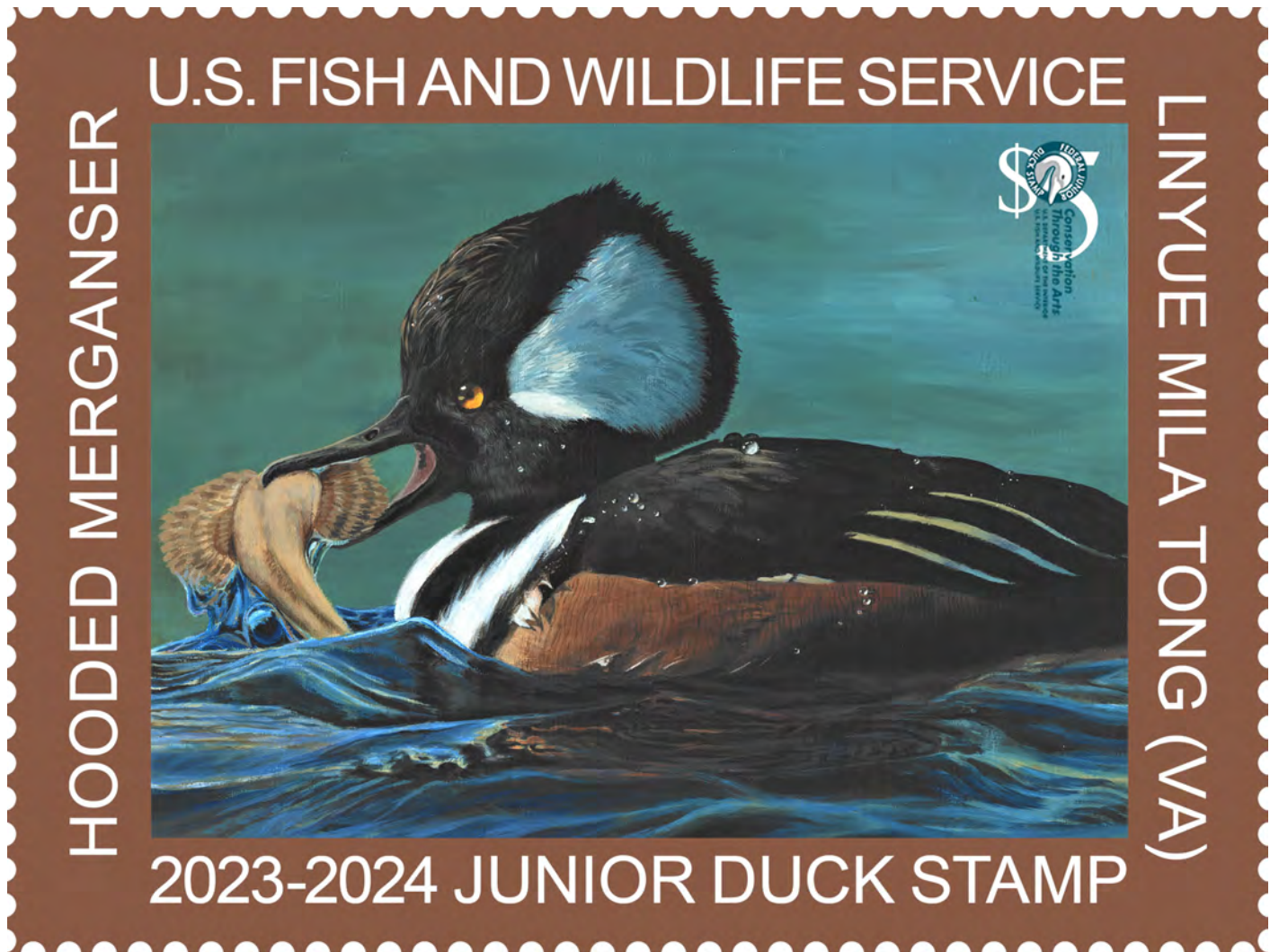


# Harvest Management Working Group

## *2023 Annual Meeting Report*



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## PREFACE

This report provides a summary of presentations and discussions that occurred at the 35<sup>th</sup> meeting of the Harvest Management Working Group (HMWG). The 2023 meeting focused on the Reconsideration of North American Duck Harvest management, the revision of the pintail Adaptive Harvest Management framework, and several updates on technical work related to the HMWG priorities. For meeting details please refer to the appended [2023 HMWG Meeting Agenda](#). The HMWG is grateful for the continuing technical support from the waterfowl management community, including many colleagues from Flyway Technical Sections, the United States Geological Survey (USGS), and other invitees from management and research institutions. We acknowledge that information provided by USGS in this report has not received the Director's approval and, as such, is provisional and subject to revision.

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## ACKNOWLEDGEMENTS

A working group comprised of representatives from the U. S. Fish and Wildlife Service (USFWS), the U. S. Geological Survey (USGS), the Canadian Wildlife Service (CWS), and the four Flyway Councils ([HMWG Members](#)) was established in 1992 to review the scientific basis for managing waterfowl harvests. The working group, supported by technical experts from the waterfowl management and research communities, subsequently proposed a framework for adaptive harvest management, which was first implemented in 1995.

The 2023 HMWG meeting report was prepared by the USFWS, Division of Migratory Bird Management based on contributions from meeting participants. G. Scott Boomer was the principal compiler and serves as the coordinator of the HMWG.

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**Cover Art:** The 2023–2024 Federal Junior Duck Stamp featuring a hooded merganser (*Lophodytes cucullatus*) painted by Mila Linyue Tong of Virginia.

# 1 Flyway and Partner Reports

## 1.1 Atlantic Flyway (Min Huang and Josh Stiller)

### Multi-stock adaptive harvest management

We are now into the sixth regulatory cycle using the multi-stock AHM decision framework in the Atlantic Flyway. We have been pleased with the performance of the framework to date, as we feel it does do a better job of reflecting the status of habitats and waterfowl within the Flyway that are available to our constituents. After this hunting season and prior to the next regulatory cycle, we will be updating the individual species weights that drive that policy decision and updating reporting rates and the resulting expected harvest rates with each regulatory alternative. The weights consist of the individual species harvest importance to each of the three regions of the Flyway (North, Mid-Atlantic, South) and the number of hunter days expended in each region. The intent of incorporating hunter days in each region is as an index of success of the strategy. If we were doing a good job with habitat delivery, hunting opportunity, and maintaining duck populations, hunter days theoretically should increase in those regions where specific species were important to hunters.

### Mallard Harvest Strategy

We implemented the Eastern Mallard harvest strategy for a second regulatory cycle. The policy strives for a 98% shoulder with no discount factor. The optimal policy for the 2024-25 season called for the continuation of a liberal 4-bird bag limit.

We continue to have concerns about model performance, specifically about the survival sub-model and the fact that finite population growth rate is not correlated with adult female survival or harvest rates or with juvenile female survival or harvest rates. Both seem a bit counter-intuitive or unrealistic. We have conducted some preliminary assessments of the sub-model performance based on suggestions received during the peer review process. Evaluations using data from the USGS gamebirds database vs. the USFWS annual data pull, modifying priors on harvest rate, and using a longer time-series (1978–2022 vs. 1998–2022) resulted in inconsequential changes in performance. The survival sub-model that incorporated no trend on juvenile survival performed similarly or slightly better than the model with a trend on juvenile survival. The effect on optimal policies was negligible. We will do further exploration of the IPM in the coming year.

We continue to observe a widening difference in mallard population trend between eastern Canada (increasing) and the Northeast US (decreasing). It is feasible that continued declines in the Northeast US will be buffered by increases in eastern Canada. This buffering could result in liberal bag limits while the US component of the mallard population is sliding. Although we did not include any constraints in the policy if Northeast mallards continue to decline, and the overall policy remains liberal, we might need to re-visit the framework in the long term.

### Black Duck AHM

The 2013 International harvest strategy required the updating and technical review of the AHM protocol every five years. It had been since that implementation that we had conducted any major technical or policy changes. Prior to the last regulatory cycle, updates were made to the framework. These included using the alternate parity constraint, increasing the spatial scale of abundance estimates from the core area to the Eastern Survey Area scale, updating the total indicated pairs definition from 2 birds equaling 1.5 total indicated pairs to 2 birds equaling 1 total indicated pairs and updating the productivity sub-model in the integrated population model. The change to the parity constraint was a policy decision that was driven by the lower than expected harvest rates in Canada when in the moderate and liberal packages. A recent trend analysis indicated a strong decreasing trend over time in harvest rates in Canada and in practical terms, it is becoming increasingly evident that there may be a limit in Canada on attainable harvest rates. Due to the decrease in expected harvest rates under each of the four Canadian regulatory alternatives combined with the parity constraint, the U.S. policy became un-necessarily more restrictive. Penalizing U.S. hunters because of declining participation (or at least realized harvest) in Canada, particularly when Canada is in a liberal policy is not what we envisioned nor desired when

we collectively agreed to the current parity formulation. The change will impose the parity constraint only if the optimal policy in Canada is either moderate or restrictive. Once Canada is able to institute more liberal harvest regulations and we have experience with those realized harvest rates, this interim parity constraint will be re-visited.

## **Future of AHM**

As we have mentioned in each of the past five meetings, the continued erosion of funding and priority for extant monitoring programs associated with migratory gamebirds is troubling. The very fact that the USFWS is making changes to their portion of the monitoring programs that drive harvest management not out of the desire for efficiencies, but out of financial necessity should finally open all of our eyes to the threats facing the machinery that drives harvest management. If the past decade is the barometer of how future budget priorities and personnel decisions will continue to disfavor migratory gamebird management and specifically harvest management, we need to stop talking around the subject and truly re-examine how we deliver harvest programs to insure continued conservation of the resource and acceptable outcomes for our constituencies.

In addition to our concerns about the continued lack of institutional support for harvest management and the necessary capital investment the process requires, we also continue to have concerns about optimizing across an infinite time series. The systems that we base our models and projections on are changing at a pace that continues to increase and we seem to be chasing that change. Our knowledge of system state can only become murkier as monitoring intensity erodes. The expected outcomes of annual decisions we are making now are likely very unrealistic even projecting out 30 years, let alone on an infinite time scale. We briefly explored options such as the discounting of future returns during the formulation of Multi-stock AHM. Our urgency, however, to implement Multi-stock, did not allow us to fully explore and vet this type of approach to optimal policies in the context of harvest management. Hopefully the larger harvest management community will embrace the theory of discounting and fully examine its utility as we collectively re-evaluate our overall approaches to duck harvest management.

Finally, the Atlantic Flyway is very troubled about the continued erosion of the partnership between the States and the USFWS. This partnership, which is the foundation upon which all of the successes of waterfowl management have been built, is in a state of disrepair. The State partners are increasingly being asked to or forced into assuming a larger share of the capital needed to deliver all the facets of migratory bird management. That, coupled with the increasing lack of input into major regulatory decision making, is disconcerting and a change of direction in the entirely wrong direction. We also have concerns about the increasing influence of NGO's and private interests in the formulation and promulgation of rulemaking that seems to be the norm, not the exception in recent times.

## **1.2 Mississippi Flyway (Adam Phelps and John Brunjes)**

Discussions of HMWG-related issues by the Mississippi Flyway Council (MFC) and Technical Section took place at the winter and summer 2023 Flyway meetings, held in Lafayette, Louisiana and Eureka Springs, Arkansas, respectively. In addition, the Technical Section meets virtually occasionally between in-person meetings. The Winter 2024 meeting will be held 19–23 February in Brainerd, Minnesota.

