Harvest Management Working Group

2015 Annual Meeting Report

December 2015
Laurel, Maryland

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PREFACE

This report provides a summary of presentations and discussions that occurred at the 27th meeting of the Harvest Management Working Group (HMWG). The 2015 meeting focused on the work related to the double-loop learning process of Adaptive Harvest Management (AHM), and the challenges of coordinating the revision of AHM frameworks across Flyways. For meeting details please refer to the appended 2015 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 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 2015 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.

Cover Photo: State technical representatives dressed for the balmy weather in Laurel, MD for the 2015 Harvest Management Working Group meeting.

1 Partner Reports

1.1 Atlantic Flyway (*Min Huang and Greg Balkcom*)

Multi-stock Harvest Management

The Atlantic Flyway is committed to the development of a decision framework based on the collective status of several representative duck species. This framework will consider the status of five representative duck species (mallard, green-winged teal, wood ducks, ring necked ducks, and common goldeneye) for determining the general duck season package. These species represent the suite of habitats that the Atlantic Flyway agencies and partners are trying to conserve and protect and are the most important species from a harvest standpoint. As we consider the status of these representative species, the ultimate goal is to integrate habitat management and harvest management objectives into this framework. In advance of implementation of this multi-stock framework there are four basic components of the framework; objectives, hypotheses, management actions/alternatives, and outcomes of those alternatives that need to be formally identified.

The Atlantic Flyway technical section and Council have identified fundamental objectives and developed the measureable attributes for those objectives. We have also made progress with developing a population model using the discrete logistic. Input into this population model so far has been mallards, ringnecks, common goldeneye, and green-winged teal. Wood ducks are the final species input into the model. The Atlantic Coast Joint Venture technical committee developed a wood duck population estimate using a Lincoln estimator. The USFWS recently presented another way of estimating wood duck population size utilizing Breeding Bird Survey and Northeast Plot Survey data. We will decide which approach to use for wood duck population size estimation and once we do, incorporate those time series into our population model. One issue that may tip the decision towards the Lincoln estimator is the fact that we may not be able to compile the BBS data in time, and thus would be using data that is 2 years old. We would prefer to use the BBS integrated data. We still have some technical work to be done with the population modeling, but we don't foresee that this will be a hurdle, merely a time constraint issue at the moment.

We think that if we treat each species population abundance as a discrete, rather than a continuous variable, that we can jointly optimize across all five species, particularly now that we are using MDPSolve software to optimize instead of ASDP. The thought is to divide up the range of each population size (0 to K) into discrete intervals (bins) that each encompass a specific range of population size. We will then model the probability that given a particular regulatory alternative (e.g. liberal duck season) and a starting population state in year t that the population will fall into a certain interval in year t+1.

Despite the fact that the AF does not want an objective function of maximizing harvest, the optimization requires that we maximize some metric, be it harvest or something else. Traditionally that metric has been harvest, as is the current case with Eastern Mallard AHM. The optimization occurs in the context and form of the objective function. Thus, how you frame the objective function is critical towards meeting the stated objectives of the framework, in our case the two fundamental objectives of sustainable duck populations and satisfied hunters. The AF feels that an objective function that strived to meet a range on the right hand side of the yield curve was the best starting point for an objective function. A shoulder strategy tends to be more conservative, doesn't maximize harvest, results in higher equilibrium populations, and from a regulatory standpoint tends to lead to more stable regulations. The AF felt that an objective function that resulted in the highest probability of equilibrium populations between 90% and 98% of MSY was a good starting point.

The hypotheses that the AF will need to consider and develop models for revolve around how harvest affects BPOP and duck survival and also how said harvest affects hunter recruitment, retention, and satisfaction. Hypotheses revolving around habitat management include how habitat management can influence duck vital rates (survival and reproduction) and how habitat management can influence hunter access. We are working with both the Black Duck JV and the Atlantic Coast JV on a number of projects to try and elucidate some of these habitat related hypotheses.

Management actions/alternatives that we will need to consider include regulatory alternatives on the harvest management side (season length, bag limits, etc) and how those affect harvest rates and hunter activity. On the habitat management side how does habitat delivery influence duck vital rates, numbers, and distribution. How also, does habitat delivery affect hunter access and behavior.

We have conducted some preliminary Human Dimensions work via an online survey to hunters in 11 of the 17 member Atlantic Flyway states. This short survey was geared towards assessing hunter preferences for regulatory alternatives (bag limits, species specific bags and season length) and the impacts to participation of those alternatives. A total of 12,740 responses were received. This constitutes approximately 7.25% of all HIP registered waterfowl hunters in the Flyway. Responses were received from hunters who lived in every state, however, 11 states were able to send out an email blast (DE, FL, MD, NC, NH, NJ, NY, PA, SC, VA, and VT) to their constituents. A total of 40% of respondents indicated that current species specific regulations in some manner negatively impacted their hunting activity. We need to investigate this further, in order to determine whether there truly is an effect on retention of hunters. It is clear that hunters in the AF want to maximize the days they can spend hunting (that is how they define opportunity) and that being able to relax the species specific regulations we currently have isn't worth losing any hunting opportunity over.

We have also completed work examining how bag limit changes might affect harvest rates and how that might vary regionally. Along with this work was a harvest derivation analysis of the 5 species that are to be included in the decision framework. This work will be critical as we start examining the tradeoffs of various regulatory options such as the status quo packages, a potential 'unrestricted' bag limit, and other perturbations.

Species Specific Harvest Strategies

The Atlantic Flyway continues to advocate the use of the least number of species specific harvest strategies. At present and given the current climate with regards to human resources, we would like to see effort put into multi-stock management rather than investing those resources into development of more species specific harvest strategies.

1.2 Mississippi Flyway (*Larry Reynolds and Adam Phelps*)

Mid-Continent Mallard (MCM) Double Looping

Harvest management discussions in the Mississippi Flyway have focused on the MCM double-looping process over the last year. Progress was made during the winter Flyway Tech Section meeting and at small-group meetings with representatives of the Central Flyway and USFWS. At their July 2015 meeting, the MF Council endorsed the document "Problem Statement: Establishing Annual Duck Harvest Regulations in the Central and Mississippi Flyways". The current status and directions of the double-looping process will be discussed in more detail later at this meeting, but at least 2 positions have been strongly articulated by our Flyway: 1) duck harvest regulations should remain centered on mallards, and 2) the NAWMP population constraint should be removed from the AHM modeling and optimization process.

However, substantial confusion exists regarding the double-looping exercise from things as fundamental as harvest management objectives to what the endpoint should look like. As an example, a key point of the first small-group meetings in 2014 was that resources allocated to support waterfowl harvest management were declining or being diverted to other uses, and that our current path was unsustainable. It seemed important that we find methods to maintain structured decision-making in harvest management with fewer resources. That message has caused some discomfort in the suggestion that our current efforts are potentially unsustainable, rather than just continuing down the path of more species-specific harvest

strategies. Especially at the Council level, some guidance may be needed regarding resource limitations as the double-looping process proceeds.

There is additional confusion, or maybe concern, about how the MCM double looping affects other Flyway issues. There is growing support to extend the end date of the framework to January 31 every year. Although extended frameworks are certainly part of the MCM double looping, there is disagreement about making such a recommendation before the double-looping is complete. There is similar uncertainty regarding the canvasback harvest strategy. Recognizing the issue of potential resource limitations, it is probably not the time to develop a completely new harvest strategy, but some decision tool is necessary until the double looping is complete. We understand that is an important topic for this meeting. Lastly, there is uncertainty over the inclusion of other hunter-related harvest management objectives within biological boundaries, like the traditionally-requested one-step constraint in AHM optimization. We've long felt that expected impacts to hunter numbers and participation induced by changing from Liberal to Restrictive harvest framework without first using the Moderate option greatly exceed any impacts to duck populations or vital rates. There are many similar hunter-related proposals, like the recommendation to increase the age of eligibility for youth waterfowl hunting that complicate our discussions.

