of ecosystem services to society (Table 1). Despite these values, societal and economic challenges have resulted in altered waterways and drained wetlands across much of North America. The term "ecosystem services" broadly encompasses the components of an ecosystem that are consumed, used, or enjoyed by humans and that ultimately contribute to human well-being (Costanza et al. 1997). Ducks have a direct value to NAWMP supporters as both food and recreation, and as the foundation of our waterfowl hunting culture (Van Der Valk 2018). Wetlands provide many other benefits derived from their ability to slow water flows and support unique biotic communities (Larsen and Harvey 2011; Smith et al. 2011; Marton et al. 2014; Pattison-Williams et al. 2018). Wetlands hold back precipitation and spring meltwater, metering out flows slowly and reducing the severity of flooding (Mitsch and Gossilink 2000; Pattison-Williams et al., 2018). Dense stands of marsh grasses in coastal wetlands slow storm surges, reducing coastal damage from hurricanes (Gedan et al., 2011; Cunniff and Schwartz, 2015; Sutton-Grier et al., 2015). Suspended sediments settle out of slow-moving water in wetlands where specialized soil microbes transform nitrogen fertilizer and return it to the atmosphere as a harmless gas (Roley et al. 2016; Cheng 2017; Hansen et al. 2018). When nitrogen-, phosphorous- and sediment-laden waters enter rivers, lakes, and oceans directly, these nutrients drive the formation of algal blooms such as those on the Gulf Coast that are rapidly degrading one of the United State's last viable and most commercially significant fisheries (Rabalais et al.,2009; Rabalais 2015; Purcell et al. 2017). All these services wetlands provide have real, quantifiable benefits for humans, and the loss of natural wetlands and other habitats has resulted in billions of dollars in economic harm via flood damage, degraded water quality, degraded soils, and degraded fisheries (Ducks Unlimited International Conservation Plan 2018). In contrast, work to conserve and restore wetland function is good business. In addition to reducing damages and the need for "grey" infrastructure, conservation work provides employment income, tax revenues to governments, profits for businesses, and jobs on par with many other industries. Anielski et al. (2013) estimated that every dollar spent on conservation by Ducks Unlimited Canada between 2008 and 2012 returned $22 dollars in economic and societal benefits.

Table 5. Examples of ecosystem services and functions provided by wetlands and other waterfowl habitats (adapted from Olewiler, N. 2004. The Value of Natural Capital in settled Areas of Canada. Published by Ducks Unlimited Canada and the Nature Conservancy of Canada. 36 pp).

Ecosystem Service	**Ecosystem Function**	**Example of Service**
Water supply	Storage and retention of water	Water storage by wetlands, watersheds, and aquifers
Water stabilization	Stabilization of hydrological flows	Moderation of flood events, supply water for agriculture and industry
Nutrient cycling	Storage, internal cycling and processing of nutrients	Nitrogen fixation, nutrient absorption and cycling
Habitat	Habitat for resident and migratory species	Foraging habitat for migratory birds, nursery habitat for juvenile fish
Genetic resources	Repositories for unique biological materials and products derived from wetland species	Medicine, raw materials, disease or pest resistant genes, ornamental species
Recreation	Provides opportunities for recreation	Fishing, hunting, boating, birdwatching
Cultural	Opportunities for non-commercial use	Aesthetic, artistic, education, spiritual, scientific research
Waste treatment	Recovery of mobile nutrients and removal of excessive nutrients, heavy metals and other compounds	Stormwater treatment, acid mine drainage treatment, treated wastewater effluent polishing
Climate stabilization	Regulation of global temperature, precipitation and other climate processes	Greenhouse gas sequestration, thermal capacity, evapotranspiration
Erosion and sediment control	Retention of soil, prevention of upland erosion	Prevent soil entering waterways, reduce water energy and erosive potential

Investments in science quantifying the provision of ecosystem services are foundational to employing important communication tools that engage and recruit new supporters. These include private corporations and foundations that may fund conservation practices aimed at sustainability of wetlands in support of corporate environment, social and governance (ESG) goals. This quantification of ecosystem services also may attract new members of the public whose advocacy is important to achieving effective conservation policy, or whose purchasing decisions are influenced by corporate commitments to sustainability.

Finally, it is important to recognize that while wetlands have tremendous capacities to provide environmental benefits, but they are not indestructible. If people need or want wetlands to continue to perform their ecological functions and provide EG&S, then society must do their part to protect them.

Recommendations:

- **Develop strategies to engage broader segments of society in the waterfowl enterprise through quantifying/articulating "multiple benefits"**
- **Strategically invest in regional-scale science that quantifies key ecosystem service benefits from actions targeted to improve conditions for waterfowl**

Success stories:

Using multiple benefits as a means to achieve conservation goals is not a new concept. Here are just a couple of examples where the quantification of multiple benefits has enhanced progress towards waterfowl goals:

Mexico has long been a leader in espousing multiple benefits of conservation. NAWMP programs in Mexico nearly always seek to simultaneously solve problems for waterfowl and society. One example is the provision of dry toilets to communities that lack modern septic facilities and surround important wetlands for waterfowl. By preventing raw sewage from entering the wetland, these low-maintenance toilets improve water quality for waterfowl but, importantly, they also improve the hygiene and health of the human population while enhancing the dignity of those receiving the toilets.

In Canada, wetland protection regulations fall under provincial jurisdiction. For the PHJV, evaluation identified ongoing wetland loss as the greatest threat to achievement of NAWMP goals. In response, the PHJV, led by Ducks Unlimited Canada, initiated an integrated program of science and communication to encourage wetland protection in Manitoba. Scientific investigation quantified how loss of wetlands higher in the watershed resulted in increased flooding, and reduced sequestration of both greenhouse gases and contaminants (specifically sediments, and fertilizer components phosphorous and nitrogen) in rivers, stream-courses, and downstream lakes. The results of this research were communicated through multiple media outlets and drew defensible connections between wetland loss and increased algal blooms in Lake Winnipeg. Annually, these blooms were responsible for the closing of popular beaches around the lake during peak summer vacation season. Simultaneously, scientists and policy experts were engaged with senior provincial bureaucrats, politicians, and other stakeholder groups to draft new wetland protection regulations. Ultimately these efforts resulted in new stringent wetland regulations being signed into law.

Progress Towards Integration

Since its inception, the NAWMP has emphasized strategically targeted conservation investments in regions that most affect waterfowl population dynamics. The 2012 Revision of the North American Waterfowl Management Plan identified 3 co-equal fundamental goals and clarified specific objectives in the 2014 Addendum. These objectives are anchored in the goals to (1) sustain waterfowl populations and population fluctuations at historic levels, (2) conserve habitats at levels sufficient to satisfy life cycle requirements of waterfowl and the desires of those who support waterfowl conservation, and (3) increase the number of supporters through a variety of activities. Additionally, the 2012 revision advocated for integrating across the three objectives. Specifically, practitioners were urged to "*Consider the impact of specific management decisions on all objectives and learning about the effects of those actions on the attainment of multiple objectives through monitoring and evaluation*." This idea was reinforced during the development of a map depicting and titled "Areas of Greatest Continental Significance to North American Ducks, Geese, and Swans" for the 2012 NAWMP Revision. Waterfowl professionals articulated the need for improved decision frameworks and use of consistent datasets for refining large-scale spatial products depicting priority areas for waterfowl and people.

During interviews with individual JVs, it became clear that there has been considerable progress on integrating population and habitat objectives (Appendix E). Of the 23 JVs interviewed, 15 indicated they had quantified habitat objectives integrated with NAWMP population objectives. On the other hand, only 2 of 23 interviewed JVs indicated that they had incorporated priorities for people into their geographic priorities for waterfowl habitat, and 0 of 23 JVs had quantified waterfowl population objectives integrated with NAWMP people objectives.

We believe slow progress on formal integration of people objectives with waterfowl population and habitat objectives should not be interpreted as a lack of interest in human dimensions by the JVs, but instead it illustrates the uncertainty surrounding this process. In fact, many JVs indicated that their partnerships have invested substantially in better understanding socio-economic factors influencing habitat conservation. These investments took many forms but included better quantification and communication of the range of ecosystem services provided by the restoration and conservation of waterfowl habitat, designing and developing programs that simultaneously benefit waterfowl and landowners, efforts to provide actionable science to inform policy debates, and extensive gathering of waterfowl hunter and non-consumptive recreation motivation, satisfaction, and demographic data (Patton 2018, Cole 2022).

An interesting outcome of the interviews with JV staff, consistent with the findings of Soulliere et. al. (2022), is that JVs seem to question whether NAWMP people objectives are truly co-equal fundamental objectives with those for waterfowl populations. This contrasts with a near ubiquitous understanding that considering people, either implicitly or explicitly, is a critical means objective toward accomplishing waterfowl population and habitat objectives. Because the treatment of people as fundamental and/or means objectives has significant implications on how people-based objectives are formed, we suggest additional discussion and reflection by the Plan Committee. People fuel the economic and political engine that drives habitat conservation activities for waterfowl in North American. As such, people seem certainly a means of achieving waterfowl habitat goals, while reaffirming people as fundamental

objectives seems to also resonate with NAWMP stakeholders. In fact, the supporting figure of Appendix C in the 2012 NAWMP Revision, based on stakeholder input, strongly suggests that people should be as considered as both fundamental and means objectives for NAWMP.