## **HMWG Priority List**

There was very little discussion regarding the priority list at the summer meeting since it had not changed. Because of the importance of the monitoring considerations, there was no interest in adding additional items to the list.

## **Reconsideration of North American Duck Harvest Management Survey: Mississippi Flyway Summary**

### **Draft Monitoring Document Review**

Most of the discussion at the summer meeting centered on the draft monitoring document that the Flyway was asked to review. Due to the length of the document and the timeline, members provided comments after the summer meeting. Those comments were compiled and provided to Pat Devers on 17 October.

As may be expected, this topic has caused a great deal of concern in the Flyway. We believe that every one of the potential reductions outlined in the draft document is likely to have negative impacts on the resource and/or on hunters. Many members tried to consider which of the alternatives are the “least bad” and which can be “recovered from” in the future given better funding environment. Overall, there was a strong rejection of any reductions in waterfowl monitoring.

We hope that these comments were helpful in preparing a document that will strengthen rather than diminish the monitoring programs for waterfowl in North America. We rely on the partnership between the Flyway and the Service to assess and manage waterfowl populations, harvest, and habitats. We feel that the data collection and reporting systems in place are already lean and would benefit from funding increases beyond 2022 levels. Therefore, the Mississippi Flyway believes that the alternatives provided for making further cuts to the Migratory Bird Program’s budget are untenable and would lead to an erosion of the agreed upon international objectives of waterfowl management in North America.

### **Concerns with SEIS 2013**

In the Mississippi Flyway perspectives document for the 2021 and 2022 HMWG meetings, concerns with SEIS 2013 were raised. The same issue is again raised here as a reminder that it has not been resolved. Once again the question of a new SEIS seems likely to be raised this week, so we would like to bring this concern to the attention of the HMWG again as those discussions go forward.

Concerns regarding drought conditions and pond and breeding population estimates in 2021 caused concern among biologists in the Mississippi Flyway regarding the appropriateness of a liberal duck season for 2022-23. The language in the SEIS regarding criteria to make changes to regulations after they have been established is nebulous. Exactly what circumstances would be extreme enough to justify or allow changes to the regulations the subsequent summer remains unclear. The process to amend the decision also remains unclear. The SEIS called for a collaborative effort to define these criteria and a process for amending regulations in this manner, but that effort has never been initiated. Indications from the Service during the summer 2021 meetings were that only a season closure could be considered in these “extreme situations,” rather than season restrictions, though that position has never been formally discussed or codified and is a source of concern for the Mississippi Flyway. We still believe that clarification of “extreme situations” and their potential remedies need to be formally addressed. We would like consultation to begin between the Service and the Flyways regarding what that process would entail.

### **Northern Pintail Harvest Strategy Revision**

The Mississippi Flyway Game Bird Technical Section met virtually twice in early November 2023. During this time, we discussed the major points brought up by the Pintail Working Group and participated in a swing-weighting exercise. This exercise clarified our objectives and the tradeoffs associated with the options under consideration.

- A peer review of the IPM is a prerequisite for approval of a revised harvest strategy.
- The group has concerns about introducing a three-bird daily bag limit (“L3”) package during a period when the population of pintails is near a record low. An L3 option is a very low priority for the Mississippi Flyway.



- There was a significant discrepancy between the top ranked strategies identified during the swing weighting and acceptance of a low closure threshold. Most states ranked the scenario with the lowest predicted frequency of closed seasons as their top choice. However, the strategies identified by this ranking have a low closure threshold (~1.0M), a population level below the observed population range (low of 1.78M in 2022) and the point that the IPM identifies as sustainable (~1.5M). For these reasons, and despite the results of the swing weighting exercise, the group has significant reservations about including a closure threshold.
- The Mississippi Flyway would prefer the Atlantic Flyway to participate fully in the national strategy. However, a flat bag of two or less would be considered for the Atlantic Flyway.
- The Mississippi Flyway wants to avoid increasing the frequency of closed seasons and would prefer to reduce the frequency of closed seasons in a manner that is biologically sustainable and socially defensible. The Mississippi Flyway is opposed to any liberalizations that increase the frequency of closed seasons.
- There is interest in investigating a “shoulder point” instead of MSY to reduce frequent changes to harvest packages.

In summary, the GBTS has strong reservations and is currently opposed to a liberalization of pintail harvest given the population status.

## **Scaup Regulations and the Revision of North American Duck Harvest Management**

The Mississippi Flyway is unsatisfied with the current scaup harvest strategy. A partial closed season is undesirable and does not achieve meaningful reductions in harvest. Nor do we believe that a reduction in scaup harvest is warranted given the low harvest rates on lesser scaup (Arnold et al. 2016). While we understand the priority shift of the HMWG toward monitoring concerns over the past two years, we believe that revisiting duck harvest management could alleviate our Flyway’s concern regarding scaup regulations while also potentially addressing some of the monitoring cost concerns.

Duck harvest management at the national or continental scale cannot succeed, or even meaningfully be attempted, without engagement from all four Flyways. Historically it has been clear that national strategies without engagement across all four Flyways have no traction. The partnerships we build are what makes waterfowl management in North America so strong. The Mississippi Flyway is concerned that these partnerships seem to be breaking down. The erosion of our ability or willingness to collaborate regarding management of waterfowl in the face of the threats we now face puts the resource at risk.

### ***1.3 Central Flyway (Mike Szymanski and Kevin Kraai)***

The Central Flyway has voiced concerns related to Service commitments to migratory game bird monitoring programs for at least 6 years, and those concerns have not been alleviated. We fully recognize that the root of the problem is associated with budgets that have been flat for more than 10 years, which really equate to declining budgets. However, the Flyway is also concerned about Service commitment to prioritizing funding for monitoring needs related to species and processes associated with hunting seasons.

We are especially concerned that partnerships within the migratory game bird management community are being devalued over relatively small sums of dollars. While not a hunted species, the Aransas wintering whooping crane survey has been slated for cancellation two years in a row without consultation with our Flyway. Not only is the whooping crane one of the nation’s emblematic endangered species, but it is also a species that can impact hunting season regulations. Thus, it is a species of dual focus by migratory bird managers in the Flyway.

Also in discussion over the past two years, has been significant alteration to the three core monitoring programs that guide midcontinent duck harvest management. The May Breeding Ground Habitat and Population Survey, preseason duck banding, and harvest surveys in their full form complete the data structure of midcontinent duck adaptive harvest management. These monitoring programs provide untold utility beyond the highly revered structured decision making

that guides duck harvest management. Dollars saved by cuts to these programs would be incredibly misaligned with damages to migratory bird management partnerships.

Our Flyway is fully committed to being a part of finding new ways of doing business to accomplish monitoring needs. However, we find great distain in being forced into a shotgun wedding approach due to problems associated with funding commitments by the Service. We expect that any process to re-envision monitoring programs, data collection, and setting of regulations, to be well-constructed with sufficient funding and time to have products that set the path forward for decades to come. We believe that it is of utmost importance that value of information, innovation, and efficiency are seen as priorities, and not just finding ways to simply cut costs. Our Flyway has already independently committed to investigating new ways to monitor harvest of geese, and made significant investments in tracking technologies to determine their value in monitoring programs.

On a brighter note, we are pleased to see the revision process for pintail harvest management concluding after pandemic-related delays. We greatly appreciate the work and accomplishments by all partners throughout the process and note that the work could not have been completed without monitoring program data.

We also appreciate the opportunity for two of our states, South Dakota and Nebraska, to evaluate Two-tier duck hunting regulations. The two states leading the effort are working to address concerns related to measurable attributes and objectives of the evaluation. This hunting season is the third year of a four-year evaluation. There is much more work to come as part of this evaluation to determine this management paradigm's utility to the overall delivery of waterfowl harvest regulations and participation by the public.

There are many looming large scale issues (decreased breeding habitat, climate change, hunter participation) and some specific (scaup harvest strategy) that need to be addressed. The management community won't be able to deal with these issues with less information from monitoring programs. It is of utmost importance that funding shortfalls be resolved not only through budget appropriations, but also via funding prioritization by Service leadership.

These are the opinions and perceptions of the Central Flyway's HMWG representatives, both long-term members of the Central Flyway; this statement has not been reviewed or approved by the entire Central Flyway membership.

## ***1.4 Pacific Flyway (Brandon Reishus and Jason Schamber)***

The Pacific Flyway discussed Harvest Management Working Group (HMWG) related issues at the August meeting and recommended the priorities list remain unchanged for 2024. The Flyway continued to express concern about the potential reduced frequency and intensity of waterfowl monitoring because of shortfalls in the Division of Migratory Bird Management (DMBM) budget. Questions again were raised whether high priorities should be ranked with this priority elevated over others, but some frustration also was conveyed that restructuring crucial monitoring programs is seemingly the long-term resolution to a fiscal problem.

### **Northern Pintails**

The revision of the Northern Pintail Harvest Strategy remains a high priority for the Pacific Flyway, and we're encouraged that substantial progress has been made to reach policy decision points. Our preferred strategy includes an L3 option, and we hope that collectively the Flyways can work toward that end to implement a revised strategy in 2024, to inform the 2025–26 hunting season frameworks.

### **Western Mallard**

The Pacific Flyway remains supportive of efforts to continue to broaden the geographic scope of the Western Mallard AHM protocol by inclusion of information from other states such as Nevada and Utah. However, we continue to view this work as neither critical nor urgent, as reflected by its lower status in the 2024 HMWG priority list.

## **1.5 Canadian Wildlife Service (Jim Leafloor)**

## **1.6 USFWS, Branch of Assessment and Decision Support (Mark Seamans)**

There are currently six staff members in the Branch of Assessment and Decision Support (BADs). The BADs Chief position has been vacant for almost three years. All work conducted by BADs is done in collaboration with state, federal, and other partners. Approximately 70% of the work performed by BADs concerns harvest management of migratory birds, with most time committed to duck harvest management followed by goose and webless species harvest management. Other work conducted by BADs relates to species population monitoring and assessments to inform permitted take management and assisting in the US Fish and Wildlife Service's effort to recover the loss of 3 billion birds. BADs staff manage the Arctic Goose Joint Venture (AGJV) grant program and the Webless Migratory Game Bird (WMGB) grant program. The AGJV is continuing to fund projects evaluating harvest estimates and Lincoln population estimates for geese. Four Webless grants totaling \$100k were awarded March 2023. Webless projects are many with the primary project being the development of integrated population models for mourning doves for each of the three management units.

Most if not all BADs projects related to duck harvest management will be discussed during HMWG meeting. These projects include the pintail AHM revision, midcontinent mallard band reporting rate study, integrating human dimensions in duck harvest management, alternative marking techniques for waterfowl, and how to make time dependent decisions in the face of system change. Nongame projects are also many and include developing survey designs to estimate the abundance of double-crested cormorant in the U.S., population assessments for dozens of Caribbean species and the effect of increased hurricane frequency and intensity on their populations, and working with the Migratory Bird Permitting Division to develop a consistent national approach to issuing permits for lethal take. In addition, in 2023 two post docs positions were initiated with the Cornell Lab of Ornithology; one to integrate Breeding Bird Survey results into their Ebird modeling, and one to use Ebird information to inform permit issuance for various industries.

BADs is regularly being asked to do more with reduced staffing levels. Beyond harvest management, there is a growing need to support the process for permitting the planned and incidental take of nongame birds, and to support the US Fish and Wildlife Service's 5&1 Strategy to help recover the loss of 3 billion birds. However, harvest management of migratory game birds will continue to be our top priority.