SEIS

The MFC recommended that late-August is the best time for the fall regulations meeting prior to the Service Regulations Committee meeting. That provides over 3 additional weeks to produce the AHM documents than currently, and provides far fewer conflicts with fall activities in Flyway states. The fall meetings in the MF are scheduled to begin August 22 in 2016 in Louisville, KY and August 21 in 2017 in Michigan.

Harvest Data

Harvest data is being used more often in waterfowl harvest management. There is expanding consideration of Lincoln-Peterson population estimates in lieu of or in association with traditional aerial surveys to monitor waterfowl populations. We also anticipate increasing need for estimates of hunter numbers and participation as regulatory changes intended to influence those parameters are considered in the MCM double looping and implementation of the 2012 NAWMP revision. Consequently there is a growing need for high quality harvest estimates. However, there are concerns about the quality of data coming from the Harvest Information Program (HIP) as evidenced by the consternation over estimated hunter numbers in the 2013-14 season that were inconsistent with license sales in a number of MF states. The concern is not limited to the USFWS; investigation of harvest data inconsistencies in at least AR and LA exposed problems with state data management as well. We are concerned that current harvest survey methodology and allocated resources are not sufficient to generate consistent, reliable estimates of harvest, hunter numbers, and hunter activity to support anticipated expanded uses of those data.

1.3 Central Flyway (*Mark Vrtiska and Mike Szymanski*)

The primary issue and work item for the Central Flyway that affect decisions for future regulatory cycles centers on the double-looping process for mid-continent mallard adaptive harvest management (MCM AHM). We believe progress has been made on MCM AHM this past year, working in conjunction with the representatives from the Mississippi Flyway and U.S. Fish and Wildlife Service (Service). Considerable work remains, and the Central Flyway looks forward to moving ahead with MCM AHM revisions, particularly as they may affect overall duck harvest management. We hope to move ahead in the double-looping process, but recognize that some aspects regarding ideal packages will need to be laid-out in a preliminary manner. Over the next year, we hope to better align our decisions with results from the upcoming Stakeholder Survey. Additionally, we recognize the emerging sub-objective of "reducing the

overhead" associated with the regulatory process (i.e., staff time devoted to technical analyses that need to be performed on an annual basis as part of the regulatory process). While most on the HMWG agree that the process could be simpler, discussions seem to end "technically heavy" with an unwillingness to move into a management paradigm built off previous AHM experience that uses basic decision making processes that could be understood by most constituents.

Currently, the new regulatory process has not been a serious issue to Central Flyway states. However, potential conflicts or issues may arise as new situations present themselves. The change in the process also requires adjustments or alternatives to harvest strategies that now longer work in the new regulatory schedule. For example, an interim or new harvest strategy for canvasbacks is necessary to work within the new regulatory schedule. The Service's Regulations Committee recently tasked the Migratory Birds Division to develop a new canvasback strategy in cooperation with the flyways for use in promulgating canvasback harvest regulations during the next regulatory cycle.

The Central Flyway remains, and is becoming increasingly concerned about the Service's commitment and resources available to various programs associated with migratory bird management, particularly game birds. Recently, the Service alerted the states to reductions in their future participation in the mid-winter survey. This is yet another example of diminishing priority, commitment and resources toward cooperative management of trust species. This management paradigm cannot be sustained without irreparable damage or major changes to the Service's ability promulgate, implement, and update harvest strategies and regulations. Undoubtedly, the Service's lack of commitment will undermine abilities of states to garner cooperative support and effort to collectively manage migratory birds.

Finally, the concerns that we have expressed in previous HMWG meetings still remain. Primarily, we see waterfowl hunter recruitment and retention, issues relating to banding programs, and Canada and light goose issues as top priorities. It should be noted that these are the opinions and perceptions of the Central Flyway's HMWG representatives, both long-term members of the Central Flyway, and that this statement has not been reviewed or approved by the Central Flyway.

1.4 Pacific Flyway (*Jeff Knetter and Dan Rosenberg*)

The Pacific Flyway Study Committee (PFSC) and Pacific Flyway Council (PFC) reviewed HMWG priorities at the early-and late-season regulations meetings in 2015. The PFC endorsed the following 2016 priority rankings and project leads for the technical work proposed at the 2014 Harvest Management Working Group (HMWG) meeting:

Highest Priorities (Urgent and Important)

- Mallard AHM Revisions (aka, Double-looping)
  - Multi-stock management (Atlantic Flyway, PHAB, HMWG).
  - Mid-continent (Mississippi and Central Flyways, PHAB, others...).
  - Western (Pacific Flyway, PHAB, others...).
- Consideration of NAWMP objectives for waterfowl management (HDWG, Flyway Councils, FWS, NAWMP Interim Integration Committee, Joint Technical Committee, others...)
- Re-invigorate institutional support for AHM (PHAB and HMWG Communications Team)

Long-range Priorities (Non-urgent but very important)

- Time dependent optimal solutions to address system change (Scott Boomer, Fred Johnson, Mike Runge).

  - Habitat change
  - Hunter dynamics
  - Climate change

- Northern pintail AHM Revision (Double-looping) (Pacific Flyway, PHAB, others...).

Additional Priorities

- Sea duck harvest potential assessment (Sea Duck Joint Venture, HMWG).
- Two-tier licensing system evaluation (Central Flyway, HMWG).

The PFC acknowledges a revised approach was necessary to address the technical challenges associated with implementation of the preferred alternative specified in the Final SEIS. In addition to this highest priority, each of the priorities identified by the Pacific Flyway (i.e., Western Mallard Model updates, pintail model updates, and sea duck harvest potential assessment) are included in the HMWG priorities.

The PFSC and PFC also recognizes the limited capacity of the U.S. Fish and Wildlife Service's (Service) staff time and resources to address the technical challenges associated with implementation of the preferred alternative specified in the Final SEIS and develop, implement and update all of the harvest strategies. Because the HMWG has not had time to fully address the current priorities identified by the PFC, we are not submitting new priorities in 2015. Therefore we reiterate our past priorities, which have not been fully addressed due to these limitations.

Western Mallard Model

Since 2011, the PFC has requested the Service revisit the Western Mallard Model (WMM), developed during 2008, to include other breeding and harvest areas important to the Pacific Flyway. The WMM was initiated to set framework dates and regulatory packages for mallards in the Pacific Flyway. During that time, only California, Oregon, and the Alaska-Yukon breeding populations were used in this population model. However, recent development of breeding population surveys in both Washington and British Columbia meet existing standards for inclusion into the WMM. Furthermore, it is necessary to revisit objectives and consider constraints to minimize large annual changes in regulation packages with relatively small changes in population size (i.e., liberal to closed seasons with no moderate or restrictive intermediate steps). The PFC recommends the Service proceed with the revision of the WMM AHM strategy for implementation during the 2017-2018 season, to incorporate additional stocks important to the Pacific Flyway, and consider a constraint to prevent major changes in regulations associated with minor changes in population size. The PFC endorsed a scoping document (requested by the Service) in September 2015.

Northern Pintail

In 2010, the PFSC recommended a pintail harvest strategy to include an option of a liberal bag limit of 3 in the recently adopted derived strategy. The PFC compromised with other flyways for a maximum limit of 2, which was adopted by the Service. The breeding populations of northern pintails were estimated at approximately 4.4 million in 2011, 3.5 million in 2012, 3.3 million in 2013, 3.2 million in 2014, and 3.0 million in 2015. Pintails have increased at least 67% in recent years from the low of 1.8 million in 2002. Based upon current population estimates, the PFC would like to reopen discussion about increasing pintail harvest potential at higher population levels.