If the desire is to retain three coequal fundamental goals with strong integration, additional support and guidance is required to help JVs focus conservation efforts more effectively. For example, if sustaining waterfowl populations is fundamental to support waterfowl hunters for the sake of waterfowl hunting itself, then JVs and/or flyways may need additional guidance regarding integration among habitat and harvest management efforts, hunter R3 efforts, and similar efforts that have not traditionally been JV foci.

Quantitatively integrating across 3 coequal goals remains both conceptually and mathematically difficult. Nevertheless, we've seen real progress since 2012 (and 2018) in breaking the problem into more formal pairwise integration of 2 goals at a time. Here are examples of that progress:

Habitat & Waterfowl Populations:

The science that relates waterfowl population growth with habitat conditions continues to strengthen. Increasingly, population models that can quantify the contribution to population growth at each life-cycle stage have been completed for several species with diverging life-history strategies (Stearns 1992, Hoekman et al. 2002, Flint et al. 2006, Coluccy et al. 2008, Johnson 2009, Amundson et al. 2011, Wilson et al. 2012, Howerter et al. 2014, Koons et al. 2014, Arnold et al. 2017, Zhao et al. 2020) With additional investment in these models, the NAWMP community should be able to increase spatial targeting of resources to geographies that drive population growth rates. Also, with nearly 4 decades of experience delivering NAWMP habitat programs, we have extensive knowledge of how relative habitat delivery costs vary by program and geography.

With these pieces of information, for a fixed set of resources available to invest in habitat, we're increasingly in a better position to optimize operational efficiency of habitat delivery investments (both where to invest, but also what types of programs we should implement in each geography) to maximize impacts on populations. Although there certainly will be political and operational constraints to achieving this optimum, formalizing this process would be a substantial step forward with information already in-hand.

The Central Hardwoods Joint Venture (CHJV) stood out to us as an exciting and somewhat unexpected example of habitat and population integration. The CHJV was established primarily for its continental importance to landbirds, yet it embraced a fairly elaborate population-based planning effort for migrating and wintering waterfowl, taking advantage of available resources from the NSST (i.e., Fleming et. al. 2019) to step down NAWMP continental waterfowl objectives to habitat objectives for their geography. They further used available landcover to assess the state of their landscape relative to desired conditions for waterfowl. We believe this provides a useful model for other JVs that have not yet integrated waterfowl population and habitat objectives.

Habitat & People:

Similar to above, we have evidence (see people section) that habitat can influence conservation supporters through access to natural spaces or growing recognition of ecosystem services, among others. Similarly, we have a better understanding of cohort-specific factors that drive participation in and expenditures on recreational activities (e.g., waterfowl hunting, bird watching) of people. Finally, relative costs of programmatic- and geography-specific costs of habitat delivery can be modelled with increasingly high confidence. Therefore, it should be possible to do the same type of optimization to maximize impact of habitat programs on people given a fixed set of resources.

Waterfowl Populations & People:

The relationships between waterfowl populations, their management, and people are important. However, our ability to quantitatively test and model relationships currently is in the early stages. One relationship of interest is between hunting participation and waterfowl populations. The long-held view is that larger waterfowl populations, which are not independent of hunting regulations, increase hunting satisfaction and participation. In Canada and the United States, this correlation has weakened in recent decades. Recent surveys of waterfowl hunters, birdwatchers, and the broader public in the United States and Canada offer additional insights. Specifically, the surveys measured hunter rankings for the relative importance of large duck populations to hunting satisfaction and shed light on the effects of waterfowl populations and expected harvest on hunters' predicted participation. Similarly, birdwatcher surveys measured effects of bird numbers, species numbers, and rarity of birds on their predicted participation.

Recently, human dimensions science has examined hypotheses about the relationship between participation in waterfowl hunting or viewing and conservation behaviors and advocacy for appropriate public policy. Hypotheses about effects of harvest regulations, a function of waterfowl populations, on hunting participation have been debated and hypothesized for decades. A United States scale research effort is underway to develop a new model of integrating waterfowl hunting regulations and their effects on hunter participation and harvest into existing population and habitat models. The goals are to create a foundation for understanding hunter dynamics, integrate them into existing modeling frameworks, and reduce uncertainties ideally to incorporate a social component into decision tools for setting regulations and managing harvest.

Habitat, People & Populations

With the above pieces in-hand, it is possible to understand where there are efficiencies in delivering habitat for both duck populations and supporters and where there would be trade-offs. This approach falls short of formal integration of the 3 goals, but it links all three in a common framework and is both computationally and conceptually tractable. As proof of concept, Krainyk et al. (2019), Palumbo et al. (2021), and Devers et al. (2017) have developed spatial planning tools at the international, regional, and state scales, respectively, that incorporate considerations for habitat delivery to meet both waterfowl population and social concerns. These powerful tools provide tangible guidance for NAWMP/NAWCA investments

across multiple scales and generate hypotheses that could be adaptively evaluated through time.

Existing examples provide powerful opportunities for extension:

1. The quantification of ecosystem services conferred by waterfowl habitat resources continues. Further work to understand the spatial and temporal flow of these multiple benefits and continuing to include these in planning tools will enhance our abilities to engage broader segments of society in conserving the many values associated with waterfowl habitats.

2. Designing efficient conservation programs necessarily requires consideration of both the benefits and costs of delivering various conservation alternatives. Incorporating relative costs into planning tools is an important antecedent to understanding the trade-offs among conservation choices.

3. When deciding among conservation alternatives, it is important to consider the rate at which benefits accrue. Generally, in instances where habitat interventions are designed to restore ecosystem function, benefits begin to accrue as soon as the restoration is complete, but it may take time for full ecosystem function to recover. Alternatively, for options that conserve existing ecosystem function, the benefits will accrue at the rate they would have been lost without conservation action (Possingham et al. 2015). Therefore, investing resources to conserve habitat at low risk of conversion may yield poor returns.

4. The sensitivity of waterfowl populations to habitat changes varies across the annual cycle. Incorporating information from recent Integrated Population Models could help focus resources on life-cycle events that are most impactful for meeting NAWMP goals.

We believe that incorporating these components into new or existing planning tools would facilitate engaging new supporters while delivering more efficient conservation programs and avoiding substantial opportunity costs currently present within funding allocations.

<u>Recommendations:</u>

- **Continue to evaluate and improve upon programmatic efficiency of delivery programs including human dimension initiatives**
- **Build on existing tools and apply them at local, regional, and international scales to ensure biological and social integration and to allow examination of trade-offs of management alternatives associated with incorporation of different sets of fundamental objectives. Extend these tools to incorporate landscape-specific risks to productive capacities, contributions to population growth, and relative costs of conservation delivery**
- **Engage the NSST, HDPET, or other relevant advisory groups to explore approaches and develop planning tools that can be applied at local, regional/JV, and**

international scales to incorporate a greater suite of ecosystem services that include econometrics and support JVs in refining their conservation plans

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Appendices

APPENDIX A: Summary of Habitat Joint Venture Survey Responses

Prior to reviewing NAWMP Population Objectives we wanted to know more about whether and how NAWMP Habitat Joint Ventures are currently using continental population objectives. In May/June 2023, we conducted a survey of JV science coordinators or planning leaders and had responses from 14 of them comprising Prairie Habitat, Prairie Pothole, San Francisco Bay, Gulf Coast, Sonoran, Rainwater Basin, Lower Mississippi Valley, Central Valley, Pacific Birds, Canadian Intermountain, Northern Great Plains, East Gulf Coastal Plain, Intermountain West, and Playa Lakes.

For 9 of 14, their JV Implementation Plan was built on some kind of formal linkage to NAWMP continental population objectives. Methods followed in doing this included:

- Fleming et al. 1
- Fleming et al. plus other 4
- Desired characteristics of JV Plans 1
- Koneff et al. 2
- NONE yet 1
- Other methods 2
- N/A mainly breeding JV 3

For the 5 that did not, their reasons for that decision included:

- Needed to add Mottled Duck objectives to winter objectives (GCJV).
- JV Strategic plan focuses on resilient grasslands (NGPJV).
- Lacked data for the "historical baseline" approach (2 JVs)
- Felt that Playas were more important to migrating and wintering waterfowl than the Fleming et al. models suggested.

Regarding use of the 80th percentile dual objective as recommended in 2014 and 2018, only 4 of 14 JVs had done so. Following are their responses and comments:

- YES (4)
    - Listed LTA and Aspirational Objectives, but their ambitious Habitat Goals do not seem to be derived from these (SFBJV).
    - Primary basis for habitat objective setting; LTA seemed insufficient (GCJV).
    - Yes, as all but one species have been at 80th percentile recently (NGPJV)
    - PLJV judged the LTA goals inadequate so adopted the 80th percentile instead.
- NO (6)
    - Assumed LTA will incorporate the variance previously observed (PPJV and PHJV)
    - Not yet; lack reliable long-term data to assess (2).
    - Our current plan pre-dates this objective.