## **1.7 USFWS, Branch of Monitoring and Data Management (Kathy Fleming)**

This overview focused on the budget, logistical, sampling, and estimation processes involved in administering the harvest surveys. The transition from a paper diary survey to the online harvest survey has resulted in a decrease in annual budget from \$481K to \$255K, due to the replacement of paper forms with email invitations and an online application. The Parts Collection Survey budget of \$530K covers printing of envelopes, shipping of envelope packages and business reply mail return envelopes. States also contribute to the budget of the Harvest Information Program by providing the sample frame for the survey. There are constraints to further reductions in the budget due to lack of flexibility, need for advanced planning, and the annual generation of the sample frame through HIP. Suggestions for reducing costs include investing in a photo PCS pilot project, eliminating mail invitations, or replacing the extensive survey with an intensive survey to reduce cost and bias. Impacts on data quality include: data problems with HIP registrations and the reliability of stratification, and possible bias in reporting hunting activity. Precision targets for harvest estimates exist but the current survey effort falls short in meeting some of these, due to low response rates and reduced budget. Recent modeling efforts have provided species-specific harvest estimates for waterfowl with precision estimates that can be used to target sample sizes needed to provide information for harvest management.

## **1.8 USFWS, Branch of Migratory Bird Surveys (Mark Koneff)**

Mark Koneff, Branch Chief, updated the HMWG on current staffing and vacancies in the Branch, Branch fleet assets, budget status, and Branch priority activities. The Branch presently has 9 full-time pilot-biologists as well as a remote

sensing and machine learning specialist. One of the pilot-biologists on staff remains in a training status. Terry Liddick, a pilot-biologist in the Branch, retired on September 30, 2023. Fortunately, the Division has been able to bring Terry back as a re-employed annuitant for one year. Given Terry's availability we will be one crew short for completion of a full WPBHS. As in the most recent two years we will fill this gap by having three neighboring crews complete this crew area before moving on to their primary assigned areas. Little to no backup pilots exist in DOI to support DMBM in the event that a pilot is ill or otherwise unable to complete the WPBHS. Overall the FWS pilot corps is approximately half that of 7 to 8 years ago. Contingency planning is underway to prepare for the potential for additional reductions in aircrew availability that might occur with short notice. Budget is a worsening challenge with a 21% reduction in operational funding (non-salary) since 2015. Reduced operational funding is further complicated by increasing fixed costs for equipment and equipment maintenance and utilization. Ongoing priorities remain training and safety, core missions supporting waterfowl and other migratory bird harvest or permitted take, remote sensing/machine learning integration, waterfowl banding, cost-recovery through support to other FWS programs and other agencies, and aerial observer recruitment and retention.

## ***1.9 USFWS, Division of Bird Conservation, Permits, and Regulations (Greg Fleming)***

Greg Fleming, Migratory Bird Hunting Regulations Coordinator, gave an update on the 2024–2025 Migratory bird hunting regulation status. The Preliminary 2024–2025 migratory bird hunting rule is at the Office of Management and Budget's, Office of Information and Regulatory Affairs; they are trying to revise the Economic analysis associated with this rule, but the rule is fine. The rule package has been to them three times over the last few months and is way behind on publishing. We have recently asked them to move it forward to get published in the Federal Register if no adjustment can be made to the Economic analysis. The Proposed rule has been ready to go since the end of October. However, we can't publish the proposed rule until 30 days after the preliminary rule publishes in the Federal Register because of the 30-day public comment period.

## **2 Partner Updates**

### ***2.1 NAWMP Committee Update (Todd Sanders)***

The Plan Committee (PC) is an international body that provides leadership and oversight for the activities undertaken in support of the North American Waterfowl Management Plan (i.e., Plan leadership and management). The PC consists of up to 18 members, 6 each from Canada, the United States, and Mexico. In the U.S., each Flyway Council nominates a representative, and the FWS Director appoints up to two federal representatives from the directorate.

The U.S. representatives on the PC include:

Jerome Ford, Co-Chair; U.S. Fish and Wildlife Service  
Vacant; Atlantic Flyway Council [previously Gray Anderson, VA]  
Joe Benedict; Mississippi Flyway Council (TN)  
Vacant; Central Flyway Council [previously Jeb Williams, ND]  
Eric Gardner; Pacific Flyway Council (WA)

The PC typically meets two times per year, generally winter and late summer, and in 2023 met virtually April 18 and 19 and October 3 and 4. The meeting objectives were:

1. To continue to provide leadership and assess progress of reporting JVs and recommend future actions, and
2. To discuss and assess planning and implementation of core aspects of NAWMP programs and strategic priorities.

The PC heard reports from two Joint ventures (species or habitat) at each meeting. The PC also heard reports from the PC's working groups including:

1. North American Waterfowl Management Plan Science Support Team (NSST),
2. Human Dimensions Public Engagement Team (HDPET),
3. Communications Committee (CC), and
4. Integration Steering Committee (ISC).

Major work item and discussion points are summarized below.

### **Working groups**

1. NSST: no major developments to report.
2. HDPET: Chair David Cobb recently retired, the new chair is Barb Avers. Private landowners are an important partner. Work is underway to better understand this group and to develop successful messages to redirect behavior.
3. CC: Efforts to inventory NAWMP communication assets (communication strategy, asset inventory report, and marketing plan); and possibly develop a rallying cry and updated logo (branding) to broaden the conservation partnerships recognizing benefits to other species and ecosystem functions. The marketing inventory provides that there is very little active marketing of NAWMP, mostly around projects. The growth of the enterprise isn't in the Plan, but in the Partners working to build it. Need to focus on partners and policy makers. The PC is onboard with concept of a rallying cry and will see what emerges. The timing with 2024 Update would be ideal to roll out the new logo and or pieces.
4. ISC: Update on initial NAWMP Performance metrics. Performance metrics may help in accountability for funds received and in fostering support. The metrics are related to the NAWMP objectives for populations, habitat, people, and integration. The primary partner working groups (NSST, HDWG, ISC) have been asked to provide input into potential metrics that are currently available and are applicable internationally or nationally to all Joint Ventures. The PC adopted NAWMP performance metric in fall 2022. The PC co-chairs sent a letter dated 15 December 2022 to the partners to confirm the performance metrics. This was provided to the HMWG via email on 3 January 2023. Also, the PC was briefed that in November 2022 the UST and NSST completed a report describing the status of Human Dimensions integration by migratory bird Joint Ventures in North America. This is important work to understand where we are currently in regards to HD and Joint Venture work, and where are gaps and potential ways forward. The report is titled "Status of Integrating Human Dimensions Into Joint Venture Bird Conservation Planning and Habitat Delivery."

### **Other major work items and discussion points**

Plans are being developed for the 2024 NAWMP plan update. The expectation is that there will be a draft for PC review in April and all three countries would sign the update in September at the AFWA meeting in Madison, Wisconsin. There is an effort to increase Mexico engagement in the Plan and update. Also discussion about increased opportunities to consider DEI (Diversity, Equity, and Inclusion) and climate change.

Discussion occurred regarding NAWMP endorsement of additional Joint Ventures, specifically Appalachian Mountains; East Gulf Coastal Plain; Oaks and Prairies; and Rio Grande. All four JVs were established for species other than waterfowl but have some waterfowl/waterbird components. These components have not been reviewed by NAWMP committees and would need to be prior to recommendation of endorsement. The benefit to the JV to be endorsed by NAWMP is formal affiliation with a continental conservation plan signed by the federal governments of the United States, Canada, and Mexico and the formal agreements that go along with that work, something that is lacking in the other bird plans. For example, Rio Grande has been working to conserve birds for decades, and this endorsement would give them further access and continental exposure. The NSST and other major bird plans have to review implementation plans to become a USFWS recognized JV, but it's up to the JV to request endorsement by NAWMP specifically and they

didn't at the time likely due to less of a waterfowl focus. At that point the JVs were not ready to move forward. Next steps in this regard is that the JVs need to go through review by the NSST. This includes significant thought put into waterfowl components of Implementation Plans. Then the PC can review their applications and why they want endorsement.

Although not discussed at the PC meeting, note also that and California Central Coast Joint Venture seeks endorsement and support by the USFWS. Initial review of the implementation plan has been completed by the USFWS Division of Bird Habitat Conservation (DBHC). Reviews have also been completed by the Pacific Flyway Council and major bird plans (NAWMP-NSST, Partners in Flight, and the US Shorebird Conservation Partnership). DBHC will compile comments and provide them along with any edits by the C3JV and submit to the USFWS Assistant Director for Migratory Birds (Jerome Ford) for review and determination of whether or not to make a recommendation to the Director for USFWS support of the joint venture.

## **2.2 *The North American Waterfowl Management Plan: 38 years of adaptive conservation. Where do we go now? (Tom Moorman)***

The North American Waterfowl Management Plan (NAWMP) was created in 1986 by visionary waterfowl managers in response to declining waterfowl populations. Joint Ventures are the core of the NAWMP business model– multiple partners with mutual interests in waterfowl and wetlands bringing resources to significant conservation challenges at landscape scales. While NAWMP implementation has been both adaptive and extraordinarily successful in conserving waterfowl habitat, acute significant threats to waterfowl and their associated habitats remain. Competing land and water uses continue to degrade habitat, while climate change presents new threats and challenges to waterfowl and other species of birds and wildlife and their habitats. The most significant and fundamental challenge for the NAWMP conservation community is achieving habitat conservation at Joint Venture scales that neutralizes or reverses large-scale losses. Substantial additional resources must be injected into the NAWMP Joint Ventures to achieve conservation at scale.

Habitat conserved under NAWMP provides significant benefits to waterfowl, but also to people and their communities. Wetlands improve water quality, sequester carbon, attenuate flooding, provide habitat for a diversity of wildlife and fish, and places for people to connect with nature. NAWMP is one of the best examples of the use of nature-based solutions to address climate change and other environmental issues on a broad, landscape-level scale. Indeed, some Joint Ventures or other partners have documented conservation outcomes that have led to increased wetland conservation, improved wetland policies, and attracted new partners.

NAWMP will remain focused on waterfowl and wetland conservation, but there is substantial opportunity to grow conservation via communication and marketing of multiple ecological benefits to attract new partners and resources. More partners, bringing more resources, will increase the scale and rate of habitat conservation on behalf of North American waterfowl, while simultaneously providing other ecological benefits to people and communities across the continent.

## **2.3 *Human Dimensions Working Group (HMWG Members)***

The HMWG revisited the issue pertaining to the lack of a designated working group member who serves as a representative to the Human Dimensions Working Group. In 2023, working group members concluded that updates from the NAWMP Plan Committee Liaison and the NAWMP Integration coordinator were sufficient to maintain a working understanding of the activities of the Human Dimensions working group. However, the working group re-affirmed a willingness to engage with the Human Dimensions Working Group on an *ad hoc* basis to address issues that are relevant to the HMWG and require additional coordination.

## **2.4 *National Science Support Team (Tony Roberts)***

The NSST recently completed an update to the NAWMP Species Priorities. The new list is currently being incorporated into NAWCA scoring. There are a number of Joint Venture projects using eBird to assist habitat conservation planning.

The NSST anticipates developing a workplan after completion of the NAWMP Update, and the resulting technical recommendations from that work.