Harvest strategies of northern pintails continue to be a high priority for the Pacific Flyway. The PFC continues to support efforts to develop harvest strategies and refine the population model to meet both biological and human dimension goals. Additionally, the PFC supports future technical developments with

the current pintail model that may include updated information on parameter estimates used in this model and possible increased bag limits in the harvest packages.

The Pacific Flyway supports reviewing the pintail harvest strategy models in an effort to develop a revised harvest strategy that will allow for a 3-bird bag limit when populations are high while simultaneously

(1) balancing objectives across all four Flyways;

(2) minimizing closed seasons;

(3) eliminating partial seasons and seasons within seasons;

(4) minimizing regulation changes; and

(5) maximizing a greater than 1 bird limit and full seasons.

1.5 Canadian Wildlife Service (*Joel Ingram*)

Migratory Birds Hunting Regulations

Migratory birds hunting regulation amendments are currently being considered for the next two year cycle that will cover the 2016-17 and 2017-18 hunting seasons. Regional stakeholder consultations are underway, regulation proposals will be published in a report that is available for public comment in January. CWS will consider input from consultations and finalize regulation proposals by the end of March. Final regulations are approved by the Governor-in-Council and published in July.

Proposals of note currently being considered:

- establishment of a mourning dove hunting season in Quebec;
- optimal Canadian policy from the Black duck International Harvest Strategy, is the moderate regulatory package;
- expansion of the lesser snow goose spring conservation measures to Yukon;

Black Duck Harvest Management

CWS remains involved in the Black Duck Adaptive Harvest Management Working Group which will be undertaking a model review in 2016.

Light Goose Harvest Management

Western Arctic lesser snow geese and Ross's geese were designated as overabundant in Canada in 2014. In 2015, a spring conservation hunt occurred for the first time in Alberta and Northwest Territories. Based upon harvest survey results there were 688 ± 125 active spring hunters in Alberta with an estimated harvest of $8,207 \pm 3,386$ light geese ($\sim 15\%$ Ross's Geese). In the Northwest Territories, 5 out of 373 (1.3%) permit buyers indicated that they hunted geese in the previous spring. CWS initiated a western arctic snow goose banding program on Banks Island to monitoring populations and effects of conservation measures. Environment Canada continues to focus science efforts to improve our understanding of impacts to arctic habitats and wildlife.

Canadian Harvest Survey Review

A review of the CWS harvest surveys has been recently initiated to: 1) revisit the survey objectives and evaluate current data needs and gaps, and 2) modernize the survey methodologies, given the new electronic permitting system. As an initial step, a questionnaire on various aspects of the survey was recently developed and circulated to seek insight and opinions from CWS staff (managers, biologists, technicians, researchers) and partners (e.g., provincial biologists, Flyway reps, JV members, USFWS colleagues). The review would benefit from input by anyone who uses Canadian harvest survey data, the questionnaire is available upon request, responses directed to Michel Gendron, by December 7th. A harvest survey working group will be formed in the New Year to lead the review. There will be ongoing engagement of partners as the review proceeds.

Modernization of Migratory Birds Regulations

CWS continues to make progress on the modernization of Canada's Migratory bird hunting regulations to improve the management of hunting in Canada. All comments received to date have been considered in the development of final regulatory proposals. The proposals will be published in the Canada Gazette for public consultation before finalization and coming into force. The goal remains to have the regulation changes in place for the 2017–18 hunting season. Migratory Game Birds Banding Needs Assessment CWS is establishing a working group to complete a banding needs assessment for all migratory game birds. The first step will be to define information needs for management and research purposes in Canada. Scope of the review has yet to be defined, and we want to complement efforts in the US.

1.6 Communication Team Update (*Jim Kelley*)

At the December 2015 HMWG annual meeting the Communications Team convened to discuss communication issues facing the HMWG and the duck harvest management community at large. The HMWG communications strategy was revised in 2014 and 2 major themes highlighted in that revision were: 1) SEIS13 implementation and 2) re-establishing institutional knowledge of and support for AHM. Communication products (white paper and Q and A's) were developed to address the first of these themes and distributed to Flyways in spring 2015 for use in interactions with various constituencies.

At this time (December 2015) we are experiencing an overlap between the 2015-16 hunting season and initiation of promulgation of regulations for 2016-17. Because the proposed rule for 2016-17 seasons will be published in mid-December 2015, the Communications Team believes that there will continue to be a need for the communications products related to SEIS13 implementation. Therefore, these products will be updated and reviewed by mid-December and distributed to Flyways soon thereafter.

The Communications Team also believes there is a continued need for communications products aimed at strengthening institutional support for AHM. Several presentations on "AHM 101" have been developed over the past few years and presented to Flyway Technical Sections and/or Councils. A more basic presentation on mid-continent mallard AHM was made to the Mississippi Flyway Council in July 2015. The Communications Team believes that a more generic (i.e. not stock-specific) version of "AHM 101" should be developed for use with internal audiences (i.e. Service Regulations Committee, Flyway Councils, other agency personnel) to foster a basic understanding, and thus ownership, of the principles of AHM for duck management. Videos that have been produced and placed on the flyways.us website continue to be useful in explaining the concepts of AHM to the public. A draft of a white paper aimed at fostering institutional support for AHM was developed in spring 2015 and will be updated and distributed for review by the Communications Team by late December 2015.

With the advent of double-looping efforts with eastern and mid-continent mallard protocols, and technical revisions to the western mallard protocol, the Communications Team believes that new communications

products should be developed over the next 12 months for use with internal and external audiences. It is likely that there will be a need for products for use with internal audiences much sooner than there will be for products for external audiences.

The following timetable (Table 1) represents the major administrative steps that either have already occurred or will be taken over the next 6 months to promulgate migratory bird hunting regulations for both the 2015-16 and 2016-17 seasons. This information has proven helpful to technicians and administrators who must reply to questions concerning SEIS13 implementation.

Table 1 – A timeline of meetings and regulatory deadlines to administer the promulgation of migratory bird hunting regulations.

June 2015	Early Seasons Service Regulations Committee meeting for 2015–16 seasons
June 2015	First Service Regulations Committee meeting for 2016–17 seasons
July 2015	Flyway Council and Technical Section meetings for 2015–16 late seasons
July 2015	Late Seasons Service Regulations Committee meeting for 2015–16
August 2015	FWS publishes early seasons final frameworks 2015–16 seasons
September 2015	FWS publishes late seasons final frameworks and season selections for 2015–16
Sept. to early Oct. 2015	Flyway Council and Technical Section meetings for the 2016–17 seasons
October 2015	Service Regulations Committee meeting for all 2016–17 seasons
December 2015	FWS publishes proposed rule for all 2016–17 seasons (30 day comment period)
April 1, 2016 Deadline	FWS publishes final frameworks for all 2016–17 seasons
April 30, 2016 (tentative)	State season selections due to FWS
June 2016	FWS publishes season selections for all 2016–17 seasons

2 2017 Regulation Cycle

2.1 Meeting and Reporting Schedules

The HMWG briefly discussed the upcoming meeting schedule (Figure 1) and noted that any technical changes to formal harvest strategies for the upcoming regulatory cycle would need to be communicated at the June meeting which may require the development of a supplemental notice in the Federal Register. As a result, some decisions may need to be made at the June meeting.

2.2 Black Duck AHM (*Pat Devers*)

Optimal country-specific regulatory policies for the 2016-17 hunting season were calculated using:

(1) the black duck harvest objective (98% of maximum sustained yield);

(2) the harvest parity constraint;

(3) 2016–17 country-specific regulatory alternatives;

(4) current parameter estimates for mallard competition and additive mortality; and

(5) 2015 estimates of 541,000 breeding black ducks and 406,000 breeding mallards in the core survey area of eastern Canada.