- No, but helpful to recognize long-term variation and dynamics of the system.
- No, modeled both but decided to stick with LTA. The more ambitious objectives were seen as prohibitively expensive, unlikely to be met, and designed for a very low probability event. (CVHJV)
- Uncertain; pending study or next JV update (4)

We were also told by a few JVs that dual objectives seemed unnecessary and confusing. More guidance is needed or just use one.

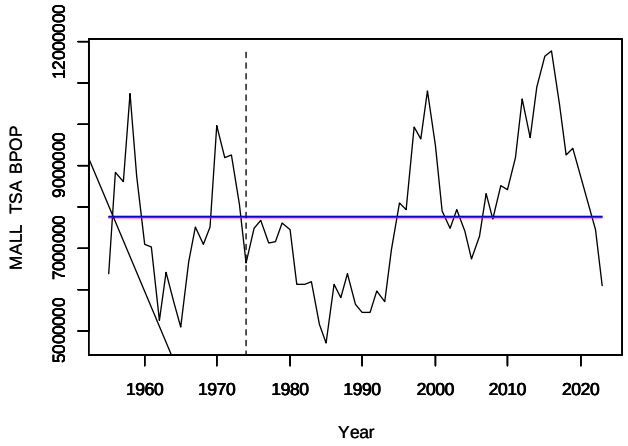
Three of the responding JVs used species' prioritization rankings first offered in the 2004 Implementation Framework; 7 did not, 4 superseded those recommendations regionally by blending them with priorities for other birds. Several JVs instead used energetic models adjusted for body size. Four JVs thought that updating these species rankings might have value for their JV; five others thought not; 5 more thought maybe with added guidance on how to use such rankings in implementation planning.

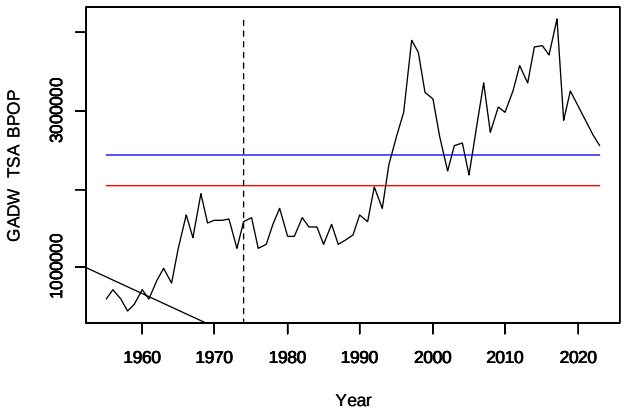
Reported frequencies of revising Implementation Plans varied widely: Three did so at 5-year intervals; 1 at 5–10 years; 5 at 10 years; 1 at 15 years; and 4 infrequently at no fixed time.

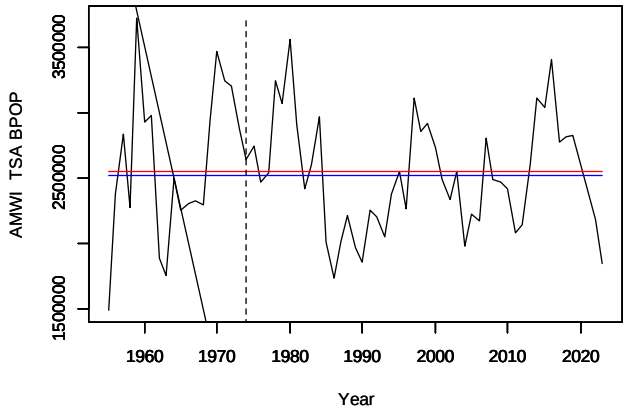
The current approach of setting and revising NAWMP objectives was generally supported though some preferred single vs. dual objectives. Several opined that infrequent change in continental objectives would be helpful. Not more often than 10 years and longer would be better. Some remain concerned about data limitations in their JV regions.

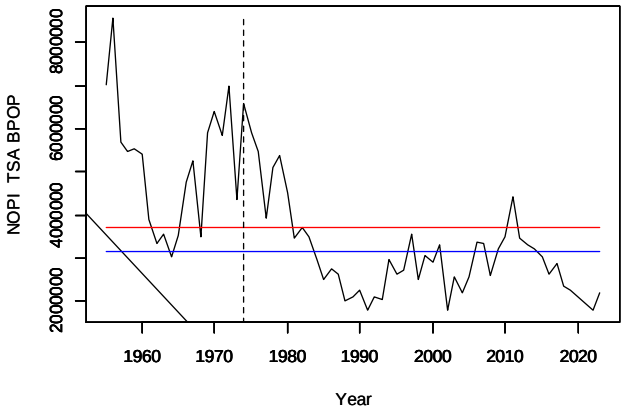
APPENDIX B: Change in TSA LTA with revision to start date from 1955 to 1974.

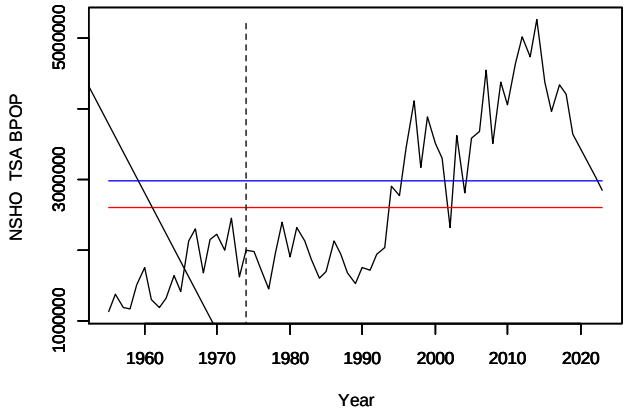
In the plots below, the TSA population estimate is shown from 1955 to 2023 in black. The vertical dashed line delineates the revised start date (1974). The horizontal red line is the LTA based on the entire 1955–2023 time series; the horizontal blue line is the LTA based on the revised 1974-2023 time series. Note: for mallards, the 1955–2023 LTA (7,734,691) is too close to distinguish from the 1974–2023 LTA (7,772,514) on this plot.

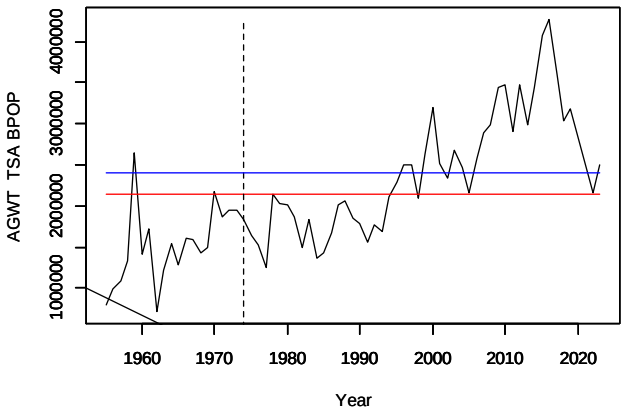









NSHO TSA BPOP
1000000
3000000
5000000
1960
1970
1980
1990
2000
2010
2020
Year


AGWT TSA BPOP
1000000
2000000
3000000
4000000
1960
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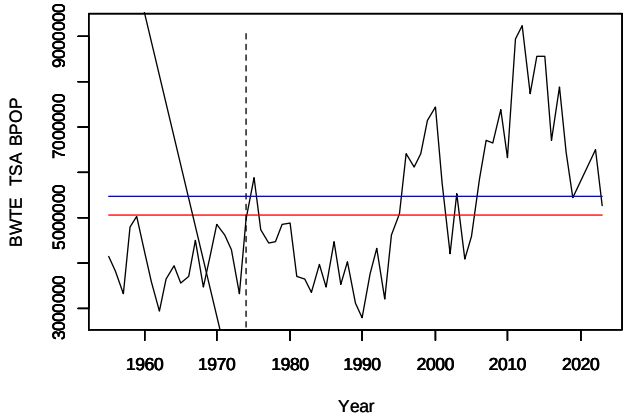
2000
2010
2020
Year