## **2.5 Communication Team (Min Huang)**

### **Communications Team:**

The HMWG Communications team as of 2022 is an ad-hoc committee that serves as the request of the larger HMWG to address communications needs. No formal work from the Communications team was requested nor did any occur since the 2022 meeting. Should the HMWG require a communications effort with the implementation of a new Pintail harvest strategy or changes in monitoring intensity, the Communications team will be activated to accomplish those tasks. The current membership of this committee includes:

Min Huang (AF, chair)

John Brunjes (MF)

Mike Szymanski (CF)

Brandon Reishus (PF)

Pat Devers (FWS)

Rosalie Wetzel (FWS)

## **2.6 Two-tier license system updates (Rocco Murano)**

Rocco Murano (Senior Waterfowl Biologist SDGFP) gave a virtual update to the HMWG regarding progress during the 3rd year of the 2-tiered duck regulations experiment in South Dakota and Nebraska. He indicated that registered participants had surpassed last year's totals in both states and were 8% (SD) and (13%) of HIP registered duck hunters to dates. He next outlined parts collection and diary data submissions showing increases in year-to-year parts collection for both states. Rocco next reviewed summarized data from the 2022/2023 duck season as well as the most recent post season survey information. In addition, Rocco discussed the addition of post season phone interviews to obtain qualitative human dimensions information to drill down into motives for using the tier 2 option.

## **2.7 Impacts of reduced monitoring effort on AHM (Devers et al.)**

The HMWG discussed the final White Paper (Devers et al. 2023) documenting the deliberations from last year's discussions of the implications of how reduced monitoring effort may impact AHM decision frameworks. The HMWG concluded that any substantive assessments focused on monitoring and AHM should be conducted in conjunction with the broader discussion of the Reconsideration of duck harvest management.

# **3 Pintail AHM**

## **3.1 Pintail AHM revision strategy development (Pintail Working Group)**

Mike Runge presented an overview of the progress that has been made to date in the development of the modeling and decision analysis part of the pintail AHM revision:

- In 2019, the U.S. Fish and Wildlife Service convened a Pintail Working Group, including representation from the four Waterfowl Technical Committees, to examine the existing pintail harvest strategy, evaluate pintail population dynamics, and develop alternative management strategies for consideration.

- The Pintail Working Group has made substantial progress in developing a new state-of-the-art population model that integrates information from waterfowl population surveys, the banding program, parts collection surveys, and the Harvest Information Program.
- We've known for some time that the harvest potential dropped significantly in the 1980s. The new population models confirm the persistence of the lower harvest potential.
- In the last year, we have made a substantial breakthrough in the predictive models we use for harvest; the new population model allows us to estimate the effects of regulations on harvest rate, rather than total harvest. This has important effects on the optimal strategies, to the point that the trade-offs associated with adding a liberal-season three-bird-bag alternative are significantly attenuated compared to the strategies under the old models.
- In August 2023, the Pintail Working Group sought specific policy input from the Flyway technical committees and Councils regarding aspects of the pintail strategy, including shoulder points, closure thresholds, inclusion of an L3 option, and the option to have a flat bag in the Atlantic Flyway. In the last 3 months, there has been considerable back-and-forth between the PWG and the technical committees in an effort to focus on a small set of strategies for further consideration. A single proposed strategy has not yet emerged from those discussions.

We then reviewed performance details for some additional strategies that were requested from the Flyways, as well as some ancillary information relevant to development of a full AHM harvest strategy. Based on this information, each Flyway then presented their respective preferences for the key policy elements that would define an updated pintail harvest strategy. This discussion highlighted some key differences in preferences across Flyways, resulting in the recognition that some additional feedback from the Flyway Technical Sections would be needed to develop full consensus on the final form of the revised pintail AHM decision framework.

## Next Steps

The planned steps for finishing this revision process include the following, recognizing that at each step, advice from the respective parties will lead to revisions and improvements to the strategy.

1. Based on feedback from the Harvest Management Working Group and continued deliberations within the PWG, we would develop a final proposal for a revised pintail strategy. (January 2023)
2. The Flyway Technical Committees provide a final technical review of the proposed strategy. (February 2024)
3. The Flyway Councils review and endorse the proposed strategy. (March 2024)
4. The proposed strategy is presented to the Service Regulations Committee for review and approval. (April 2024)
5. The revised strategy works its way through the regulatory process. (2024-2025)
6. The revised strategy is implemented. (Autumn 2025)

## 4 Reconsideration of North American Duck Harvest Management

### 4.1 Introduction to session (Scott Boomer)

The HMWG began Wednesday's session with an orientation to the day's agenda (Table 1) focused on the "Reconsideration of North American waterfowl harvest management." This overview highlighted some of the elements of the current crisis, affirmed that we have an opportunity to change the process, recognizing that if we apply the principles of Adaptive Management, the resulting framework should provide a more robust and efficient system for informing waterfowl harvest regulations.

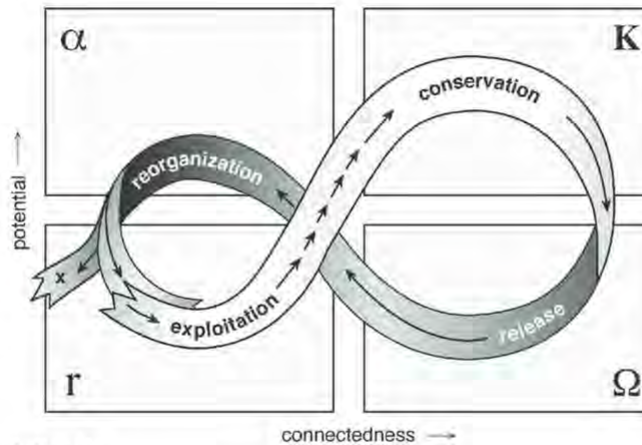


**Table 1** – Agenda for Day two of the Harvest Management Working Group meeting focused on the Reconsideration of North American Duck Harvest Management.

<b>Agenda</b>	
Purpose	<p>Communicate:</p> <ul style="list-style-type: none"> <li>• The current crisis</li> <li>• The need to adapt and an opportunity for meaningful change</li> </ul> <p>Problem framing:</p> <ul style="list-style-type: none"> <li>• Identify current factors limiting waterfowl harvest management</li> <li>• Anticipate future limitations and opportunities for learning</li> <li>• Identify key features from current system to retain</li> </ul> <p>Planning Next Steps:</p> <ul style="list-style-type: none"> <li>• Who does the work</li> <li>• What resources are needed</li> <li>• What is the timeline</li> </ul>
Presentations	<p>How did we get here? (Boomer et al.)            USFWS Perspectives (Richkus)            Insights from Cultural Evolution (Berl)</p>
Group Discussion	<p>Identification of factors limiting waterfowl harvest management            Breakout groups            Reporting out            List of factors or impediments to waterfowl harvest management performance            List of features missing from waterfowl harvest management</p>
Group Discussion	<p>Identification of core principles of waterfowl harvest management            Round Robin            List of features from current system that need to be retained (nonnegotiables)</p>
Planning next steps	<p>Development of working subgroups and assessment teams            Identification of resources necessary to transform waterfowl harvest management</p>

- $\alpha$  = Reorganization or transformational change
- 1) Greatest potential for institutional shifts
  - 2) Conditions ripe for innovation
  - 3) E.g., 1995

- $r$  = Growth:
- 1) Resource investments
  - 2) \$ (AMAT)
  - 3) AHM Task Force
  - 4) Joint Task Group
  - 5) Build up of staff and institutional buy-in
  - 6) Proliferation of AHM frameworks



- $K$  = carrying capacity:
- 1) AHM matures
  - 2) Technical revisions
  - 3) Double-loop learning
  - 4) Rigidity in decision process
  - 5) Loss of relevancy and resources
  - 6) Accident waiting to happen

- $\Omega$  = Creative destruction
- 1) External shocks expose vulnerabilities
  - 2) Structural breakdowns
  - 3) Emerging opportunities for change
  - 4) Release of resources

Figure from: Holling 2001

**Figure 1** – Institutional changes in the Adaptive Harvest Management program depicted within the 4 distinct phases of the adaptive cycle of socio-economic systems. The figure was adapted from a graphic in [Holling \(2001\)](#).

## 4.2 An emerging crisis for AHM (Scott Boomer and Fred Johnson)

We described historical changes of the Adaptive Harvest Management program within the theoretical framework of adaptive cycles ([Holling 2001](#)). Soon after a political controversy in 1994, waterfowl sport harvest regulatory decision protocols were significantly revamped with the implementation of mid-continent mallard AHM. Based on this successful implementation, the AHM program then experienced rapid growth as multiple decision frameworks were developed in response to an increase in partnership buy-in, technical capacity, and administrative support ([Figure 1](#)). We argue that as an institution, AHM has reached its carrying capacity ( $K$ ), resulting in a rigid and less resilient decision process. As a result, AHM as currently implemented is increasingly vulnerable to external shocks (e.g., COVID 19, budgetary shortfalls, and reduced technical capacity), heightening concerns about AHM effectiveness or more importantly, potential breakdowns in the decision-making process. We suggest that the HMWG should begin exploring options for navigating the “Omega” phase of the adaptive cycle in order to minimize the negative consequences associated with the destructive potential of this process, while taking full advantage of any corresponding emerging opportunities for meaningful changes in AHM.

## 4.3 Science and practice of culture change for adaptive harvest management of waterfowl (Richard E.W. Berl)

Richard Berl provided background on theories of cultural and institutional change to provide context for the consideration of transformational change in the adaptive harvest management of waterfowl, drawing from systems theory ([Foster-Fishman et al. 2007](#)) and the field of cultural evolutionary science ([Mesoudi 2016](#)). First, he provided a conceptualization of culture as transmitted information, including values and practices regarding wildlife, which determine support for various management and policy approaches. Second, he described the processes by which culture changes over time, which create a need for institutions to adapt to broader culture change in order to retain relevancy and support. Based on the literature and prior implementation efforts in state fish and wildlife agencies ([Berl et al. 2022](#)), Richard provided recommendations for engaging in the process of intentional change of institutions and internal

culture, and emphasized that the reconsideration is an opportunity to include a diverse set of partners, encourage integration across management objectives and governance institutions, and extend the benefits of healthy waterfowl populations and ecosystems.

#### **4.4 Identification of factors limiting AHM (HMWG)**

The Harvest Management Working Group participated in a breakout session to identify and discuss several key problem-framing elements important to the implementation of AHM. HMWG meeting participants were sorted into break out groups to respond to a set of questions focused on scales, decision timing, communication, harvest management objectives, modeling and monitoring, and stakeholders. Each breakout group summarized their answers and reported back to the working group in a facilitated discussion. There was some agreement among groups that the administrative scales of waterfowl harvest management were sufficient and that hunters continue to be the primary stakeholders of waterfowl harvest management (Table 2). Most groups suggested that it would be advantageous to revert to the original decision timing (post survey - pre-SEIS) and that it may be useful to consider alternative decision epochs (i.e., non-annual regulatory decisions). Several breakout groups stated that the current formulations of the objective functions used in AHM were adequate for maintaining sustainable harvests, but may constrain the ability to meet other management objectives. In addition, there was some agreement among groups that the HMWG should actively pursue an optimal tradeoff between cost and management complexity, particularly from a risk management standpoint. Most groups continue to be concerned with structural uncertainty and our ability to predict the impacts of harvest mortality on waterfowl populations, but there was also a fair amount of agreement that non-stationary system change will continue to be problematic as we implement AHM.

The results of these discussions were useful in highlighting the features of the current system of adaptive harvest management that may need to be addressed and modified when considering changes to AHM decision protocols. A complete listing of each of the breakout group results have been appended to this report in an (Appendix ).