The optimal regulatory policies are the MODERATE alternative in Canada and the RESTRICTIVE alternative in the U.S. On-going technical work includes transition of model optimization code from ASDP

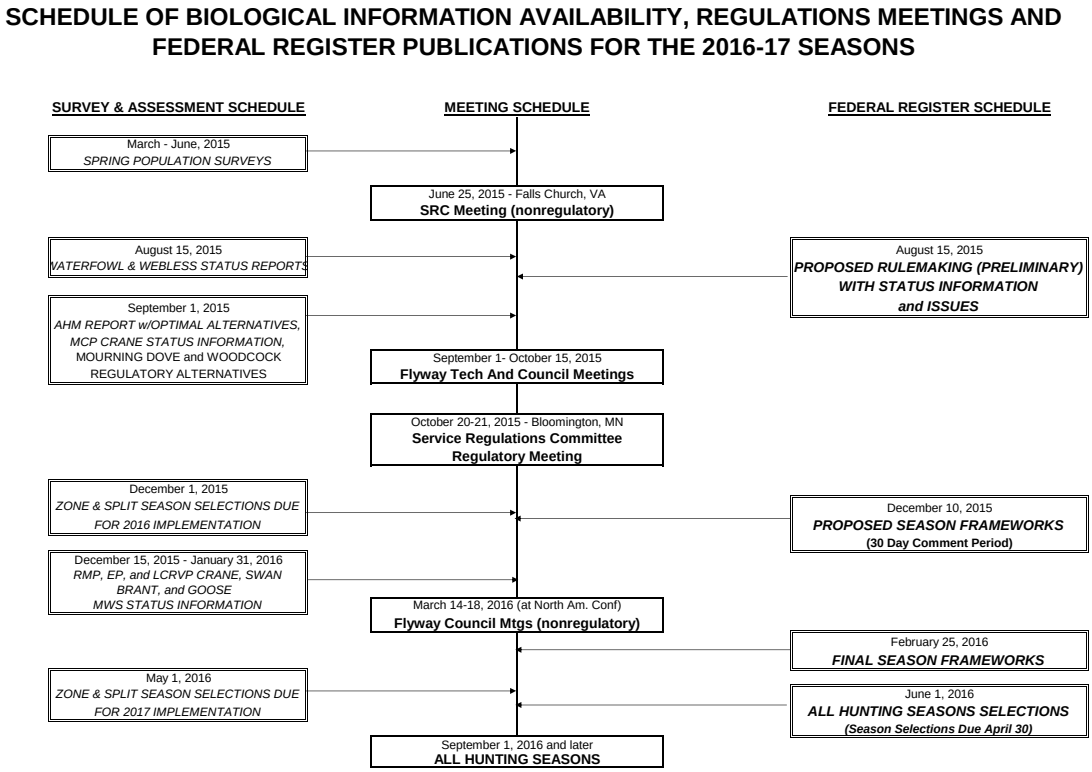

Figure 1 – Schedule of biological information availability, regulation meetings, and Federal Register publications for the 2016–2017 regulations cycle with updated AHM protocols associated with the implementation of the SEIS 2013.

to MATLAB and MDPSolve and a revision to the definition of Indicated Breeding Pairs (IBPs) as measured by the Eastern Breeding Waterfowl and Habitat Survey. Based on an analysis of long-term data from the Quebec helicopter survey and New Jersey plot survey it is apparent that most observations ($> 80\%$) of 2 black ducks consist of male-female pairs and that male-male pairs are less common than originally assumed. Therefore, observations of 2 black ducks should be considered 1.0 IBPs rather than 1.5 IBPs. This revision results in a decrease in the estimated abundance of black ducks, but does not change the trend in abundance over time. This change will be made in 2016.

2.3 2017 Canvasback harvest strategy development (*Pam Garrettson, HMWG*)

Following the October 2015 Service Regulations Committee meeting, a small committee consisting of at least one representative from each Flyway and FWS personnel met to develop a preliminary set of priorities and objectives for canvasback harvest management. The HMWG discussed these objectives and possible options for assessing canvasback status and setting regulations. All participants expressed a desire for stable, simple canvasback regulations. Participants also noted that the mid-continent mallard AHM double-looping process and the exploration of multiple-stock management could mean that the overall

regulations framework within which canvasbacks are managed could look very different in a few years. Thus, they desired a biologically sound but simple method that could be employed in a timely manner in the interim. The group agreed to explore Potential Take Level (PTL) analyses of currently available canvasback data. Fred Johnson, ran some preliminary analyses, using the demographic invariants method to derive estimates of r_{max} (the intrinsic population growth rate) and K (carrying capacity), based on historic canvasback BPOP, age ratio and harvest data. Using these estimates in a discrete logistic growth model, he used the program MDPSolve ©) to calculate the optimal harvest rates of canvasbacks under an objective of maximizing long-term cumulative harvest. The resulting policy calls for an L2 season at canvasback BPOPs $> 480,000$, a closed season at BPOPs $< 460,000$, and an L1 season between 460,000–480,000. The committee requested that Pam Garrettson and Erik Osnas write up these analyses and results, and do some additional exploratory technical work prior to the winter flyway tech section meetings.

3 Partner Updates

3.1 Implementation of the 2012 NAWMP Revision: Report from the Interim Integration Committee (*Dale Humburg*)

Seven recommendations from the 2012 NAWMP Revision provide the overall framework for implementation:

(1) Develop, revise or reaffirm NAWMP objectives so that all facets of North American waterfowl management share a common benchmark;

(2) Integrate waterfowl management to ensure programs are complementary, inform resource investments, and allow managers to understand and weigh tradeoffs among potential actions;

(3) Increase adaptive capacity so structured learning expands as part of the culture of waterfowl management and program effectiveness increases;

(4) Build support for waterfowl conservation by reconnecting people with nature through waterfowl, and by highlighting the environmental benefits associated with waterfowl habitat conservation;

(5) Establish a Human Dimensions Working Group to support development of objectives for people and ensure those actions are informed by science;

(6) Focus resources on important landscapes that have the greatest influence on waterfowl populations and those who hunt and view waterfowl;

(7) Adapt harvest management strategies to support attainment of NAWMP objectives.

Progress on these objectives has been through specific initiatives by various waterfowl working groups (e.g., revision of objectives, stakeholder surveys, revisiting landscape priorities, public engagement task groups, and "double-loop" efforts for harvest management) or by thematic approaches throughout implementation (e.g., emphasis on SDM, broad participation to ensure integration, and focus on monitoring and evaluation). Methodical progress in implementation and ultimately, a 2018 NAWMP Update is anticipated through interim "stakes in the ground" in the form of a special session at the 7th North American Duck Symposium (NADS - February 2016) and a second Future of Waterfowl Management Workshop (FoW2 - September 2017 - initial workshop was in 2008). Presentations at NADS include conceptual frameworks as well as tangible progress towards implementation:

- From coherence to integration: challenges of multiple scales, decision authorities, and processes (Michael G. Anderson)
- Values translated into objectives: Engaging waterfowl stakeholders (David C. Fulton, et al.)

- Modeling and Managing Linkages across Objectives: Beyond the JTG (Michael C. Runge)
- Adaptive Harvest Management: Re-examining harvest objectives and approaches (Mark P. Vrtiska, et al.)
- Integrating Human Dimension Considerations into Joint Venture Habitat Delivery (Michael F. Carter, et al.)
- Focusing resources on important landscapes: A spatial framework for integrating NAWMP objectives (Michael G. Brasher, et al.)
- Integrated annual cycle models of North American ducks: progress, pitfalls and prospects (John M. Eadie, et al.)
- Multi-Level Learning in Waterfowl Conservation (Fred A. Johnson, et al.)