BWTE TSA BPOP
3000000
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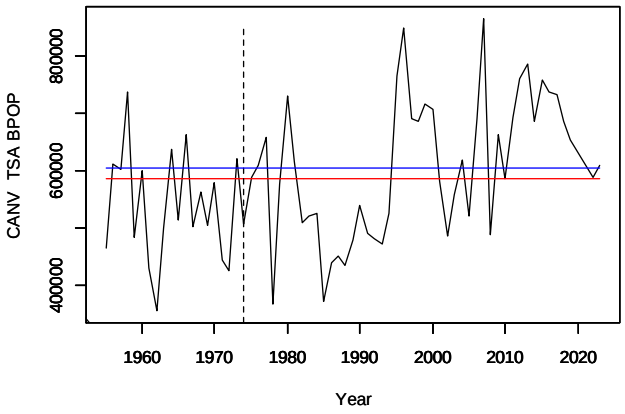
CANV TSA BPOP
400000
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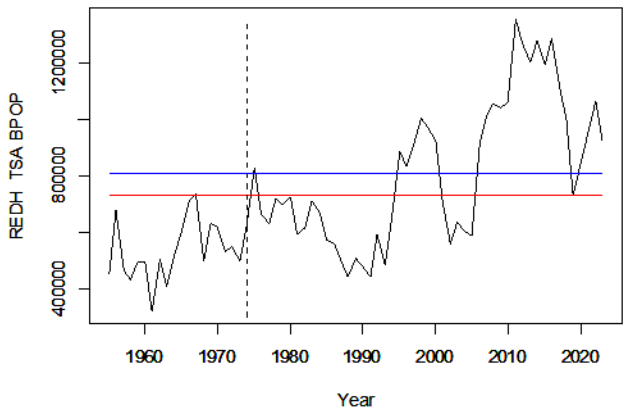
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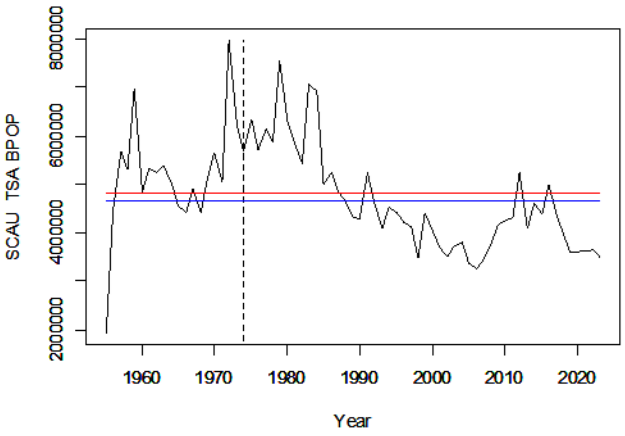
SCAU TSA BPOP
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4000000
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8000000
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2000
2010
2020
Year

APPENDIX C: Sea Duck Joint Venture Continental Technical Team Sea Duck Information Update

Species, stock	Obj	Popn Size	Source	Proposed Action	Research Results
HARD, east	3000	4,000	winter survey	Update number: Canadian winter population 6100 (Gutowski et al 2022, recent surveys in QC, St.Pierre-et-Miquelon); US winter population unknown, C LePage expert opinion is 2000. Highlight need for US wintering popn estimate. CTT thinks new estimate may be available in 2 yrs. Objective needs to be reconsidered next NAWMP, as new information suggests larger population could be supported.	COSEWIC 2013: The eastern North American wintering population has declined from historical estimates of 5000 - 10,000 to fewer than 1500 individuals. Numbers appear to be increasing in North America over the last ten years to an estimated 3700 individuals, but still less than 2000 Harlequin Ducks spend the winter in eastern Canada. Gutowsky et al 2022: Using localized annual rates of mean population change from CBC data to project counts from dedicated surveys, we suggest wintering areas in the provinces of NL, NS, and NB may currently be supporting a combined total of 5682 birds (95% CI 5065-6354) in 2022, well exceeding the recovery target of 3000 individuals listed in the 2007 management plan. 2K in the US (winter) would be a minimum estimate (Gilliland pers com) and was based on expert opinion (Christine LePage - # of wintering birds in St Pierre/Michelon and eastern US states). From Glen Mittlehauser, Maine Nat History Observatory: no reliable pop surveys since 2008 Waterbirds pub. Based on scattered surveys he's done, he thinks they likely have a similar population size as was reported in 2008. Greenland numbers are not solid. Need follow-up with Greenland scientists to see if they have something recent. Objective of 3000 comes from: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/management-plans/harlequin-duck-eastern-proposed-2007.html
HARD, west		250,000	winter survey	Cut popn size estimate	
LTDU		1,000,000		Cut popn size estimate	
KIEI, east		200,000	winter survey	OK, cite Greenland survey	Greenland winter survey - should be pretty accurate according to Scott Gilliland
KIEI, west		400,000	migration count	Keep. Cite Point Barrow survey and indicate this is an "index." https://link.springer.com/article/10.1007/s00300-019-02581-6	This number may be based on the Point Barrow counts. While those may provide some useful info for trends (maybe??), would not use them for abundance estimates. No reliable estimate, remove estimate from table.

COEI, A	165K pair	250,000	~~winter survey~~	Revise estimate to 105,000 pairs, expert opinion. Cite recent workshop report. https://link.springer.com/article/10.1007/s42532-021-00083-6	250K is the US wintering population estimate from the Atlantic Coast Winter survey 2008-11; From Scott Gilliland: We are working on a summary document for dresseri and we put together a minimum modelled estimate based on the number of birds detected in the CBCs in the USA and the winter eider surveys in Canada. Here is the section that report the results of the CBC/winter survey estimates: "In the U.S., simulations estimated that between c. 87,000 and 374,000 common eider were present across 70 circles with a mean total count of 228,644 (Figure 1). In Canada, 61,443 common eider were counted in surveyed areas (with counts from northern regions of subspecies overlap adjusted to dresseri, Figure S1). Range-wide, we estimate contemporary abundance of common eider within surveyed areas to be c. 290,000 birds, ranging between c. 148,000 and 435,000. High variability in CBC counts in MA between 2016-2020 led to high variability in range-wide estimates. "Gutowsky et al. draft report"
COEI, N	400000	260,000	eCA winter	Remove Objective. Keep 260K as CA wintering, revise next NAWMP. Add Greenland Popn size 500K on another line with citations (see column F).	Greenland Institute of Natural Resources says 500,000 in winter (https://natur.gl/arter/common-eider/?lang=en) in 2017. Merkel F.R., Mosbech A., Boertmann D. & Grøndahl L. 2002. Winter seabird distribution and abundance off south-western Greenland, 1999. Polar Research 21, 17–36, doi: 10.1111/j.1751-8369.2002.tb00064.x. Merkel F. R., Lambert Johansen K., Due Nielsen R., Petersen I. K., Sterup J., & Mosbech A. (2019). Wintering seabirds in south-west Greenland, 2017. Polar Research, 38. https://doi.org/10.33265/polar.v38.3462
COEI, HB	275000	260,000	winter survey	Popn size OK cite Gilliland unpublished data. Objective should be reconsidered next NAWMP.	This is from unpublished winter survey conducted in 2006 (Gilliland, unpublished data)
COEI, P		150,000	misc data compilation + expert opinion	OK, add citations, expert opinion	Estimate derived from a compilation of data from different regions (U.S. Fish and Wildlife Service. 2006. Action plan for Pacific common eider. Unpublished report. U.S. Fish and Wildlife Service, Anchorage, Alaska, USA) Estimate seems ok although some expert opinion used for unsurveyed areas
STEI	Recovery	1,000	breeding survey	Change breeding to 500. US breeding population: combination of foot sureys near Utqiagvik, aerial survey in Barrow Triangle, ACP survey. Indicate winter 50K, cite recovery plan.	Citation: U.S. Fish and Wildlife Service. 2019. Species Status Assessment of the Alaska-breeding Population of Steller's Eiders. Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. 149p. https://ecos.fws.gov/ServCat/DownloadFile/163633

SPEI	Recovery	20,000	breeding survey	OK, breeding estimate from: ACP survey, YKD coastal zone survey, YKD nest plot. Add note on wintering population. Cite recovery plan: Global population of spectacled eiders, including breeding populations from Alaska and Russia, winter in the northern Bering Sea south of St. Lawrence Island. Results from aerial winter survey in March 2023 are not yet available, but based on previous surveys conducted in 2009 and 2010, the global population is likely around 300,000 individuals.	Citation winter population: U.S. Fish and Wildlife Service. 2021. Species Status Assessment of Spectacled Eiders. Fairbanks Fish and Wildlife Field Office, Fairbanks, Alaska. 150p. https://ecos.fws.gov/ServCat/DownloadFile/209520
BLSC, east		200,000	winter survey	OK, based on AWSD survey, cite report … NOTE: James/Hudson Bay Molting survey reports ~300K male BLSC, suggesting a much higher value, but not sure how this translates to total birds or breeding birds. Recommend revise number using this value and information on sex/age ratios from photo surveys in next update.	2012 Winter Survey Report: 211K as 3 yr avg, no visibility correction, US wintering popn, Avalon: 150K Molting survey reference: https://seaduckjv.org/wp-content/uploads/2014/11/SDJV-PR82-Badzinski-annrpt-FY13.pdf
BLSC, west		300,000	breeding survey	Update popn size to 220K.	No formal report for this survey. Suggest citing USFWS unpublished data. 2018 BLSC index (not adjusted for detection) in 80% of Alaskan breeding areas = 102,309. Use VCF from previous studies (Stehn and Platte 2012; unweighted avg detection rate of 0.594) = 172,237. Add the 20% not covered = 215,296. Does not include non-breeders. Citation should be USFWS unpublished data (no final report published by MBM).
SUSC, east		150,000	winter survey	Cite AWSD survey report.	Atlantic US wintering est, no detection correction, 3 yr mean: 150K, Avalon: 142K
SUSC, west				No reliable estimate	On the Pacific Coast, the wintering population is estimated at approximately 225,000 Surf Scoters, based on compilation of results from a variety of independent surveys (J. Hodges, unpublished). Wintering numbers were stable for Kodiak Island (1991-2005) and southern coastal British Columbia (1999-2011), but decreasing in Puget Sound (1999-2013) and San Francisco Bay (1981-2012) (Crewe et al. 2012; Richmond et al. 2014; Bowman et al. 2015). The number of Surf Scoters detected on Alaska breeding surveys appears to have declined from 1993-2012 (Bowman et al. 2015). No idea where the NAWMP number comes from. There are no reliable sources of info at continental level. The number may come from the Koneff 2017 paper: Western SUSC Koneff et al 2017: 413687 (211809, 888205); Eastern SUSC: 387514 (150571,890743)? Cut this population size estimate - we don't have data to support it.