#### **4.5 Foundational principles of AHM (HMWG)**

The Harvest Management Working Group participated in a round-robin discussion to identify and discuss the foundational elements of Adaptive Harvest Management. The objective of this exercise was to generate a list of the essential features of AHM that would need to be retained in any updated harvest management decision frameworks. For the round-robin, each meeting participant was asked to identify which parts of current AHM decision frameworks were negotiable when thinking about revising AHM, and which parts would be considered non-negotiable when thinking about changes to current decision protocols.

The Harvest Management Working group was unanimous in affirming that maintaining a cooperative process between state, federal, and tribal partners was essential to consider in any effort to revise or modify AHM decision protocols (Table 3). In addition, there was a clear consensus that harvest management decisions should continue to be based on an explicit, science-based, decision-analytical framework that includes agreed-upon objectives, regulatory alternatives, predictive models, and a formal decision analysis informed with monitoring data.

The Harvest Management Working group recognized that there should be flexibility when considering the other important elements of the harvest management decision problem that may be crucial in developing solutions for solving the suite of current issues that challenge the implementation of AHM. In particular, the level of complexity in the AHM process (e.g., decision framing and timing) was highlighted by the HMWG as an important attribute that should be evaluated and may need to be negotiated when re-envisioning how AHM is implemented in the future. Moreover, the HMWG voiced a clear willingness to consider new perspectives and ideas when thinking about the negotiable attributes (see Appendix for full listing) of the harvest management decision problem.

**Table 2** – A summary of participant responses to questions discussed at the Breakout Session of the Harvest Management Working Group meeting.

<b>Problem Framing Element</b>	<b>Summary of Responses</b>
Scales	Some consensus that biological scales for waterfowl harvest management are adequately defined. There was some general agreement that the Flyway designations were appropriate at the administrative level. Some concerns that Flyway scale is too coarse and that states may need more flexibility.
Decision Timing	Strong agreement that pre-SEIS decision timing (post-survey) is ideal, but some recognition that administrative bottlenecks may make reverting back to old timing infeasible. There were some common suggestions that it may be worthwhile to pursue decision frameworks with different decision epochs (e.g., regulatory decision every 2 or 3 years).
Communication	Most groups highlighted that technical details and the regulatory complexities (e.g., static or changing bag limits, or SEIS inconsistencies) associated with AHM were a primary communication challenge. In addition, several groups highlighted difficulties in explaining the benefits and success of AHM to administrators.
Objectives	There was some agreement across groups that the current formulation of the objective function(s) in AHM provide an effective means of balancing harvest and waterfowl conservation. However, there is concern that the “MSY” based objectives may not adequately capture other objectives (e.g., maximizing hunting opportunity, minimizing closed seasons, or minimizing negative impacts on the hunter population).
Modeling and Monitoring	Most groups highlighted the need to find a trade-off between management and modeling complexity and harvest opportunity. Several groups suggested that this trade-off should be evaluated from a risk management framework.
Uncertainty	Most groups identified the following forms of uncertainty affecting our ability to manage waterfowl harvest: non-stationary system change, partial control of harvest, structural uncertainty (N vs H, N and/or h on hunter numbers/dynamics), and partial observability (limits to monitoring key state variables and bias).
Stakeholders	There was general agreement that the primary stake holders of waterfowl harvest management were hunters (recreational and subsistence) and indigenous communities. There was less agreement that the general public were primary stakeholders.
AHM Regrets	Some groups suggested that AHM should have explicitly considered multi-stock dimensions (e.g., less mallard-centric, focus on low harvest potential species) from the beginning. Some groups highlighted that more emphasis on research and experimentation may have been warranted, along with the realization that administrative and budgetary support should have been more explicitly linked to monitoring commitments.

**Table 3** – A summary of participant responses to Round Robin questions discussed at the Harvest Management Working Group meeting.

<b>Negotiables</b>	<b>Summary of Responses</b>
1.	Decision timing and/or frequency.
2.	Level of complexity in decision making framework (complexity - opportunity tradeoff)
3.	Model formulations and monitoring designs
4.	Expanding partnerships and governance structures
5.	Regulatory alternatives
<b>Non Negotiables</b>	<b>Summary of Responses</b>
1.	Cooperative management process involving state and federal partnerships along with co-management councils of indigenous communities.
2.	Migratory Bird Treaty Act trust responsibilities and conservation mandates
3.	Science-based, decision-analytical framework (objectives, alternatives, models, monitoring, decision analysis)
4.	Flyway (administrative) and continental (biological) scales
5.	Annual monitoring (BPOP, banding, and harvest)

## 5 Research and Technical Updates

### 5.1 *Time-dependent optimal solutions to address system change (Jamie Ashander)*

A big challenge for harvest management is anticipating system change in our management strategies. Is early action needed to achieve our objectives in a changing system? If so, when and how should anticipatory management differ from status quo practice?

We present an update on our ongoing project applying techniques for time-dependent optimal management to the question of setting hunting regulations for mid-continent Mallard (MCM), given potential future climate change. We use a simplified implementation of the AHM model coupled to a climate-based pond dynamics model. We describe a model that predicts May pond counts in the Prairie region of the USA and Canada (a key predictor of mallard reproduction) as a function of climate variables (precipitation and temperature) and estimate parameters for two scenarios for May pond sensitivity to climate. By combining this pond model with downscaled projections of future climate from CMIP5 (ensemble projections based on 29 general circulation models for two emissions scenarios, RCPs 4.5 and 8.5), we develop projected trajectories of May pond counts in the Prairies under four climate futures. We then use dynamic programming and a simplified version of the AHM model to derive a time-dependent optimal policy for each climate future. We show how time-dependent optimal policies differ between these futures, with more liberal harvest policies being favored to maintain harvest goals under futures where May ponds are more sensitive to climate. We also assess the expected value of perfect information (EVPI) about future climate change for the objectives of mallard harvest management. We conclude by emphasizing that the frequency of policy updates and monitoring provide important context for interpreting these results.

We comment on our work in the context of theoretical results for time-dependent optimal management (Tucker and Runge 2021). That paper showed that the net benefits of adopting a time dependent policy (versus maintaining a status quo policy and failing to account for system change) depend on the nature of change; they are weak for slight declines and are highest for very strong declines in carrying capacity (K). In this context, we note how our results might differ for a broader suite of waterfowl, particularly species with less harvest potential or higher climate sensitivity than Mallard ducks. We also comment on potential differences for species with “slow” life history (e.g., due to delayed maturity, lower productivity, and longer lifespan) compared to Mallard ducks.

## **5.2 Update on efforts to integrate human dimensions into the waterfowl harvest regulatory process (Richard E.W. Berl, Patrick K. Devers, G. Scott Boomer, and Michael C. Runge)**

The goal of this project is to explore and evaluate an integrated framework for the consideration of waterfowl population dynamics, waterfowl hunter dynamics, and hunter behavior to inform the annual process of setting harvest regulations for North American waterfowl. Our process draws from established theory and practice in human dimensions and adaptive harvest management, and is based in a causal inference approach that allows for predictions, with uncertainty, of the potential outcomes of future changes to the waterfowl-hunter-harvest system.

We presented updated models that incorporate hunter recruitment, retention, and reactivation (R3) as discrete processes and track pools of potential, active, and inactive hunters as states that hunters transition between as part of those R3 processes. This updated framework allows for hypothesized drivers, such as hunter density and hunter satisfaction, to have different effects on each R3 process. Preliminary parameter estimation of the hunter, waterfowl, and harvest models allowed for depiction of the observed dynamics of the integrated system over a 20-year period. Forecasting of the parameterized relationships into the future showed that, under status quo conditions, numbers of active hunters will likely continue to decline, and with fewer hunters afield, harvest numbers will as well, leading to an increase in the waterfowl population. An aging hunter base is predicted to contribute to the decline in hunter numbers if recruitment rates fall below hunter mortality rates. We explored a number of different potential future scenarios in which shifts in cultural values (e.g., [Manfredo et al. 2021](#)), changes in participation rates, changes in recruitment rates, and changes to the regulatory framework could affect the dynamics of the integrated system over time.

This work provides a foundation for understanding the linked socio-ecological components of the waterfowl-hunter-harvest system, reduces key uncertainties surrounding the role of human behavior in the harvest process, aids in crafting targeted questions for future research, and contributes to integration across biological and social NAWMP objectives.

## **5.3 Assessing harvest impacts (Thomas Riecke)**

Understanding the impacts of harvest on animal demographic rates is critically important for sustainable wildlife population management. Adaptive Harvest Management of North American waterfowl populations has served as a model system globally for the management of harvest of wildlife populations. I used blue-winged teal and northern pintail banding and survey data to explore the potential for hierarchical modeling approaches (e.g., structural equation models) to provide additional insight into the mechanisms underlying observed relationships between demographic rates and harvest. Preliminary results help identify existing challenges, and indicate the potential for these types of models to help resolve uncertainty and identify new challenges (e.g., changes in population sex ratios). Continued collaboration and constructive exchanges among agencies, NGOs, and researchers will be beneficial as harvest management approaches continue to evolve and drive sustainable management.

## **5.4 Evaluating waterfowl habitat from remote imagery (John Yeiser)**

John Yeiser gave a presentation on the potential for cloud-based remote sensing to inform waterfowl harvest management. He reviewed basic information about remote sensing techniques and its relevance to the biological data on waterfowl that the Service collects annually. He provided examples of how to calculate meaningful environmental metrics at continental scales and incorporate them into machine learning algorithms that can predict waterfowl distributions and abundance. He then outlined a preliminary analysis of Waterfowl Breeding Population Habitat Survey (WBPHS) count data to predict Northern Pintail distribution in response to basic climate and environmental metrics. Importantly, this example included predictions of NOPI distribution during 2020 and 2021 when the WBPHS was not flown. This exploratory analysis provided perspective on how remote sensing could supplement ongoing harvest management as well as help us innovate new ways to approach harvest management at continental scales.

## **5.5 Mississippi Flyway wood ducks (Adam Phelps)**

Many states in the southern part of the wood duck's range have noticed that catching adult males during pre-season banding is very difficult, while northern states band the majority of that cohort. Biologists in Indiana began talking with Michigan in 2018 about this phenomenon and whether a molt migration by adult male wood ducks had any management implications. At the time, through these informal conversations, the question seemed interesting, but not particularly important. The Mississippi Flyway began to revisit this issue in 2022. Staff from four states, the USFWS, and other organizations have been ongoing, and recently began to include members of the Atlantic Flyway.

When the daily bag limit for wood ducks increased to 3 per day in the Mississippi and Atlantic Flyways in 2008, there was (and remains) some disagreement whether kill rates on northern adult males or rangewide adult males is the appropriate metric to monitor harvest. This matters because work by Garrettson and Balkcom showed that northern males can sustain a kill rate of up to 14.3%, but rangewide males can sustain kill rates of up to 16.6%. The allowable kill rate for northern males has been exceeded twice since 2015 and four times since 2003, but the allowable kill rate for rangewide males has never been exceeded. If post-breeding, pre-banding movement by adult males confounds our banding efforts, then these kill rates and conclusions drawn from them regarding their sustainability are suspect.

The group has five key questions for this work (below) as they begin to develop a formal proposal. Work is unlikely to begin until at least summer 2025 as the Atlantic Flyway finishes up other wood duck projects currently underway, so these questions are subject to revision and refinement as the work progresses.