The presentations at NADS essentially provide a progress report on implementation of the Revision. They also set the stage for the progression from planning (2012 Revision) through implementation, assessment, and engagement necessary to ensure continued evolution of waterfowl management on the continent. The challenge will be to capture the gains made during 2012-17, engage the professional community in advancing these themes further, and transition from technical progress (NADS) to policy implementation (FoW2). Potential policy advances might take the form of the following:

- Agree on the highest priority and scale of decisions that integrate waterfowl populations, habitat, and supporters
- Establish a framework for revisiting NAWMP objectives (HD-informed values) and a process for considering future revisions
- Confirm Adaptive Harvest Management as the framework for regulations; however, consider potentially changes in harvest management objectives
- Recommend amended harvest objectives and a process and schedule for periodically revisiting regulations packages
- Institutionalize human dimensions approaches to the point of routinely and correctly incorporating results into adaptive management
- Assess tradeoffs with regard to waterfowl habitat delivery and allocate resources in light of multiple objectives (waterfowl populations, hunters/viewers/general public, and EGS)
- Use decision support to guide management actions in light of alternative and often conflicting management objectives
- Reorganize institutions and processes as necessary to support an integrated system of waterfowl conservation

The plan for moving forward with implementation and planning for the 2018 Update involve the following general schedule:

- 2015
  - Plan Committee reviews framework for the NAWMP Update
  - Formulate an Update Steering Committee (USC)
  - Lock in FoW2 workshop
  - Develop an assessment/update process

- 2016
  - Participate in the 7th North American Duck Symposium - NAWMP special session
  - Plan Committee approves the update assessment and planning process
  - Initial plans and working group assigned for the Future of Waterfowl Management Workshop
  - Develop invitations for FoW2 (send out well in advance of workshop)
  - Initiate 2012 Revision assessment as part of planning for FoW2 (USC)
- 2017
  - Complete stakeholder survey and determine how to integrate into FoW2 and 2018 Update
  - Conduct FoW2 workshop
  - Final assessment of 2012 Revision and incorporate into process of 2018 Update
  - Draft actions for 2018 Update
  - Draft of 2018 Update review by waterfowl management community
- 2018
  - Finalize 2018 NAWMP Update - submit for signature

3.2 Human Dimensions Working Group (*Mark Vrtiska*)

The Human Dimensions Work Group (HDWG) met 9–10 September, 2015 in St. Louis, Missouri in conjunction with the Public Engagement Team (PET). The primary topic of the meeting was the impending stakeholder surveys (i.e., general public, waterfowl hunter, and bird viewer). Initial (and considerable) discussions were on the sampling frames for each of the surveys. The sampling frame for the general public survey was going to follow that of the National Fish and Wildlife Survey conducted by the U.S. Fish and Wildlife Service. The waterfowl hunter survey was going to be derived from the Harvest Information Program (HIP) registrants from each state and use all those individuals who had waterfowl hunted (i.e., indicated they had hunted either ducks or geese). Finally, the member database from e-Bird was going to be used given the large number of registrants in this database and the lack of sufficient members in some state-level ornithological groups.

Considerable discussion also was spent on finalizing or narrowing various questions on each of the 3 surveys, and individuals form the HDWG were assigned to each survey to assist. Additionally, Dave Fulton and Jason Spaeth, U.S. Geological Survey, Minnesota Cooperative Fish and Wildlife Research Unit, presented information and lead discussion regarding the discrete choice modeling sets, both from how it works to examination and discussion of the choice sets themselves. The initial topics of the choice sets came from workshops conducted earlier with hunters and viewers conducted across the U.S. There was discussion regarding the time lines for submittal to Office of Management and Budget.

The PET portion of the meeting centered on the development of the action plans for the 3 task groups (Landowner, Viewer and Hunter Groups) that have been formed under the PET/HDWG. There also was discussion of the refinement of the overall Public Engagement Strategy as well as relationship between the Task Groups, PET, HDWG, and other North American Waterfowl Management Plan entities, assisting and supporting Joint Ventures in human dimensions and public engagement delivery, and considerations for implementation.

3.3 NSST (*Pat Devers*)

The North American Waterfowl Management Plan Science Support Team has aligned their resources with objectives and tasked identified by the Interim Integration Community. Of particularly focus is the identification of priority landscapes for birds, people and ecological goods and services. Two sub-committee are addressing priority tasks including the Net Landscape Change Committee and National Wildlife Refuge Land Acquisition Committee. The executive committee has started the process of revising the 5-year work plan and is coordinating with the Tri-Initiative Science Team to create a single, all-bird science support team.

3.4 Species integration updates

The Black Duck Joint Venture in partnership with the USGS Cooperative Research Unit at Auburn University has made significant progress in the development of a prototype life cycle model that links population demographics to regional carrying capacity and hypotheses regarding limiting factors. The annual life cycle model allows managers to evaluate competing scenarios regarding the relative contribution of changes in regional habitat carrying capacity on the black duck populations allowing managers to target habitat delivery in priority regions.

3.5 Group discussion: HMWG and partner engagement during AHM revision process (*Harvest Management Working Group*)

The HWMG discussed issues of integration and heard feedback and updates from members of the Human Dimensions Working Group, the NAWMP Science Support Team, and the Interim Integration Committee. In addition, working group members affiliated with each of the species integration projects (black duck, pintail, and scaup) also provided updates on progress and next steps. After much discussion, the working group acknowledged that harvest management implications of integrating objectives across major waterfowl institutions (e.g., harvest and habitat management communities) were best addressed at the Flyway scale with partners involved with revising AHM decision frameworks under the double-loop learning process.

4 SEIS Recap and outstanding issues

The HMWG briefly discussed the current status of each AHM decision-making framework in relation to the promulgation of the 2016 harvest regulations. Some technical issues related to optimization details that were encountered in preparation for the 2016 regulatory cycle were introduced.

4.1 Mid-continent mallard optimization details and decision points (*Fred Johnson, Paul Fackler, Scott Boomer, Guthrie Zimmerman, Ken Williams, and Bob Dorazio*)

We first briefly reviewed the history of AHM for mid-continent mallards, including changes in objectives, regulatory alternatives, and models, as well as how model weights and the harvest strategy have evolved since 1995. The SEIS represents yet another major revision, in that a regulatory decision must be conditioned on the observed population size, pond numbers, and decision made in the previous year. In other words, spring population size and pond numbers will not be known at the time the decision must be made (late winter), and so we must rely on their expectations based on resource status and the decision in the previous year. A major challenge in this effort has been the necessity to adopt new optimization software (MDPSolve ©), and to ensure that the analysis is structured and coded correctly. This effort has

been subject to extensive peer review and we are comfortable that the necessary analytical framework is now ready for identifying the optimal regulatory choice for the 2016–2017 hunting season (to take place in the winter of 2015–2016). The optimal strategy under SEIS consists of four tables of breeding population size and pond numbers, one for each of the possible regulatory choices made in the previous year. Not surprisingly, the strategy gradually becomes more liberal as the decision in the previous year becomes more restrictive. The strategy is generally more knife-edged than the current one, in that the moderate alternative rarely appears in the strategy. The expected performance of the SEIS strategy in terms of population size and the frequency of regulatory alternatives is generally similar to that expected from the current strategy, with some indication that there would be slightly more liberal seasons and slightly fewer moderate seasons. Overall, we do not expect major changes in the performance of harvest management for midcontinent mallards with implementation of the SEIS.