WWSC, east		60,000	winter survey	Cite AWSD survey report.	Atlantic Coast Wintering survey (US wintering est, no correction, 3 yr mean: 60K, Avalon too far south)
WWSC, west				No reliable estimate	No idea where original WWSC number comes from and don't know of any source of info that would provide continental pop estimates.
GOLD		1,239,000	TSA + ESA	LTA as objective, rename to COGO. Recommend	
COGO				Remove, note GOLD is mostly COGO given WBPHS coverage	
BAGO, east	7500	8,500	winter survey	Ok, revised next time	Derived from easter winter surveys - reference is CWS population status report or C LePage (personal communication). Preliminary results suggest popn size to 11,500 based on 2020 CWS-QC winter survey, but C LePage recommends leaving for now and updating after she completes analyses during winter 23-24 (note: 2012-22 avg EWS-QC breeding population is 5700 pairs).
BAGO, west		260,000		Cut popn size estimate, anlayze exisiting data to produce estimate for next revision	This estimate is derived from Rothe, T. C., P. I. Padding, L. C. Naves, and G. J. Robertson. 2015. Harvest of sea ducks in North America: A Contemporary Summary. In J.-P.L. Savard, D.V. Derksen, D. Esler and J.M. Eadie (editors). Ecology and conservation of North American sea ducks. Studies in Avian Biology (in press), CRC Press, New York, NY P. 441 in that chapter: based on expanded coverage of winter waterfowl surveys in Alaska (Hodges et al. 2008 and some unpublished USFWS data): "collectively, winter surveys indicate that there may be 250,000-300,000 Barrow's Goldeneyes in the western population from Alaska to California." Status and Trends chapter ofthe same book (Bowman et al. 2015) doesn't give a pop estimate and says " no range-wide surveys provide estimates of population size or long-term trends..." (p.21) Consensus: we don't have a population estimate for wBAGO.
BUFF		1,306,000	TSA	Update to current WBPHS total, use LTA for	
MERG		1,331,000	TSA + ESA	Update to current WBPHS total, as with GOLD, recommend analysis to provide species specific; ~~use LTA for objective~~	
HOME					

APPENDIX D: NAWMP 2023 Species Prioritization Tables (Roberts et al. 2023)

Species/Population	Plan objective	Population trend/size	Threat breeding	Threat nonbreeding	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

APPENDIX D (continued).

Duck Species	Listed species	Combined score for goal				
		Social	Habitat	Population	Total	Rank
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	3	3	7	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

Appendix E: Progress Assessment Questionnaire and Interviews

Joint Venture	Waterfowl Habitat Geographic Prioritization	Integration of People Goals	Quantified Habitat Objectives	Habitat Objective Integration with NAWMP Population Objectives	Year of NAWMP Population Objective	Habitat Objective Integration with NAWMP People Objectives	Habitat Objective Attained[1]	NAWMP Population Goal Supported[1]
Atlantic Coast	Y	N	Y	Y	2014-18	N	UNK	UNK
Appalachian Mountains	N	N	N	N	NA	N	NA	NA
Central Hardwoods	N	N	Y	Y	2014-18	N	100%	100%
Canadian Intermountain	Y	N	Y	N	NA	N	UNK[6]	NA
Central Valley Habitat	Y	N	Y	Y	2014-18	N	88%	NA[6]
East Gulf Coastal Plain	N	N	N	N	NA	N	NA	NA
Eastern Habitat	Y	Y	Y	N	NA	N	UNK	UNK
Gulf Coast	Y	N	Y	Y	2014-18	N	92%	93%
Intermountain West	Y	N	Y	Y	2004-12	N	100%[2]	100%[2]
Lower Mississippi Valley	Y	N	Y	Y	2004-12	N	76%[3]	76%[3]
Northern Great Plains	Y	N	N	N	NA	N	NA	NA
Oaks and Prairies	N	N	N	N	NA	N	NA	NA
Pacific Birds Habitat	Y	N	Y[4]	N	NA	N	UNK[6]	UNK
Prairie Habitat	Y	N	Y	Y	2014-18	N	26%	97%
Prairie Habitat-Boreal	Y	N	Y	Y	2014-18	N	18%	~100%
Playa Lakes	Y	Y[5]	Y	Y	2014-18	N	79%[5]	79%[5]
Prairie Pothole	Y	N	Y	N	NA	N	40%	NA
Rainwater Basin	Y	N	Y	Y	2004-12	N	59%	45%
Rio Grande	N	N	N	N	NA	N	NA	NA
San Francisco Bay	Y	N	Y	N	NA	N	UNK	UNK
Sonoran	Y	Y	N	N	NA	N	NA	NA
Up. Mis. River / Great Lakes	Y	Y	Y	Y	2014-18	N	UNK	UNK
Affirmative/Total	**17/22**	**4/22**	**16/22**	**11/22**	**NA**	**0/22**	**NA**	**8/22**

NA = Not applicable

UNK = Unknown

[1] Proportions capped at 100%

[2] Data available only for SONEC portion of IWJV

[3] Data available only for the MAV portion of the LMVJV

[4] Canadian portion only of the PBHJV

[5] Goal is to meet as many waterfowl objective DEDs as possible on 200,245 acres of playas over the aquifer to meet integrated waterfowl and people-related aquifer recharge objectives

[6] Data not readily available

From August through October, 2023, we queried Coordinators of all 22 Migratory Bird Habitat JVs (JVs) for information about their JVs waterfowl habitat planning, integration, and assessments. These queries were initiated with distribution of a sample version of Table 1, along with detailed guidance to inform its completion. Anticipating a prevalence of nuanced responses, we also conducted MS Teams call interviews with staff of all but 2 JVs, to ensure our intentions and their responses were mutually understood by interviewees and interviewers. As further checks on consistency, one Habitat Team member participated in every interview, all interviews included at least one other Team member, and the NAWMP Coordinator participated in many interviews.

All JVs returned a completed questionnaire, and responses are summarized in Table 1. The vast majority of JVs employ some degree of waterfowl habitat geographic prioritization, but the rigor, spatial resolution, utility, and intended use vary widely. These range from treatment-specific spatially explicit decision-support tools across all or most of some JVs, to simply identifying the wetland habitat base within all or a portion of a given JV, to simply excluding relatively small ecoregions of a JV that do not contain important wetlands. The only JVs without any semblance of waterfowl habitat geographic prioritization are those that were established primarily for their continental significance to landbirds.

Only 4 JVs with geographic habitat prioritizations do so with explicit incorporation of people priorities, though many more implicitly consider impacts to people or otherwise incorporate human dimensions in planning and/or habitat delivery. No JV has explicitly incorporated people into their quantified habitat objective for waterfowl. Taken together, these facts suggest that JVs have not broadly incorporated people as fundamental objectives, but rather employ human dimensions in the context of means objectives toward fundamental biological objectives.

The vast majority of JVs have quantified waterfowl habitat objectives for all or a portion of their geography, and where such planning is available for only a portion of a JV, that portion is typically the most relevant to waterfowl. Only half of JVs explicitly link their waterfowl habitat objectives with NAWMP population objectives. The remainder of those with habitat objectives are either linked to waterfowl population objectives not taken from NAWMP (n=1) or based on assessments of historic habitat conditions, opportunity, and/or feasibility. For JVs that link their habitat objectives to NAWMP population objectives, all but 3 have used the most contemporary NAWMP population objectives

available, and at least 1 of those is on the cusp of a planning update that would use the more contemporary NAWMP population objectives.

Half of JVs measure progress toward their waterfowl habitat objective and can produce a measure of that progress, at least for a portion of their JV, and degree of progress varies markedly. Eight JVs can provide a measure of progress, for at least a portion of their JV, consistent with the Plan Committee's new habitat metric – "proportion of stepped-down NAWMP population goal that is currently supported by the JV landscape."