1. To what extent do adult males move northward post-breeding? It appears that they do, in large numbers, since males seem to largely disappear in summer from the southern portions of the breeding range.
2. Is there such a thing as a "northern adult male" wood duck? If southern breeders are being banded as northern breeders in large numbers, kill rates may be inaccurate. They may differ between southern breeders that do not molt migrate, those that do, and/or northern breeders.
3. Is the current north/rangewide harvest framework valid? Are associated kill rates correct?
4. Are we monitoring the wrong cohort? If adult males are monitored as a surrogate for the population, and if there is concern that they do not reflect patterns for the entire population (i.e., that northern birds are less robust to harvest), perhaps the appropriate cohort to monitor is adult females.
5. Learning fall migration departure dates useful for closure assumptions to develop Lincoln-Peterson estimates.

This material was presented to the Harvest Management Working Group as a preliminary informational item. The Mississippi and Atlantic Flyways will continue to update the Harvest Management Working Group as this work moves forward.

## **5.6 Reward banding update (Pam Garrettson)**

The final banding season of mid-continent mallard band reporting study occurred July–Sept 2023. This should improve the precision of the overall estimate, and provide an additional year of reward bands applied to the mid-continent mallard population, which will provide additional future indirect reward band recoveries for estimating reporting in the absence of ongoing reward banding efforts. Scott Boomer has been analyzing data each year for use in AHM updates, and he has compiled and updated these results in a working R-markdown document that is available upon request. MCM band reporting probabilities increased markedly since the previous study, and currently stand at approximately 0.90 overall. Data from the MCM reporting study may also help us elucidate the nature of the persistent gap in black duck reporting between the US and Canada. The Canadian Bird Banding Office reviewed a draft manuscript of the black duck work, and is interested in knowing if this pattern of differential reporting occurs elsewhere in Canada (e.g., western provinces).

## **5.7 Black duck AHM updates (John Yeiser)**

John Yeiser gave an update on black duck adaptive harvest management (BDAHM). The objective of BDAHM is 98% of maximum long-term cumulative harvest. There is a parity constraint for BDAHM that dictates that harvest should not be greater than 60% for either Canada or the U.S.

Recent assessments indicated that Canadian harvest was lesser under liberal policies than expected, which because of the parity constraint, was forcing the U.S. into a moderate package. In consultation with the Black Duck Adaptive Harvest Management Working Group (BDAHMMWG), the Branch of Assessment and Decision Support decided to introduce a temporary alternate parity constraint. This alternate parity constraint says that if either Canada or the U.S. is in its most liberal policy, then the parity constraint is not enforced. Otherwise the parity constraint works as originally written. This alternate parity constraint has been used for optimizing black duck harvest policies for the 2023-24 and 2024-25 seasons. The temporary parity constraint will be re-assessed in coming years as we assess the impact of more liberal Canadian policies.

There have also been several technical updates to BDAHM, including updating the spatial scale of abundance estimates from the “core area” (Waterfowl Breeding and Population Habitat Survey [WBPHS] strata 51, 52, 63, 64, 66, 67, 68, 70, 71, and 72) to the eastern Canada scale (WBPHS strata 51-53, 56, 62-72). The definition of total indicated pairs (TIP) was also altered from 1 bird observed equals 1.5 TIP to 1 bird observed equals 1 TIP. This new definition was based on relatively recent observations from Quebec and New Jersey which indicated that the majority of observed pairs were male-female. The potential impacts of these updates on optimal policy derivation were assessed using retroactive analyses of past data. Results indicated that updating the spatial scale and TIP definition will not hinder policy optimization.

The BDAHMMWG also investigated the productivity submodel within the integrated population model that informs policy optimization. This submodel assumes negative density dependence, a negative trend in productivity over time, and a negative effect of mallard abundance, which represents the hypothesis that mallards compete with black ducks for breeding resources and therefore have impacts on black duck reproductive output. There was no population model for mallards within the BDAHM framework, however, and there were concerns that the current model structure could be introducing unnecessary variance.

John along with the BDAHMMWG used leave-future-out cross validation to explore different model structures for productivity. The top performing models had random year effects and no time trend. Models with and without the mallard competition parameter had similar predictive power, so the BDAHMMWG decided to remove the mallard competition parameter. The policy optimization therefore no longer considers mallard abundance. John also reviewed updates to harvest rates estimation for black ducks. BDAHM now includes a generalized linear model to predict harvest rates. This model allows for trends over time and effects of harvest policy on age- and sex-specific harvest rates in both countries. BDAHM also now uses updated reporting rates for 1-800 and web address bands based on a recent reward banding data from 2017-2019.

## **5.8 Proposal for the re-establishment of an Adaptive Harvest Management Task Force (HMWG)**

The HMWG began discussing the critical need to establish a deliberative body to discuss the important policy implications of changes to AHM decision protocols. Historically, the HMWG has interacted with an Adaptive Harvest Management Task Force, who provided policy guidance and leadership as AHM was first established. More recently, an AHM Joint Task Group was convened to develop policy guidelines focused on the relationships between the objectives of harvest and habitat management plans (Anderson et al. 2007). The HMWG appointed a Steering Committee to identify the key responsibilities and makeup of a new AHM Task Force. In addition, the HMWG also thought it was important to develop an Objectives Committee to help identify the technical work that will be required as we consider alternative approaches to implementing AHM.



## **6 HMWG Priority Actions and Work Plan**

The HMWG opened up a discussion to review the annual process for identifying and finalizing HMWG priorities. This past year was challenging because the HMWG was unable to meet over the summer to discuss work progress towards the priorities that were discussed at the 2023 HMWG annual meeting. Several progress reports on many of the FY2023 priority action items associated with [HMWG Priorities](#), were presented at this year's meeting. The HMWG noted that additional work items that the Service or the Flyways would like to see addressed that are not included in these actions would necessarily delay completion of the highest priority tasks.

### ***6.1 2024 HMWG meeting***

The next HMWG meeting will be hosted by the Mississippi Flyway from 10–12 December 2024.

## LITERATURE CITED

- Anderson, M. G., D. Caswell, J. M. Eadie, J. T. Herbert, M. Huang, D. D. Humburg, F. A. Johnson, M. D. Koneff, S. E. Mott, T. D. Nudds, E. T. Reed, J. K. Ringelman, M. C. Runge, and B. C. Wilson. 2007. Unpublished Report from the Joint Task Group for clarifying North American waterfowl management plan population objectives and their use in harvest management.
- Arnold, T. W., A. D. Afton, M. J. Anteau, D. N. Koons, and C. A. Nicolai. 2016. Temporal variation in survival and recovery rates of lesser scaup. *The Journal of Wildlife Management* 80:850–861. URL <https://wildlife.onlinelibrary.wiley.com/doi/abs/10.1002/jwmg.21074>.
- Berl, R. E. W., M. J. Manfredo, M. Gasta, D. Smith, L. Sullivan, C. A. Jacobson, C. Bishop, J. Camuso, T. Eason, J. P. Hayes, R. Jacobson, C. Melcher, J. Newmark, P. Novotny, S. P. Pauley, C. Smith, C. Sparks, K. Stoner, J. Strong, and J. Ver Steeg. 2022. Building a systems framework to facilitate adaptive organizational change in state fish and wildlife agencies. *Conservation Science and Practice* 4:e591. URL <https://conbio.onlinelibrary.wiley.com/doi/abs/10.1111/csp2.591>.
- Devers, P. K., G. S. Boomer, M. D. Koneff, K. K. Fleming, and T. A. Sanders. 2023. Preliminary considerations by the Harvest Management Working Group of the potential consequences of changes to U.S. Fish and Wildlife Service's Monitoring Programs. U. S. Department of Interior, Washington, D. C. 40pp.
- Foster-Fishman, P. G., B. Nowell, and H. Yang. 2007. Putting the system back into systems change: a framework for understanding and changing organizational and community systems. *American Journal of Community Psychology* 39:197–215. URL <https://doi.org/10.1007/s10464-007-9109-0>.
- Holling, C. S. 2001. Understanding the Complexity of Economic, Ecological, and Social Systems. *Ecosystems* 4:390–405. URL <https://doi.org/10.1007/s10021-001-0101-5>.
- Manfredo, M. J., T. L. Teel, R. E. W. Berl, J. T. Bruskotter, and S. Kitayama. 2021. Social value shift in favour of biodiversity conservation in the United States. *Nature Sustainability* 4:323–330. URL <https://doi.org/10.1038/s41893-020-00655-6>.
- Mesoudi, A. 2016. Cultural Evolution: A Review of Theory, Findings and Controversies. *Evolutionary Biology* 43:481–497. URL <https://doi.org/10.1007/s11692-015-9320-0>.
- Tucker, A. M., and M. C. Runge. 2021. Optimal Strategies for Managing Wildlife Harvest Under System Change. *The Journal of Wildlife Management* 85:847–854. URL <https://wildlife.onlinelibrary.wiley.com/doi/abs/10.1002/jwmg.22047>.

**Harvest Management Working Group  
2023 Meeting Agenda  
San Diego, California**

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**Tuesday 5 December 2023**

- 08:00 Welcome, introductions, logistics, agenda (Boomer, Reishus, Schamber)
- 08:15 Flyway reports  
Atlantic, Mississippi, Central, Pacific (State Technical Representatives)  
US Fish and Wildlife Service (Flyway Representatives)  
Canadian Wildlife Service (Roy and Leafloor)  
US Fish and Wildlife Service DMBM/BADS (Seamans)  
US Fish and Wildlife Service DMBM/BMDM (Fleming, K)  
US Fish and Wildlife Service DMBM/BMBS (Koneff)  
US Fish and Wildlife Service DBPR/BPR (Fleming, G)
- 10:00 Break
- 10:30 Partner updates  
NAWMP Committee update (Sanders)  
NAWMP Update (Moorman)
- 12:00 Lunch
- 13:00 NAWMP and National Science Support Team (Roberts)  
A revised process for promulgating hunting regulations (Sanders)  
Communication team (Huang)  
Two-tier license system update (Murano)  
Impacts of reduced monitoring on AHM (Devers et al.)
- 15:00 Break
- 15:30 Pintail AHM Revision: strategy development (Pintail Working Group)
- 17:00 Adjourn
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**Wednesday 6 December 2023**

- 08:00 Introduction to session: reconsideration of North American duck harvest management (Boomer)  
Emergent Crisis (Boomer et al.)  
USFWS Perspective (Richkus)  
Selective forces of institutional change and cultural adaptation (Berl et al.)
- 10:00 Break
- 10:30 Facilitated group discussion: identification of limiting factors of AHM (HMWG)  
List of impediments  
Next steps
- 12:00 Lunch
- 13:00 Facilitated group discussion: foundational principles of AHM  
List of nonnegotiables
- 15:00 Break
- 13:00 Facilitated group discussion: outlining steps for transformation of AHM  
Next steps (HMWG)
- 17:00 Adjourn
- 

**Thursday 7 December 2023**

- 08:00 Meeting recap (Boomer)

- Time-dependent optimal solutions to address system change (Ashander)
- Integrating human dimensions (update Berl)
- Evaluating waterfowl habitat from remote imagery (Yeiser)
- Assessing harvest impacts (Riecke)
- 10:00 Break
- Evaluating waterfowl habitat from remote imagery (Yeiser)
- 10:30 Mississippi Flyway wood ducks (Phelps)
- Reward banding update (Garrettson)
- Black duck AHM updates (Yeiser)
- 12:00 Lunch
- 13:00 Pintail AHM Revision: strategy development (Pintail Working Group)
- 14:00 Proposal for the re-establishment of a harvest management steering committee(s)
- Membership
- Roles and responsibilities
- 15:00 Break
- 15:30 HMWG Priorities (HMWG)
- Plans for 2024: action items and task assignment (HMWG)
- Next meeting: location (Mississippi Flyway: ), date, topics...
- 16:30 Meeting summary and parting thoughts (HMWG)
- 17:00 Adjourn

# Discussion Results from Breakout Session 1

**Table 4** – Answers to discussion questions from each Group in the first Breakout Session at the Harvest Management Working Group meeting.