5 AHM Revisions: Mississippi and Central Flyways

5.1 Problem Statement (*Adam Phelps, Larry Reynolds, Mike Szymanski, Mark Vrtiska, Jim Kelley, Jim Dubovsky*)

The US Fish and Wildlife Service (Service) in conjunction with the Mississippi and Central Flyways (MF and CF, respectively) apply the principles of adaptive resource management [i.e., Adaptive Harvest Management (AHM)] to determine appropriate duck harvest regulations each year. AHM is used to derive an optimal regulatory strategy which specifies the conditions (duck breeding population size, habitat conditions) under which regulatory alternatives would be selected. Annual Flyway-specific framework regulations (i.e., season length and overall duck bag limit) are determined solely by the status of mid-continent mallards. In addition, for some other species (e.g., northern pintail and scaup), species-specific AHM strategies have been developed that are used to set regulations for those species. Other species-specific duck regulations typically are not adjusted annually, and do not have specific objectives associated with their abundance or harvest.

The AHM approach explicitly recognizes that the consequences of hunting regulations and responses of waterfowl to changes in their environment cannot be predicted with certainty and provides a framework for making objective decisions in the face of that uncertainty (Williams and Johnson 1995). Inherent in the adaptive approach is awareness that management performance can be maximized only if regulatory effects can be predicted reliably. Thus, AHM relies on an iterative cycle of monitoring, assessment, and decision-making to clarify the relationships among hunting regulations, harvests, and waterfowl abundance. Thus far, the AHM process has provided managers some insight about the biological system (that is, to determine which model set makes the best predictions). However, the potential ability to learn about hunters and how they interact with the system has not been formally considered. Moreover, experimental aspects regarding effects of harvest have never been a formal priority in AHM objectives. There continues to be little support for prioritizing experimental aspects of AHM.

The entirety of our experience with AHM has been under liberal hunting seasons. Although good from the standpoint of hunter opportunity, the lack of variation in regulations has limited the ability of managers to understand how duck populations and hunters respond to changes in regulations (e.g., whether realized harvest rates under moderate and restrictive packages match our predicted harvest rates). However, nearly two decades of liberal packages have provided an opportunity to experience variation in hunter numbers, harvest, and population dynamics with relatively stable regulations. This extraordinarily long period of stable regulations has provided insight to the "partial controllability" of the system (see "Uncertainty" below).

Current strategies and protocols for duck harvest management are technically complex, somewhat difficult to understand by managers and explain to constituents, and require dedicated individuals with unique skill sets and sophisticated software to develop, refine, and operate them. The waterfowl management community recognizes that the resources required for maintaining current waterfowl monitoring efforts and

AHM decision frameworks are dwindling. Further, the benefits realized from rigorous, fine-scaled harvest management may not justify the costs associated with higher levels of complexity in the technical requirements of the current regulatory process. In some cases, lower population levels and less dynamic regulations (i.e. not changing regulations in response to relatively small changes in abundance) may be acceptable trade-offs for a regulatory process that is less costly in both complexity and data intensity. Therefore, a more efficient and less resource-intensive informed decision-making process for promulgating regulations than that currently in use is desirable.

After 20 years of implementation, harvest managers and partners have begun to review the technical and policy elements of AHM. The Mississippi and Central Flyways are reviewing AHM in the context of the 2012 North American Waterfowl Management Plan (NAWMP). A significant challenge posed in the NAWMP is to address growing concerns about declining waterfowl hunter numbers.

The 2012 NAWMP specifies goals and objectives for waterfowl populations, habitats, and participation and support by people involved in waterfowl-related activities. In particular, the NAWMP highlighted the growing disconnect between society and nature as a significant new threat to waterfowl conservation. In response, NAWMP includes a new goal of "Growing numbers of waterfowl hunters, other conservationists and citizens who enjoy and actively support waterfowl and wetlands conservation." This stated goal provides an opportunity for harvest managers to more explicitly examine the role of harvest in achieving NAWMP goals and objectives. To date, emphasis in AHM has been on understanding and predicting the relationship between harvest and duck populations, but the linkages between harvest and habitat objectives, and harvest and hunter dynamics, need further development.

State managers are particularly concerned with declining participation in duck hunting, and are interested in better understanding the relationship between regulations and participation, and perhaps more formally accounting for declining participation in making harvest management decisions. As currently implemented, the AHM process includes multiple objectives related to mid-continent mallard (MCM) population status but does not explicitly consider risk to hunter populations.

Regardless of the dichotomy regarding risk to duck and hunter populations, the question remains as to what role (or to what extent) harvest management should play in meeting NAWMP duck population and hunter objectives. When considering whether the AHM objective function should continue to integrate the NAWMP mallard population goal, we considered whether it is appropriate to devalue harvest in an attempt to meet population goals that are based on habitat. We recommend that the NAWMP population goal be removed from the MCM AHM objective function in this revision. Instead, harvest objectives should drive the NAWMP mallard population objectives in the next NAWMP revision.

The double-loop process of adaptive management provides an opportunity to revisit operational decision-making frameworks to determine if objectives are being achieved, have changed, or if other aspects of the decision problem are adequately being addressed. Often the feedback resulting from this learning leads to efforts to adjust decision-making frameworks in response to a shifting decision context, novel or emerging management alternatives, or a need to revise assumptions and models that may perform poorly or need to account for new information. Adaptive management depends on this iterative process to ensure that decision-making protocols remain relevant in evolving biological and social systems. Recently, technical representatives from the MF and CF along with partners from the Service have invested considerable effort to revise duck harvest management in the Mississippi and Central Flyways.

Nature of the Decision Problem: The decision problem under consideration is the selection of the most appropriate annual hunting regulations in the Mississippi and Central Flyways in order to achieve stated management objectives.

Objective(s): The goal of mid-continent duck harvest management is sustainable duck populations, maximizing long-term hunting opportunity while minimizing regulatory change. This goal addresses the following points:

(1) Maintain hunter numbers and effort at or above the 1999-2014 average.

(2) Maintain duck populations sufficient to sustain hunting opportunity.

(3) Implement policies and regulatory processes that are less resource intensive.

Actions: For each AHM strategy, a set of regulatory options is specified that ideally are designed to result in different population responses to harvest (e.g., changes in survival rates). The options are defined in terms of season length and bag limit. The "action" is to select the regulatory option that best achieves stated objectives given the state of the system and our understanding of system dynamics.

Frequency and Timing of Decision-making: The set of regulatory options will be finalized during the spring/summer SRC meeting, and a specific option will be selected in October for use during hunting seasons the following fall.

Frequency of Reviewing the AHM Process (i.e., "double-looping"): A comprehensive review of the process should occur when it is apparent that the protocols are not meeting management objectives or when information arises suggesting the predictive demographic models are no longer appropriate. Between such revisions, regulatory options should be in place long enough to gain experience with them, so that option-specific effects can be reliably predicted. Regulatory options should be reviewed when it is evident they are not having the desired effect or when objectives of management change. This may entail changes to the biological system, changes to the social system (that is, hunting), or other (currently unforeseen) changes.

Dependent decisions: Any decision that affects the MCM AHM frameworks will have ramifications for harvest management of other duck stocks. The implications of changes to the overall frameworks for these other strategies will need to be detailed and discussed with other interested Flyways, depending on species.

Spatial Scope: The harvest regulation problem relates to duck harvest management at the mid-continent scale, encompassing the Central and Mississippi Flyways. However, it has continental implications for the harvest management of other duck stocks (scaup, pintail, black duck).

Uncertainty: In regulating waterfowl harvests, managers face four fundamental sources of uncertainty: partial controllability, partial observability, structural uncertainty, and environmental variation. These sources and their implications for waterfowl management have been previously described (Nichols et al. 1995, Williams et al. 1996, Johnson et al. 1997). Decision frameworks will account for these sources of uncertainty and others if they arise. Uncertainty exists not only for duck ecology, but also for hunter dynamics.