APPENDIX F: From 2018 Plan

2.3 People

The 2012 Revision differed from previous plans in its visionary articulation of a third goal: to expand the numbers of waterfowl hunters, other conservationists and citizens who enjoy and actively support waterfowl and wetlands conservation. To achieve this goal, the 2014 Addendum established the following objective:

"Increase waterfowl conservation support among various constituencies to at least the levels experienced during the last two decades"

The 2014 Addendum distributed this objective among three constituent groups:

- active waterfowl hunters;
- North American citizens who appreciate and take action to support wetlands and waterfowl conservation; and
- landowners participating in habitat conservation programs.

The 2014 Addendum identified initial quantifiable objectives for these groups because these metrics exist and can
be tracked over time. These objectives are based on:

- the average number of hunters in the U.S. and Canada from 1999 to 2013 (1.2 million and 178,000, respectively);
- the average number of waterfowl viewers traveling more than 1 mile from home from 1996 to 2011 (14.4 million;
  comparable data not available for Canada or Mexico) or out of state (4.6 million);
- the number of birdwatchers in Canada (4.7 million; 18% of the population), and
- the 1999–2013 sales of Migratory Bird Hunting and Conservation Stamp (commonly referred to as the Federal Duck Stamp) in the U.S. (1.6 million; $23.5 million revenue) and Migratory Game Bird Hunting Permits in Canada (~178,000; $3.2 million revenue).

Objectives for increasing the populations of constituent groups have been established based on national trends in participation. However, refined objectives will better account for the diversity that exists in state, provincial, and regional trends in participation— especially participating landowners. This will require developing a common framework for use by states, provinces and/or JVs to establish participation objectives that make the most sense for the implementation area. More work remains to understand the connections between management decisions related to birds, habitat, and people's support of waterfowl conservation.

As a first step, the Human Dimensions Working Group (HDWG) coordinated surveys in 2017 to better understand the motivations and behaviors of constituency groups related to waterfowl and wetland conservation (hereafter, NAWMP Stakeholder Surveys). These surveys provide information from hunters and birdwatchers in the U.S. and Canada, and from the general public in the U.S. Similar general public survey information is available in Canada from the 2012 Canadian Nature Survey (Federal, Provincial, and Territorial Governments of Canada 2014). The

results of these surveys are being finalized; initial findings and next steps are provided in section 3 and 4.

APPENDIX G: Papers and Presentations Using Hunter, Birdwatcher, and Public Survey Results

Wilkins, E.J., Miller, H.M., and Schuster, Rudy, 2017, Results of a U.S. General Public Survey to Inform the 2018 North American Waterfowl Management Plan Update (2017): U.S. Geological Survey data release, https://doi.org/10.5066/F7G15ZQ6

Wilkins, E.J., and Miller, H.M., 2018, Public views of wetlands and waterfowl conservation in the United States—Results of a survey to inform the 2018 update of the North American Waterfowl Management Plan: U.S. Geological Survey Open-File Report 2017–1148, 134 p., https://doi.org/10.3133/ofr20171148

Wilkins, E.J., Sinclair, W., Miller, H.M., Schuster, R.M. 2018, Does Proximity to Wetlands Matter? A Landscape-Level Analysis of the Influence of Local Wetlands on the Public's Concern for Ecosystem Services and Conservation Involvement. Wetlands https://doi.org/10.1007/s13157-018-1076-8

Wilkins E.J., Miller H.M., Tilak E., Schuster R.M. (2018) Communicating information on nature related topics: Preferred information channels and trust in sources. PLoS ONE 13(12): e0209013. https://doi.org/10.1371/journal.pone.0209013

Wilkins E.J., Cole, N.W., Miller, H.M., Schuster R.M., Dayer, A.A., Duberstein, J.N., Fulton, D.C., Harshaw, H.W., Raedeke, A.H. (2019) Rural-urban differences in hunting and birdwatching attitudes and participation intent. Human Dimensions of Wildlife. 24(6). https://doi.org/10.1080/10871209.2019.1661046

Rutter, J. D., Dayer, A.A., Harshaw, H.W., Cole N.W., Duberstein, J.N., Fulton, D.C., Raedeke, A.H., Schuster R.M. (2021) Racial, Ethnic, and Social Patterns in the Recreation Specialization of Birdwatchers: An Analysis of United States EBird Registrants. Journal of Outdoor Recreation and Tourism. 10.1016/j.jort.2021.100400

Harshaw, H.W., Cole N.W., Dayer, A.A., Rutter, J. D., Fulton, D.C., Raedeke, A.H., Schuster R.M., Duberstein, J.N. (2021) Testing a continuous measure of recreation specialization among birdwatchers. Human Dimensions of Wildlife. 10.1080/10871209.2020.1843741

Rosenblatt, C.J., A.A. Dayer, J.N. Duberstein, T.B. Phillips, H.W. Harshaw, D.C. Fulton, N.Cole, A.H. Raedeke, J.D. Rutter, C.L. Wood. (2022) Highly specialized recreationists contribute the most to the citizen science project eBird. Ornithological Applications. 10.1093/ornithapp/duac008

Cole, N.W., Fulton, D.C. (2022) North American Waterfowl Management Plan Survey Regional Profile. U.S. Geological Survey Scientific Investigation Report. (pre-print)

Cole, N., Wilkins, E.J., Clements, K., Schuster, R.M., Dayer, A.A., Harshaw, H.W., Fulton, D.C., Duberstein, J.N., & Raedeke, A.H. (????) Perceived constraints to participating in wildlife-based recreation. Journal of Outdoor Recreation & Tourism. (Accepted November 3, 2023.)

Sainsbury, K.A., Harshaw, H.W., Fulton, D.C., Cole, N.W., Dayer, A.A., Duberstein, J.N., Raedeke, A.H., Schuster, R.M., Vrtiska, M.P. (in press) What waterfowl hunters want: exploring heterogeneity in hunting trip preferences. Wetlands. (Accepted September 28, 2023).

Presentations

Dayer, A., Wilkins, E., Miller, H., Schuster, R., Duberstein, J., Fulton, D., Harshaw, H., Raedeke, A. (2018, June 19). *Wetland conservation behaviors of hunters, wildlife viewers, anglers, and non-wildlife recreationists*. Presentation for the International Symposium of Society and Resource Management. Sandy, Utah.

Harshaw, H., Duberstein, J., Fulton, D., Miller, H., Dayer, A., Raedeke, A., & Schuster, R. (2018, June 19). *Influence of social networks and identity diversity of the conservation involvement of North American birdwatchers.* Presentation for the International Symposium of Society and Resource Management. Sandy, Utah.

Fulton, D., Harshaw, H., Miller, H., Raedeke, A., Schuster, R., Dayer, A., & Duberstein, J. (2018, June 19). *Using discrete choice experiments to understand trip preferences of birdwatchers and waterfowl hunters in the United States and Canada.* Presentation for the International Symposium of Society and Resource Management. Sandy, Utah.

Raedeke, A., Fulton, D., Harshaw, H., Miller, H., Schuster, R., Dayer, A., Duberstein, J., & Wilkins, E. (2018, June 19). *A coordinated, adaptive framework for birdwatcher and waterfowl hunter public engagement.* Presentation for the International Symposium of Society and Resource Management. Sandy, Utah.

Schuster, R., Wilkins, E., Miller, H., Fulton, D., Harshaw, H., Raedeke, A., Duberstein, J., & Dayer, A. (2018, June 19). *Communicating information on nature-related topics: Information channels and trust in sources preferred by the American public.* Presentation for the International Symposium of Society and Resource Management. Sandy, Utah.

Schuster, R., Wilkins, E., Miller, H., Fulton, D., Harshaw, H., Raedeke, A., Duberstein, J., & Dayer, A. (2018, June 19). *Communicating information on nature-related topics: Information channels and trust in sources preferred by the American public.* Presentation for the International Symposium of Society and Resource Management. Sandy, Utah.