Question 1.	Scales: Are the current spatial scales that we use to manage waterfowl harvest appropriate? Please consider both biological and administrative scales.
Group 1	Generally speaking, our administrative boundaries are appropriate, and we have adjusted them as appropriate over time. Not sure if it's appropriate now to make changes to Flyway boundaries or not? Are zones appropriate? Effectively increase hunting opportunity. Does it scale down management too much? Does it add too much pressure on the birds (e.g., exposure days). Can Flyways disagree on some decisions and still be able to make regulatory changes? 4 Flyways are necessary for the big picture and appropriate. Generally appropriate biologically, but there are some species w/ different needs. More room within a Flyway for special circumstances, and differences between states etc. would be appropriate. Generally scale is appropriate from national Flyway perspective.
Group 2	Biological: yes; current designations are good... administratively too coarse, state geographies are too disparate... One size does not fit all. Flyways are too coarse. Temporal aspects of when harvest occurs is also important. Harvest derivations are acceptable... Alaska is its own Flyway.
Group 3	Need national/spp-level assessment; Flyway-level allocation/assessment Could be more flexibility administratively. Lost opportunity as a whole, perhaps more state-specific regulatory/flexibility: low vs. high harvest states (e.g., pintail - CA, TX/LA; AP CAGO - MD) Geese - still legacy divisions; could be additional amalgamation probably (Flyway-specific, temperate/migrant) More Flyway-specific flexibility - less contingent on other Flyways; if under overall cap, less need for coordination (ease of passing regulations). Disparity in geese vs. duck regs & FWS policy (number of zones, etc.) Anything that has formal harvest policy - yes; AF - multiple-stakeholders involved, NE US mallards spatial extent; in past, used MC mallards. For the most-part, seems appropriate; for national strategies, ; range-restricted species (e.g. geese), have ability to tailor down to specific states/areas; Flyways work pretty well together working together on combined populations (EP Tundra swans; works relatively well); existing framework and structure can allow for broad/narrow spatial management. Administrative scale comes out of MBTA; coordination with Canada; is spatial resolution right; question is about federal decision; resolution at Flyway-level; have we got too fine-grained in some cases; don't think this is the part that's broken; is there flexibility that could be achieved; interesting questions about resolution - are we trying to do too much at Federal level. Brought up example of Europe - nation-specific management would be analogous to state-level management, likely not efficient. Long history from biological data that contributed to development of Flyway system; not perfect but adaptive as new information becomes available; e.g., crane, woodcocks - are past management boundaries consistent with data (e.g., new info from telemetry data). Black ducks lots of coordination between Canada/US.
Group 4	Biologically: yes, consistent with recognized pop'ns. Admin: yes, legal mandates dictate structure. Yes - population scale is appropriate. Some people (refuges) don't. Partnerships are important in admin scale. Pintails, mottled ducks are exceptions. Admin breakdown wouldn't help b/c it's not a logistical issue. Monitoring scale may be appropriate, but coverage may have gaps, in absence of real-time monitoring. Admin breakdown/simplification would create problems. We work within mandated boundaries. Admin regions don't factor into decision making. Probably. Flyways are best admin scale for thinking about packages. Ohio may not belong in Miss. Biological: probably, opportunity to revisit some pop'n delineations. Some exceptions.
Group 5	"Appropriate" should reflect tradeoffs among our objectives and constraints. At present time it seems clear that we are bumping up hard against our constraints (\$, people, expertise, etc) so perhaps its becoming less appropriate.
Question 2.	Decision Timing: How satisfied are you with the timing and frequency of decision making for waterfowl sport harvest? What challenges would arise if changes were considered in the temporal aspects of decision making in AHM?
Group 1	In a perfect world it would be best to have the upcoming season decision made based on current BPop etc. without a year delay. We know this isn't likely to happen. If we monitor every other year how often are decisions made? Annually, bi-annually? Etc. Can we change the decision-making process, so we don't have to make decisions annually and also maintain current monitoring structure? It takes a long time make changes with respect to Harvest Strategies etc. Changing timing would likely necessitate a change in frameworks and result in overall more restrictive policies.

- Group 2 Would like to go back to pre-SEIS, frequency of regs... should we consider decision sequencing... every 2 to 3 years... yes we should... we may be forced to go to every other year. Reg decision span over many years... need to know what the trade off is... Technical challenges would include changes in models, optimization, would raise questions about monitoring requirements during years regulations don't change... Preference for the annual decision making to be maintained...
- Group 3 Annual decisions probably too frequent in most cases, as far as risk management & actual changes made to regs. Balance of risk management: annual data/decision vs. longer period; w/ SEIS 2013, idea of setting regs year in advance or multiple years seems more palatable; Canada sets regs for 2-yr cycle. Hard to judge - been in liberal for so long; more important if reg changes more often; Longer time between decisions - more risk - or more risk adverse & lost opportunity. However, stability in regs seems to always be important when discussed, so perhaps a desired outcome. More clarity on emergency closure language; if moving to longer time period of decision making, could you take on more risk if more clarity on emergency closure. Capacity limitation; there are species we'd like to update frameworks and can't, disservice to public; if longer time period, could that free up more time; rigidity to structure (e.g., EMALL, switching to Multi-Stock). Satisfied with annual decision making, makes the most sense, especially geese which really do need close monitoring, where harvest can dig you in a hole where population takes awhile to recover. For maybe some ducks, longer time period might be possible. SEIS already affects timing and satisfaction by making decision 1 year out. Service/Reg setting CFR process creates dis-satisfaction; dissatisfaction when mis-match between Federal and State reg setting process, but maybe will be better in future. Many species we don't make annual reg decision (e.g., blue-wing teal, shoveler, wigeon, etc.) and even framework regs are pretty stable. Annual decision frequency makes this management system super robust (coupled with annual monitoring); important feature for selling system; Canada has 2-yr season setting process, maybe some flexibility there. Two scales: harvest strategies are in place for long time; inform them every year w/ annual data. Treaty language says we need to monitor system; pretty satisfied, as good as could be with annual monitoring. If we change frequency, vulnerable to litigation.
- Group 4 Annual is appropriate, given data. Need to be able to make adjustments. Current year regs is no longer an option. More than 1 year delay causes communication, conservation problems. Don't need to revise and update harvest strategies every year. Don't know. Could some species (webless) be every other year (or less)? Dependent on monitoring-improved monitoring needed, unless comfortable with more risk. Federal timeline is too constricted, loss of people. Constituents don't understand disconnect with delayed reg setting. Communications challenge. Set it and forget it may not work well for many species, can't entertain it without more monitoring. Fine in absence of federal delays. Prefer to have seasons set in April from state perspective. Annual is appropriate for resource, less frequency, exacerbate hunter loss, loss of relevancy. Frequency will have to decrease to keep pace with monitoring-no sense in updating with no new information. Will lead to more conservative seasons.
- Group 5 Unsatisfied with the SEIS 13 imposed disconnect between data collection and decisions. I believe its caused communication challenges and misunderstandings of process while we've gained very little relief in time available for assessment, reporting, and regulatory processes. Approach similar to what Todd presented makes more sense...make the regulatory lift the negotiation around and publication of the strategies and find and more streamlined and simpler regulatory solutions for annual regulatory actions that are in keeping with the published strategies. Need solution to tight regulatory timeline in summer regardless of frequency of DM. We could support multi year decision making easily. Monitoring importance increases under this approach not decreases. Reduce perception of tight mgt control.. Extend decisions 2-3 years or more with little impact on performance.

Question 3. Communication: What is the most difficult part of your job when it comes to communication and AHM? Please provide examples.

Group 1 Explaining to high level administrators the value of AHM because it has been successful. It is hard to keep them engaged when there isn't a problem to solve. In general, my biggest challenge is keeping higher level staff engaged in and maintaining an understanding of the process and/or informed of changes. I rarely have had questions from the public regarding AHM (Region USFWS) Public concerns about lack of conservatism in harvest: too much harvest and too much pressure. This also relates back to timing of surveys- low BPop and fully liberal regs because seasons are set. Communicating the process to the public is very difficult. Frameworks are common conversation especially closing dates. Frequently hunters want later closing dates. It is difficult to explain differences in AHM strategies between species. Difficult to explain the number of Days as well as zones and splits. Mechanics of AHM and the process. Difficulty in explaining how harvest is generated and plays in to AHM. The technical aspects of models can be easy to explain but not the optimization of decisions resulting from models. Explaining the value of the dataset to others is very difficult (e.g. the value the long term dataset). Communicating AHM process to academia is a challenge.

- Group 2 Challenges communicating technical details to decision makers, hard to find a common ground. In AK, communication issues don't really arise from hunters. Disconnect from monitoring and SEIS timing issues. Difficulty with explaining the models and technical details of the process the black box. Hard to communicate the uncertainty. Not much trouble explaining AHM, what is difficult is the communication burden (length and intensity), limited by access to technical experts, difficult to keep on top of cleaning up the misinformation and factual errors.
- Group 3 The need for it, specifically relative to goose management (r vs. K-selected species), complex (derived) vs. simple (prescribed) - but perhaps more litigation risk, allocation issues, overharvest potential, etc. w/ ducks. Optimization, infinite time horizon - vs. next 5, 10 years, etc. Fudge factors - scaling factors; e.g., scaling H to h (vs. Padding and Royle bias adjustment like w/ goose Lincoln estimates). Explaining to public; population estimates change every year with Bayesian models, not necessarily most important; hard to explain - right vs. wrong decisions; with absence of information, error on side of caution; EMALL going back to liberal without change in simple index - but model has changed, hard to convey that to public. Why we have reduced bags on species that seem abundant (e.g., pintail; 1 in 4 hunters will shoot a pintail on any given day; not like that in other states). Scaup on lower Columbia River, essentially all you will see. Communication issue with buy-in to AHM - everything decided in advance, so if in-year conditions change; pressure in CA to reduce bag on mallards because locally less abundance with drought. SEIS and 1-year delay; local conditions that hunters experience may not reflect continental dynamics; Mismatch of what hunters see and why regs are the way they are; growing mistrust of science. Internally, communicating AHM and success to leadership. Victim of our own success (e.g., Pam's presentation - reduced conflict), conveying that to leadership.
- Group 4 Complexity of technical underpinnings, optimization. Diff in harvest potential and strategies among species. Trouble conveying the benefits of AHM, rather than structure. Necessary complexity. With lack of funding, we can't maintain—might overexploit pop'ns. We still need some SDM process with targeted monitoring. Explaining the optimization process and how policy is derived (black box), e.g., 2 years of dry prairies and open seasons. What helps is population models. Explaining whole process to state admin. Optimization is a small piece, whole process is so different from anything else. Risk of loss of support for machinery is that we might lose hunters that don't come back
- Group 5 Depends on audience, procedurally/institutional naïve audiences require more background and context to explain what seemingly obvious solutions to problems are not employed; with management personnel its often been communicating the benefits and differences of formal adaptive strategies vs learning by doing and also parsing technical and policy elements of decision problems and why its so important to distinguish them.

Question 4A. Objectives: For most AHM decision frameworks, we cast a multi-criteria decision as a single objective optimization problem. Does this capture the objectives of waterfowl harvest management? Please list any objectives that are not being considered in AHM.