- *Environmental variation* This form of uncertainty arises from temporal and spatial variation in weather conditions and other key features of the environment; an example is the annual change in the number of ponds in the Prairie Pothole Region, where water conditions influence duck reproductive success. Climate change, a form of environmental system change, has the potential to exacerbate all forms of uncertainty described above. In the past, AHM strategies have assumed long-term stationarity in the managed system; that is, stochastic fluctuations that occur around some long-term mean and that can be predicted from historical data. Climate change and other forms of large-scale system change are problematic because they represent conditions outside the range of experience and are difficult to describe probabilistically.

- *Partial observability* Partial observability refers to the ability to estimate key population attributes (e.g., population size, reproductive rate, survival rate, harvest and harvest rate) only within the precision afforded by existing monitoring programs.
- *Structural uncertainty* Structural uncertainty is the result of an incomplete understanding of biological processes; a familiar example is the longstanding debate about whether harvest is additive to other sources of mortality or whether populations compensate for hunting losses through reduced natural mortality. Another example of structural uncertainty is the strength of density-dependent feedback mechanisms in regulating duck population abundance. Structural uncertainty increases contentiousness in the decision-making process and decreases the extent to which managers can meet long-term conservation goals. There are concerns that structural uncertainty surrounding the model set has grown over time, particularly the last few years, raising the following questions: Has the systemic over-prediction reversed? Would incorporating data from 1996-present address concerns with this structural uncertainty? Would a third, partially compensatory model help?
- *Partial control* Partial controllability refers to the ability of managers to control harvest only within limits; the harvest resulting from a particular set of hunting regulations cannot be predicted with certainty because of variation in weather conditions, timing of migration, hunter effort, and other factors. Under AHM, harvest rates expected under different regulatory options are expressed probabilistically to account for this variability. However, partial control over the harvest rate remains a problem. The harvest rate predictions under all but liberal frameworks may be suspect, because the predictions of those harvest rate distributions were developed decades ago. Hunters may not, and probably do not, behave in the same way as they did historically. Even if the predicted distributions of harvest rates are correct, there is large overlap between liberal and moderate packages. When the packages are revisited, these likely will need better separation or, if this separation cannot be gained using three packages, perhaps only two regulatory options would be needed to ensure that the distributions are better separated. In addition, it is not clear how those predicted harvest rate distributions were developed or how they could be revisited (i.e., what data do the evaluations need and are they available).

These or similar sources of uncertainty also affect the ability to monitor and influence hunter participation. We currently have little information regarding what motivates individuals to hunt ducks. The necessary information, surveys, and/or experiments have not been conducted to understand how hunter effort, numbers, and satisfaction relate to harvest or opportunity. There are many factors that determine whether or not an individual will participate in waterfowl hunting. Additionally, unlike for duck demographics, sociological phenomena could greatly influence the number of duck hunters, which could exacerbate uncertainty issues. The primary tool managers use that affects hunting opportunities, regulations, is not likely a major recruitment or retention tool. While regulations might negatively affect retention, hunter numbers seem unlikely to be augmented solely through regulations, but impacts are largely unknown.

Monitoring: AHM requires annual information updates to monitor relevant state variables that 1) inform regulatory decisions, and 2) provide an observational basis to model predictions that facilitates learning in AHM (i.e., reduction of uncertainty). Key monitoring programs currently informing midcontinent mallard AHM include the WBPHS (traditional survey area), the continental pre-season banding program, and national harvest surveys. Measures of hunter numbers and effort will need to be incorporated, if or when hunter metrics are explicitly incorporated into the decision-making process. These monitoring programs are required not only by AHM modeling procedures, but are also part of the necessary and responsible data collection to understand and explain system and population dynamics.

Constraints: Beyond monitoring-related constraints, other fiscal and personnel constraints include resources required for technical assessment and to administer the regulatory process, including coordination and collaboration with states and other stakeholders. The process for adopting migratory game bird hunting regulations is constrained by three primary factors. Legal and administrative considerations dictate

how long the rulemaking process will last. Most importantly, however, the biological cycle of migratory game birds controls the timing of data-gathering activities and thus the dates on which these results are available for consideration and deliberation.

Experimental aspects of AHM are not a priority. Social constraints limit our ability to actively learn about the system by perturbing it. For instance, we are functionally prevented from enacting restrictive seasons during times of high breeding populations by hunters and managers who want the most hunting opportunity possible (or enacting very liberal seasons when duck abundance is low), even though doing so may increase the rate at which we learn about system dynamics. Unfortunately, large natural fluctuations in duck populations, sufficient to elicit substantive changes in hunting regulations which in turn could substantially increase certainty in management, could take decades. This time scale has limited our ability to detect not only the impacts of different regulatory packages on duck populations, but also any impacts to hunter numbers through significant changes in duck populations (and thereby regulations).

Decision Makers: Final decision making authority on waterfowl harvest regulatory proposals has been delegated to the Assistant Secretary (of the Interior) for Fish, Wildlife, and Parks. The Service Regulations Committee of the Service formulates regulatory proposals in collaboration with the Flyway Councils and forwards recommendations to the Service Director. Following a public comment period and any subsequent modifications, the regulatory proposals are sent to the Assistant Secretary for final approval.

Primary Institutional Mandates and/or Regulatory Authority: *Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Hunting of Migratory Birds.* U.S. Department of the Interior (2013) "The Service will continue to employ AHM as a tool to help determine the appropriate regulatory decisions regarding migratory bird hunting that will be consistent with long-term conservation. Continued evolution regarding the technical inner workings of this process (i.e., model structures, model weight updating, optimization procedures, etc.) will be subject to annual review and modification as warranted by increased understanding and new information. Such reviews and modification will be discussed with Flyway Councils and subject to public review through the annual Federal Register process for establishing annual regulations."

Migratory Bird Treaty Act (16 U.S.C. §703-712) The Secretary of the Interior is authorized and directed by the MBTA to determine when it is compatible with conventions to issue regulations that allow the take of migratory birds and their nests and eggs. All of the four migratory bird conventions are applicable to the adoption of annual regulations for the hunting of migratory birds: the *Convention for the Protection of Migratory Birds* with Canada (1916), the *Convention for the Protection of Migratory Birds and Game Mammals* with Mexico (1937), the *Convention Between the Government of the United States of America and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment* (1974) and the *Convention Between the United States and the Union of Soviet Socialist Republics (now Russia) Concerning the Conservation of Migratory Birds and Their Environment* (1978). All of the conventions include provisions for both allowing and controlling hunting.

The MBTA specifies that when adopting hunting regulations, the Secretary give "due regard" to, among other considerations, the distribution, abundance and flight lines of migratory birds. These considerations, especially abundance, can change from year to year, so regulations have traditionally been promulgated annually. Doing so has necessitated assessments of the status of migratory bird populations before regulations are developed. Annual assessments help ensure that regulations are adjusted appropriately to achieve the objective that harvests of migratory birds are kept at levels compatible with long-term population sustainability.

The North American Waterfowl Management Plan (NAWMP)

> " ...The waterfowl management community has revisited waterfowl management objectives through the North American Waterfowl Management Plan (NAWMP) revision, highlighting

fundamental linkages between the objectives for waterfowl populations, habitat, and the hunting population. One of the emerging themes resulting from these developments raises the question of how managers should consider risk when managing for waterfowl, habitats, and people.

In order to achieve the NAWMP vision in today's environment, this Plan sets forth three overarching goals for waterfowl conservation:

- Goal 1: Abundant and resilient waterfowl populations to support hunting and other uses without imperiling habitat.
- Goal 2: Wetlands and related habitats sufficient to sustain waterfowl populations at desired levels, while providing places to recreate and ecological services that benefit society.
- Goal 3: Growing numbers of waterfowl hunters, other conservationists and citizens who enjoy and actively support waterfowl and wetlands conservation.