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APPENDIX H: Potential Human Dimensions / Goal 3 Performance Metrics

Impact	Metric	Baseline Data	Data Collection	Timeframe	Needs
1. Various Constituencies actively support waterfowl and wetland conservation.	Membership (% or #) in conservation groups	S1: (Q30);S2: (Q14); S3: (Q9); S4: (Q34); S5: (Q14); S6: (Q25, Q26)	Future survey work (national, regional, state/provincial/territorial, partner surveys)	≥2 yrs	Future survey work to evaluate change from baseline; no periodic survey in Canada; no consistent way of measuring or providing baseline data for Canada or the Provinces; inconsistent ability to report across levels of government; regular funding for long-term monitoring; Canadian National Surveys need to be bilingual
	Level of involvement in conservation groups	S1: (Q31); S2: (Q15); S3: (Q9); S4: (Q37, Q38); S5: (Q15); S6: (Q26)			
	% engaged in supporting conservation policies	S1: (Q35); S2: (Q21); S3: (Q10); S5: (Q15); S6: (Q31)			
	Amount ($) of contributed to wetland conservation	S1:(Q33, Q34); S2: (Q17); S4: (Q35); S5: (Q17); S6: (Q30)			
	# contributing $ to wetland conservation	S1: (Q33, Q34): S2: (Q17, Q18); S3: (Q9); S4: (Q35);S5: (Q17, Q18, Q19); S6: (Q28)			
	Level of concern for loss of wetland benefits	S1: (Q38, Q39); S2: (Q24, Q25); S3: (Q16, Q17); S5: (Q24, Q25); S6: (Q34, Q35)			
	Level of trust in conservation agencies and organizations	S1: (Q32); S2: (Q16); S3: (Q12); S5: (Q16); S6: (Q27)			
2. Landowners actively conserve wetlands	# of state/federal duck stamps sold	Administrative Data	Agreement of partners to collect and share program participant data	≤2 yrs with development	Establish data sharing agreements; work through availability and feasibility of reporting across countries; inconsistencies in data formats
	# of Indigenous communities engaged in wetland and waterfowl conservation partnerships	Administrative Data			
	Participation in partner-led conservation programs	Administrative Data			
	Landowner participation in programs (e.g., Farm Bill programs, Partners for Fish and Wildlife, state-specific programs, etc.	Administrative Data			

S1 = U.S. Waterfowl Hunter Survey; S2 = U.S. Birdwatcher Survey; S3 = U.S. General Public Survey; S4 = Canadian Nature Survey; S5 = Canadian Birdwatcher Survey; S6 = Canadian Hunter Survey

Impact	Metric	Baseline Data	Data Collection	Timeframe	Needs
Various constituencies participate in waterfowl and/or wetland-related recreation	# of waterfowl hunters	Inconsistent availability of administrative or survey data	Future survey work (national, regional, state, provincial, territorial, partner surveys); Administrative data	≥2 yrs	No periodic survey in Canada; inconsistent ability to report across levels of government; ability to determine purpose for purchasing duck stamps
	# of birdwatchers targeting wetland areas	Currently no consistent way of measuring	Explore possibility of working with eBird or other sources to look at # of wetland hotspots and # of people visiting those sites		
	# of first-time participants		Work with broader R3 community to define consistent definitions and methods for data collection	≥2 yrs with development	Develop consistent definition and method for tracking
	# of reactivated participants				
	Participant demographics	U.S. Waterfowl Hunter Survey; U.S. Birdwatcher Survey; U.S. Public Survey; Canadian Nature Survey; Canadian Birdwatcher Survey; Canadian Hunter Survey	Survey data; Administrative data	≤2 yrs with development	No periodic survey in Canada; inconsistent ability to report across levels of government
NAWMP partners use social science to inform decision-making	# of policies, programs, frameworks, regulatory decision-making processes, or decision support tools explicitly informed by NAWMP survey data or other social science data sources		Agreement of partners to collect and share program participant data	≤2 yrs with development	Establish data sharing agreements; work through availability/ feasibility of reporting across levels of government; inconsistencies in data formats
	# of decisions/policies aligned with NAWMP goals		Agreement of partners to collect and share data	≤2 yrs	method for compiling and sharing data
	# of NAWMP partners and other wetland/waterfowl stakeholder organizations invited to actively engage in decision-making processes.		Agreement of partners to collect and share data	≤2 yrs with development	method for compiling and sharing data; shared understanding of spectrum of engagement

APPENDIX I: Consolidated List of Recommendations

Population Recommendations

- We propose adjustment to the LTA duck objectives for the WBPHS TSA. A careful analysis of the changing survey design and protocols during the earliest years of the WBPHS TSA concluded that the 1974–2023 time series may be more appropriate for determining LTA objectives.
- We propose to include birds from an expanded region beyond the Eastern Core Survey Area.
- We recommend using a sex ratio of 1.0 (i.e., all 'unknown' pairs are treated as a male–female pair) to estimate pairnumbers, similar to how breeding pair data are analyzed under the black duck adaptive harvest management framework for estimating population size in Eastern North America. For these select duck species in the ESA, the time period 1998–2023 was used to calculate the LTA and 80th percentile objectives.
- To ensure that NAWMP population objectives remain relevant and useful for setting habitat objectives and gauging conservation success, we recommend a reconsideration, between now and the next Plan Update, of how these objectives are formulated
- We urge the Plan Committee to ask the NSST, who are well suited and have the technical capacity to do this work, to form a working group to (1) consider the utility of the current scale of NAWMP objectives for conservation planning, (2) assess the capacity of current monitoring frameworks to provide information needed by the JVs for effective objective setting, and identify gaps that should be filled (e.g. Great Lakes States, Pacific Flyway provinces and states, far eastern Quebec); and (3) undertake the analytical work, if necessary, to derive new population objectives that are useful at local geographies, but that can be integrated to the continental scale.
- We recommend that conservation planners not view population or habitat objectives as static values to be achieved annually, but rather regard them as the desirable long-term product of the variation inherent in natural systems plus JV management actions.
- Continue currently operational surveys, including: WBPHS, Central Arctic Canada Pacific Common Eider Breeding Survey, Parts Collection Survey, Puget Sound Assessment and Monitoring Program, Arctic Coastal Plain Survey, and Quebec/Newfoundland Common Eider Winter Survey.
- Apply the results of CWS's experimental scoter survey work to improve the current WBPHS survey for late-nesting sea ducks through design revisions or augmentation.
  Continue the Pacific black scoter Breeding Survey, last conducted in 2018. This is one of the few situations where it is logistically feasible to estimate the breeding population size of a sea duck, as the survey covers a large portion of the breeding area for PBLSC (~80%) and is timed appropriately. This information may be of interest to the Alaska Native communities, as these scoters are an important subsistence harvest species in Alaska and could contribute to the development of a management plan. Efforts to estimate detection on this survey have been variable, so revisiting the survey design prior to repeating the survey would be necessary but achievable.

- Update the NAWMP Western Gulf Coast mottled duck population objective with WGCMDBPS based objective of 212,000 individuals. Future NAWMP updates should consider revising the population objective based on information from surveys in the Texas Brush Country should additional information become available.
- There is some indication of unaccounted for error and/or bias in the ESA survey data for mergansers and goldeneyes. Because individual species are not identified during the WBPHS, there are insufficient data for determining species/population objectives. It may be possible to improve these estimates by analyzing/modeling the sources of uncertainty in the existing WBPHS ESA data.
- Inclusion of surveyed areas beyond the TSA deserves further consideration. This has already been done for the ESA with added utility for both JV habitat conservation planning and harvest management. Once that is accomplished a more routine pattern of reviewing objectives may be preferable.
- We urge that the NAWMP Plan Committee commission a routine review of population objectives every 10 years.
- We recommend that the NAWMP Habitat JVs embrace Fleming et al. (2019) as the preferred approach for stepping down continental duck population objectives to regional scales, especially JVs supporting nonbreeding waterfowl populations.
- We suggest that an evaluation of the status and future roles might be timely for both the Pintail Action Group and Scaup ActionTeam .
- Strong communication and collaboration among all the Species and Habitat JVs remain important priorities.

<u>Habitat Recommendations</u>

- Provide support and guidance to ensure objectives articulated in JV Implementation Plans are linked to NAWMP goals
- Provide support and guidance to JVs to ensure that geographic prioritization is articulated at spatial scales adequate to inform partner actions
- Develop ability to assess progress toward habitat objectives
- The Plan Committee continue to promote information sharing among JVs relative to planning, evaluation, and science, such that the best methods and processes become widely adopted, while also encouraging continual advancement on these fronts.
- The Plan Committee reiterate its expectation that JVs be able to populate the PC's new metric of "proportion of the stepped down NAWMP population objective supported by the JV landscape."
- Continue to track rapidly advancing climate science and incorporate it into planning as appropriate

- Ensure wetland protection policies remain in place/are established to maximize system resiliency
- Continue to evaluate and integrate waterfowl habitat conservation with natural climate solution strategies and agricultural-based climate adaption strategies
- Develop strategies to address human dimension challenges (including hunting-related funding) from waterfowl distributional changes related to climate and land use change.