- Group 1 Fewer regulations for hunters to consider in field could be a good objective. Do not account for impact of harvest regulations on hunter dynamics (we do not account for participation) We do not keep track of frequency of regulation change as part of annual decision making. Many objectives we only actually deal with in the set up phase and not in the decision making process.
- Group 2 What is not captured, objectives related to simplicity for communication purposes... objective to optimize cost versus benefits with different frameworks... intensity of data needed to implement a an option... What is missing... formal connection between objectives for differing hunting strategies. MSY is more about opportunity than the biggest pile of dead ducks... current method to employ constraints and shoulder points is useful to avoid negative impacts of knife-edged strategies e.g., frequency of change or % of time in closed seasons.
- Group 3 Risk to conservation concern species (CANS, Pintail, etc.) At what point is harvest so much that you dig population into a hole - thinking more abundance and negative feedback; related to closure threshold, but is there a more sophisticated way to do some discounting. Big concern is avoiding closed seasons; shoulder strategies get at what you want but chicken-vs. egg. Predictions/optimization of number of hunters (Ricky's work). Total pile of dead ducks isn't experience by individual hunter. As state manager, believe optimization captures protecting resource and allowing for harvest - it does that. In hunter surveys, lots of people say seeing ducks is important, harvest maybe less so, so is that reflected. Optimization doesn't care if open vs. closed, maximizing total harvest - but yeah, maybe ways to discount harvest to avoid closure. Metrics we use for hunting opportunity and hunting satisfaction do they actually measure what hunters want (or are they only variables we can measure). Do we have any way to measure hunter satisfaction.
- Group 4 Yes, comfortable. But how are trade-offs treated and how has it changed over time? Including other partners will change objectives. Cost of meeting fundamental objective of maximizing opportunity and conservation? Feasibility of overhead to run everything. Risk to waterfowl pop'ns vs risk to hunter pop'ns. In the face of uncertainty, how weigh opportunity vs conservation? Sustainable populations, of which harvest is a piece.

Group 5 No as evidenced by the importance of evaluating strategy “performance metrics” in defining explicit objectives...Our objectives balance opportunity and sustainability(population size) but we’re often more concerned about regs frequency or regulatory stability (no knife edge) than Neq or total harvest for example. Human dimensions metrics like hunter satisfaction, wildlife viewer satisfaction also have historically been assumed to be addressed by our single objectives and I think that is appropriate given the challenges of framing such objectives more explicitly.

Question 4B. Modeling and Monitoring: We develop sophisticated models to make predictions about future system responses to exploitation. Learning through AHM requires observations from monitoring programs to compare to these predictions. What is more important to you: minimizing the cost of this complexity or maximizing harvest opportunity? Why?

Group 1 It really depends on the relationship between the two. If you can minimize cost a lot and have little impact on opportunity then minimizing cost makes sense. Minimizing complexity- more people can do work and increases trust in the system. We likely aren’t in a situation where we are maximizing use as it is. Too much time trying to maximize harvest comes at a cost. Continuing current opportunity is more important than minimizing cost at this point. The process must be sustainable and resilient.

Group 2 Minimize complexity... benefits of simplification... optimizing where to find the best trade-off... can we find where the optimal is on the cost benefit curve. But we also have to work within the constraints of trust responsibilities when thinking about complexity.

Group 3 Threshold as far as harvest opportunity vs. complexity; don’t care MSY (6 vs. 5) - but at some point it does matter (2 ducks). Issue of risk management - tolerate more risk (do you have to give up either?). Maximizing opportunity far more important, especially in the short-term (not infinite time horizon). Accept minimal risk, probably could except more risk. Maximizing harvest is more important, because minimizing cost could lose all opportunity (if you have no monitoring can’t support anything). Minimizing cost of complexity; system is fragile, tried to squeeze out every last duck, requires lots of maintenance, lots of monitoring. Increasing complexity has led to fragility of system. If we could perhaps back off a bit, maybe we could have simpler models, simpler monitoring. We’ve been under assumption hunters want us to maximize harvest, but not necessarily supported by data/HD surveys.

Group 4 Balance complexity and opportunity for impacts on people, but don’t have objectives for either. Minimizing cost is not an objective. Now, objectives dictate how resources are distributed. Cost is a constraint—could we provide more opportunity with more money? Can’t do what we do without monitoring, can’t deliver opportunity. Pre-IPM, don’t know how pop’n will respond to different harvest rates. Minimize complexity for some species. Partial controllability of harvest makes it difficult to manage with precision—gap in communication on precision. Simpler models make more sense for the control we have.

Group 5 How I would navigate this tradeoff doesn’t matter much. Who and how decide what the appropriate balance is? Partial control is relevant.

Question 5. Uncertainty: From your perspective, what form of uncertainty is the biggest impediment to our ability to inform waterfowl harvest regulations?

Group 1 Do hunters shoot only what is available? (Don’t control harvest). Effectiveness of harvest regulations on harvest rate? Uncertainty between BPop and Big H. Measurement error in key parameters.

Group 2 System change... structural (functional forms)... Bias... fixed sample frame of WBPHS... assumptions (e.g., stationarity...) landuse, social dynamics.

Group 3 Restricted budget and monitoring. Ability to predict future, system change. Compensatory vs. additive effects. State of the system, think we monitor it pretty well; how to reconcile various datasets Budget and monitoring;

Group 4 Population status (monitoring). Impact to hunter pop’n. Budget. Public support for hunting. System state. System change and assumptions about what monitoring numbers mean (e.g., counting drake numbers as a pair). Social and cultural dynamics.

Group 5 Non-stationarity and its effect on all sources of uncertainty (env, structural, partial control, partial observability).

Question 6. Stakeholders: Who are the primary stakeholders of waterfowl harvest management? Are there any groups or interested parties that are not currently considered stakeholders, but should be?

Group 1 Hunters because question is phrased as “Waterfowl harvest management.” If phrased differently then perhaps other groups. Respective agencies involved in the process (e.g., us in this room).

Group 2 Indigenous communities, hunters, agencies. We do manage the resource for the public benefit...



Group 3	Avid duck hunters; can we better represent average public - Joe the Plumber... Hunters are primary stakeholder; primary objective, though, is ensuring sustainable populations/abundance - so other stakeholders considered; with CAGO, e.g., conflict species, more explicit objectives for other stakeholders (e.g., farmers). People can't perceive continent duck population of 3.5M vs. 3M, e.g., based on local observations. Waterfowl themselves, the resource. General public; Broader public; little room/resources to broaden tent, primary goal is ensure harvest is sustainable; how do we involved others.
Group 4	Alaska Natives, birdwatchers, climate change people, ecosystem function people (ecosystem services). Hunting community, Tribes (Potawatomi and cranes). Hunting community, landowners. Adversarial relationship b/w Great Lakes (GLFWC) and Tribes.
Group 5	Sport hunters and subsistence hunters. Subsistence hunters especially outside AK are left out. Non consumptive users? Don't feel non-consumptive users are primary stakeholders.
Bonus	If you could go back to the setup phase of AHM, what would you do different?
Group 1	Multi-stock approach from beginning? Was this possible? Make it less mallard centric and less data hungry.
Group 2	Use an IPM... design a system that had more involvement by administrators... and a dedicated budgeting process to support monitoring...
Group 3	Explicit consideration of low harvest potential species. Broader objectives and Experimental seasons.
Group 4	Nothing, but we've learned. Design, implement, integrate studies of climate change, human dimensions (system change). Put bounds on proliferation of frameworks, strength in setting general waterfowl seasons. Within that, better, simpler ways for setting specific frameworks. Monitoring system change, sex ratio. Cost and overhead.
Group 5	Confront the multistock issue upfront; deal with risk/uncertainty more effectively and explicitly at the outset - how we manage multiple stocks with different life history/status/harvest pressure.

## Discussion Results from Round Robin Session

**Table 5** – Foundational elements of Adaptive Harvest Management identified from each participant of a Round Robin discussion at the Harvest Management Working Group meeting.

<b>Negotiable</b>	
1.	Time-step
2.	Harvest packages
3.	Prescribed, derived, adaptive
4.	Monitoring approaches/programs
5.	Analytic framework (PTL, discrete logistic, balance equation)
6	Complexity associated with single species management
7	Level of complexity/simplicity
8	Amount of biological risk
9	Trade-off between complexity and opportunity
10	Frequency of decision making
11	Amount of harvest opportunity
12	Doesn't have to be optimization
13	Learning and adaptation - Testing hypothesis through regulatory process
14	Structure and content of decision making
15	Monitoring programs can change (but must serve decision making) Types and design of monitoring programs
16	Service Regulations Committee
17	Integration of populations, habitat, and people
18	Partners at the table
19	Additional flexibility with regulations
20	Intensity of monitoring
21	Technical details of modeling framework
22	Incorporation of additional objectives
23	Non-rigorous surveys
24	Annual abundance and habitat survey
25	Harvest regulatory packages
26	Harvest objective (MSY, RSS)
27	Structure and composition of Fed/Flyway decision making bodies
<b>Non negotiable</b>	
1.	Cooperative process between Feds and Councils
2.	Decision-analytical approach (science-based)
3.	Flyway or Continental scale (no state options)
4.	Scientific rigor/defensible
5.	MSY or RSS
6.	Objectives associated with MBTA (sustainable harvest/trust responsibilities)
7.	Science based
8.	Defensible decision process
9.	Durable decision making (can withstand legal challenges)
10.	Annual decision making
11.	Cooperative management with Flyway partnership (state-federal partnerships) Partners must have regulatory authority. Cooperative state/federal monitoring
12.	Co-management with indigenous communities
13.	Decision-analytic approach (includes appropriate monitoring; quantifiable objectives, Etc.)
14.	Objectives, Alternatives, Models, Monitoring, Trade-off analysis

15. Monitoring (Annual - but methodologies can change, Scientifically rigorous - counts and banding, Annual estimates of abundance and take)
  16. Having hunting seasons
  17. New partners must bring something new to the table
  18. Maximizing opportunities for hunters
  19. Providing hunting opportunity commensurate with current levels (not necessarily same as maximizing) - assuming biologically appropriate (requires monitoring)
  20. Annual banding program, harvest estimation
  21. Minimum of 2 data streams
-

## FY2024 Harvest Management Working Group Priorities

**Table 6** – Priority rankings and project leads identified for the technical work reviewed at the 2023 Harvest Management Working Group.

<b>Priority Level</b>	<b>Status</b>	<b>Participants</b>
<b>Highest Priorities (Urgent and Important)</b>		
Reconsideration of North American duck harvest management	On-going	Flyway Councils, DMBM
Northern Pintail AHM revision	On-going	Flyway Councils, DMBM, USGS
Evaluation of Experimental two-tier license system	On-going	Central Flyway, DMBM
<b>Long-range Priorities (Non-urgent, but Very Important)</b>		
Time-dependent optimal solutions to address system change (e.g., habitat change; hunter dynamics; climate change).	On-going	USGS, BADS
<b>Additional Priorities</b>		
Assessment of diving duck harvest capacity	Proposed	Flyway Councils, DMBM
Western mallard AHM revision	On-going	Pacific Flyway, BADS
Waterfowl Banding Needs Assessment	On-going	BADS, USGS, Flyway Councils

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This list includes only permanent members of the Harvest Management Working Group. Not listed here are numerous persons from federal and state agencies that assist the Working Group on an ad-hoc basis.

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**Figure 2** – The participants of the 2023 Harvest Management Working Group meeting in San Diego, California.