<u>People Recommendations:</u>

- Clarify the nature of NAWMP people goals as both fundamental and means
- Provide guidance and support for habitat planning that incorporates fundamental NAWMP people goals
- Provide guidance and support for JVs to integrate habitat planning with people goals and metrics, including processes for weighting potentially competing criteria
- Baseline and Trend Information about Hunters, Birdwatchers, and Conservation Supporters:
    - The NAWMP Update Steering Committee should discuss and incorporate updated objectives for Goal 3 of the NAWMP and or how the objectives currently serve us, considering what we've learned since 2012. Should what we are measuring for the people goal still be the # of participants/supporters? Can we think about new objectives that might be more effectively linked to how we think about people in NAWMP now – beyond hunters and birdwatchers?
    - The NAWMP Committee should secure professional and financial resources to repeat the hunter, birdwatcher, and public surveys that were done in 2015-2016. Such surveys may provide one of the few metrics in measuring NAWMP Human Dimensions objectives or identifying trends at a national scale. To achieve this end, a strategy should be developed, and a clear process defined for how to repeat these surveys, and the frequency to repeat.[4]
- Discussion is warranted to identify what the NAWMP community needs to know, and from which supporters or potential supporters. A well-planned strategy for the surveys would help bring clarity to the survey targets, questions, etc. For example, we would benefit from an understanding of how well-existing partners and supporters, or prospective partners and supporters, understand the importance of wetlands to quality-of-life issues - water quality and quantity, clean air, flood attenuation, waterfowl, bird, or other wildlife/fish habitat and populations, etc. An iterative survey is the approach NAWMP has taken to improve habitat management alternatives and would help track how general attitudes may be changing through time. Managerial inferences will be much stronger if these are designed to measure the change in response to specific actions taken by the NAWMP community in an adaptive framework (i.e., "Based on previous surveys we predict that if we take action ‘A’, the response by the target audience ‘T’ will be ‘R’. Then take action ‘A’, monitor response ‘R’ and adapt predictions).

[4] It may be advantageous to repeat the NAWMP surveys within a reasonable time of the CSU America’s Wildlife Values Survey (likely in 2026) however, caution should be exercised to avoid overlap, depending on the approach taken for respondent recruitment for the public survey.

- A comprehensive review of the legal and regulatory mechanisms for the conservation of wetlands across the Canadian prairies was developed and distributed among PHJV partners; Farnese, 2023. In Canada, recent studies have identified wetland visitation habits among the public, bird habitat values orientations, pro-environmental behaviors, willingness to donate to NAWMP, and conservation preferences. A systematic review on landowner engagement in wetland conservation practices is currently in progress in Canada and a more comprehensive landowner survey will be conducted in 2024. A more comprehensive landowner survey—perhaps at the JV—in the US would be beneficial. Some data on landowner behaviors may be identified via the above-noted literature review or it may be available from the Natural Resource Conservation Service, the National Agriculture Statistical Survey, or other sources. However, a focused and consistent approach for sharing the resultant information should also be designed to meet the end user needs (i.e., JVs and NGOs delivering private lands programs).

- Identification of Needs and Barriers to Effectively Implement Programs:
  - The NAWMP Committee should undertake a human dimensions literature review(s) to identify the highest priority for future social science research needed to advance wetland and waterfowl conservation. The options include but are not limited to a systematic review that characterizes what has been done and what hasn't (e.g., identify particular research outcomes/information needed by NAWMP and then systematically review the literature to investigate whether this information is available and the degree to which this information is 'complete'). A second option could be a more focused literature review done with a specific purpose related to NAWMP (e.g., private landowner motivations to participate in wetland conservation, migratory bird hunter support of conservation, or segmenting the literature by landowners, birders, or other emphases). Such a literature review could take on deliberative elements to persuade and/or support a position/argument. Ultimately, both types of literature reviews may be needed; literature to make the case for the application of social science and why it is important (sort of normative), and a systematic review to identify what is known, and what the gaps are. Depending on the quality, extent, and diversity of approaches used, in the social science literature on waterfowl/wetlands conservation, there may be an opportunity to conduct a meta-analysis of studies. When designing a literature review, consideration should be given to the intended audience and how this information would be provided to end users, such as JVs (e.g., specific workshops, the North American Duck Symposium, or the annual meeting of The Wildlife Society.)
  - The NAWMP Committee should undertake a comprehensive gap analysis to determine the needs of JVs and key NAWMP partners to improve conservation delivery. JVs have called for additional resources, tools, and information (guidance and communication products) to be able to deliver more on-the-ground conservation. JVs have also asked for more guidance and resources on how to integrate social science into their planning and activities. This is especially important and urgent today given the large amount of conservation funding available from a multitude of sources.
  - There is a significant need to better understand what motivates people to participate in and/or support conservation, and a need to identify what the barriers are for them to participate in conservation. This needs to be addressed for both consumptive and non-consumptive users. Identification of the obstacles, challenges, information gaps, etc. would greatly improve the ability of the NAWMP community to grow support for wetland conservation. Removal of

barriers should be ground-truthed to know if removing barriers results in greater participation. Such an effort would help to inform the NAWMP community about how we could increase support for wetland/waterfowl conservation across the hunter community, birdwatchers, and current or prospective supporters.

- Evaluation of Program/Initiative Effectiveness:
    - The NAWMP community requires a means to measure the effectiveness of habitat initiatives delivered by the conservation community, and new NAWMP marketing activities that have been proposed. For example, NAWMP should be communicating to many different audiences about the importance of conservation and the impact of the NAWMP community's collective on-the-ground conservation. It would also be useful to know if our investment in social science initiatives is helping professionals and benefitting organizations involved in conservation delivery. Additionally, as new marketing initiatives are deployed, an evaluation strategy should be implemented to measure if the messages being communicated are changing attitudes and behaviors.
    - Assess NAWMP's current guidance on increasing participant (hunter and birdwatcher) numbers and consider updating guidance regarding NAWMP's role or niche in these efforts relative to other partners (i.e., states, provinces, NGOs,). However, NAWMP should retain a strong message of the importance of supporting recreation opportunities and involvement. Additionally, the NAWMP community should explore how recreationists and supporters (e.g., hunters, and birdwatchers), through NAWMP partnerships, can engage in advancing the concepts of multiple benefit conservation and how this broader set of benefits will help achieve the NAWMP goals.
- Financial Resources to Support Key NAWMP Initiatives:
    - Identification, development, and implementation of appropriate waterfowl and wetland conservation messages, programs, or campaigns intended to alter behaviors, attitudes, or opinions regarding waterfowl and wetland conservation (or wildlife conservation in general) and the natural benefits (i.e., EG&S) are required at the JV scale. Such messages, programs, or campaigns would hopefully assist or alter actions on important conservation policies that would benefit NAWMP objectives. Science-based messages can work to engage and increase our partners and supporters and result in an increased scale of conservation on the ground. Financial resources for the development of these conservation messages or initiatives and implementing the NAWMP Marketing Plan should be identified and secured immediately.
    - The need for well-trained professional staff to continue NAWMP efforts remains critical. New challenges have become evident in the gap between university graduate programs and employers of waterfowl professionals. At the foundation, a broader understanding is needed within the NAWMP community, and particularly among decision-makers, of the critical need for the training of the next generation of waterfowl and wetland scientists to ensure the long-term success and viability of NAWMP. This requires effective ways to promote training, recruiting, and hiring of an inclusively diverse group of North Americans working in waterfowl science and management programs. To address these needs, NAWMP should continue the NAWPEP effort through awareness, leadership, and support for coordinating and implementing its strategic plan.

- Identify and implement ways to help the NAWMP enterprise connect with new partnerships that focus on community-scale EG&S benefits in a way that also moves waterfowl and wetland conservation forward. Initial work needs to invest resources in quantifying the relevant specific EG&S benefits at different communities or scales, especially in economic or other terms from typical, broadly used, or critically important conservation techniques for waterfowl habitat. Such actions would represent new partnership and funding opportunities. Efforts should be inclusive of diverse participants, include the development of a human dimensions community of practice, and identification of mechanisms for the dissemination of information and best practices. It may also include intentional engagement of marginalized communities in the review and development of NAWMP initiatives to better inform and garner support.

<u>Recommendations Around Promotion of Multiple Benefits</u>

- Develop strategies to engage broader segments of society in the waterfowl enterprise through quantifying/articulating “multiple benefits”.
- Strategically invest in regional-scale science that quantifies key ecosystem service benefits from actions targeted to improve conditions for waterfowl

<u>Integration Recommendations</u>

- Continue to evaluate and improve upon programmatic efficiency of delivery programs including human dimension initiatives
- Build on existing tools to ensure biological and social integration and to allow examination of trade-offs of management alternatives associated with incorporation of different sets of fundamental objectives. Extend these tools to incorporate landscape-specific risks to productive capacities, contributions to population growth and relative costs of conservation delivery
- Engage the NSST, HDPET, or other relevant advisory groups to explore approaches and develop planning tools that can be applied at local, regional/JV, and international scales to incorporate a greater suite of ecosystem services that include econometrics and support JVs in refining their conservation plans

APPENDIX J: Working group membership

Populations Working Group

Mike Brasher
David Gordon
Alan Hanson
Joe Lancaster
Jim Leafloor
Shawn Meyer
Eric Reed
Tony Roberts
Emily Silverman
Josh Vest
Kathy Fleming (co-chair)
Mike Anderson (co-chair)

Habitat Working Group

Kristin Bianchini
Heath Hagy
Cary Hamel
Kristina Hick
Kurt Mazur
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Jena Moon
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Josh Vest
David Howerter (co-chair)
Barry Wilson (co-chair)

People Working Group

Barb Avers
Andrew Don Carlos
Annette Glick
Ashley Gramza
Howie Harshaw
Katie Sainsbury
Jacey Scott
Corie White
Dean Smith (co-chair)
Mark Vrtiska (co-chair)