Two of these goals, dealing with populations and habitat, have always been foundational to the NAWMP. The third goal, focused on people, is new insofar as being an explicit part of this Plan. It underscores the importance of people to the success of waterfowl conservation, and is born out of concern for the ongoing loss of waterfowl hunters, the opportunity presented by growing numbers of people who pursue waterfowl with cameras and binoculars, and a recognition that the NAWMP can succeed only if waterfowl conservation is relevant to broader societal issues. "

Finally, state wildlife agencies have evolved and now operate under the North American Model of Wildlife Conservation (Geist et al. 2001). Following the tenets of this model, states have developed a public trust doctrine that uses science as the proper tool to implement policies that also provide for public input, allowing all individuals in good standing the right to hunt. Thus, in managing duck hunting regulations, state wildlife agencies must have processes in place that balance the status of the resource with equitable hunting opportunity.

5.2 Revision Progress and Objectives (*Adam Phelps, Larry Reynolds, Mike Szymanski, Mark Vrtiska, Jim Kelley, Jim Dubovsky*)

A subgroup of the Mississippi and Central Flyway technical sections and representatives from the U.S. Fish and Wildlife Service (FWS) met in June 2015 in Kansas City, MO and continued discussions on revisions to mid-continent mallard adaptive harvest management (MCM-AHM). Earlier drafts of a problem statement had been developed by the group, but some discrepancies regarding language and meaning were identified by FWS. The group discussed and added language proposed by Scott Boomer to improve the problem statement. Along with discussion about the problem statement, the objectives and underlying goals were refined as:

Objective: The goal of mid-continent duck harvest management is sustainable duck populations, maximizing long-term hunting opportunity while minimizing regulatory change.

This goal addresses the following points:

- Maintain hunter numbers and effort at or above the 1999-2014 average.
- Maintain duck populations sufficient to sustain hunting opportunity.
- Implement policies and regulatory processes that are less resource intensive.

Additional considerations for the group were that of having mallards continue to drive overall duck season and removal of the North American Waterfowl Management Plan goal as a constraint. Future steps would include development of a consequence table to examine trade-offs and exploration of potential AHM packages. Other discussions also concerned updating of current information to be used in models as well as

the possibility of examining new models in AHM. Management of other duck stocks was discussed without complete resolution.

Current work is focusing on development of potential packages to be simulated through the updated model set (and possibly other methods). How the revised AHM process handles species for which there are current harvest restrictions and/or strategies in place is a crucial part of the process. In addition, a consequence table is under development. This tool will allow the two Flyways to weigh the interactions of all the various components of duck harvest management to reduce the pool of potential management actions considered. In addition, it will allow the Flyways to more explicitly examine these tradeoffs in the context of refining our objectives for duck harvest management for the coming decade. Much of this work will be undertaken at a meeting in spring of 2016. Implementation of the revised mid-continent AHM process is tentatively planned for the 2018-19 hunting season (to be in place by fall of 2017).

5.3 Models (*Scott Boomer, Guthrie Zimmerman, Nathan Zimpfer, and Jim Nichols*)

The resolution of structural uncertainty through mid-continent mallard AHM represents learning. Historical changes in model weights from mid-continent mallard AHM were presented and discussed in relation to the results of recent assessment work updating mid-continent mallard age ratio, vulnerability, and survival estimates. The relationship between annual survival and harvest remains a key source of uncertainty in the harvest management of mid-continent mallards (*Anas platyrhynchos*). Consequently, current efforts to update the mid-continent mallard Adaptive Harvest Management (AHM) model set require reliable estimates of survival and harvest probabilities. While contemporary estimates of harvest probabilities are available from operational AHM protocols, estimating historical harvest probabilities is problematic because band reporting probabilities have varied over time and space in relation to changing band inscriptions and reporting methods. Our research objective was to estimate cohort-specific survival, harvest, and band reporting probabilities with a Brownie model that integrates all preseason band recovery information for mid-continent mallards marked from 1987-2014. We used a random effects parameterization within a hierarchical, Bayesian estimation framework to model temporal variation in reporting probabilities specific to each band inscription while explicitly modeling the process correlation between harvest and survival probabilities for each cohort. Similar to previous reward band investigations, we found that reporting probabilities increased significantly over the 1990's even for birds marked with AVISE and ZIP bands. Commensurate with the liberalization of harvest regulations, harvest probabilities for each age and sex cohort increased. Adult male harvest probabilities have averaged 0.09 (SD = 0.003) since 1987. Overall, annual survival rate estimates for juvenile males and females declined as harvest probabilities increased, suggesting evidence for additive harvest mortality ($\rho = -0.67$ and $\rho = -0.45$) for juvenile males and females respectively. We found similar patterns for adult males ($\rho = -0.35$) but the evidence for adult females was not as strong ($\rho = -0.11$). Juvenile to adult harvest vulnerability ratios have increased for male and female mid-continent mallards, suggesting that the ratios used in AHM models should be updated. These results will provide the basis for updating population models for use in mid-continent mallard AHM.

6 AHM Revisions: Atlantic Flyway

6.1 Problem Statement (*Greg Balkcom, Min Huang, Paul Padding*)

Broad Overview and Background Since 1997, an Adaptive Harvest Management (AHM) process has been used to set harvest regulations for eastern mallards based on an objective of maximizing long-term cumulative harvest and predictions from six population models representing different hypotheses about uncertainty in density dependent recruitment and bias in survival or recruitment estimates. Beginning in 2010 as part of the double looping process, the Atlantic Flyway (AF) and Division of Migratory Bird Management began a rigorous re-evaluation of all components of the mallard AHM decision frameworks. During this review, several questions arose concerning Eastern Mallard AHM. The questions focused on

four general ideas: (1) Should we continue to set regulations in the AF using our current approach without any modifications?; (2) Should we continue using the Eastern Mallard AHM process, but work to improve the model used to support the process?; (3) Should we continue using the same process, but consider a new suite of models?; (4) Should we consider an alternative process, other than Eastern Mallard AHM, for setting waterfowl regulations in the AF?

An evaluation of the performance of the model set used to support Eastern Mallard AHM was the initial step of that double looping process. This assessment indicated that the current relationships used to predict survival as a function of harvest and recruitment as a function of breeding population size did not perform adequately, resulting in a consistent over-prediction of mallard population size in 5 of the 6 years from 2006 to 2011. The current framework also prescribed a closed season at an Eastern Mallard BPOP of 650,000. A decision was made to develop an interim model set, drawing from the MCM AHM set as a way of buying some time to determine just what the best next step was. Given the results of this assessment, the AF then deliberated over the utility of modifying the current framework, or a more fundamental question of whether the AF desired to continue to base duck harvest management decision solely on the basis of mallards.

Through a structured workshop in 2012, the Atlantic Flyway Council and Technical Section determined that the current Eastern Mallard AHM decision framework did not adequately address the fundamental objectives for duck harvest management in the AF. Eastern mallards are not the best representative species for the Flyway as they constitute less than 25% of overall harvest in the flyway and are not really representative of any of the other species in the flyway. The AF determined that a decision framework based upon a suite of ducks that better represent the habitats and harvest distribution of the flyway was more desirable than the current Eastern Mallard AHM framework. Additionally, development of a multiple species framework might also be the best way to truly integrate harvest and habitat management in the manner envisioned by the Joint Task Group and the NAWMP Revision.

At their winter 2013 meeting the Atlantic Flyway Council formally recommended that the Atlantic Flyway work with the USFWS to develop a multiple species decision framework for setting the general duck season in the AF. In May 2013 the technical section finalized the fundamental objectives for duck harvest management, identified a number of means objectives associated with each and went through a ranking and weighting exercise of those objectives. The three fundamental objectives for duck harvest management in the AF are, (1), Sustain AF duck populations at levels that meet the legal mandates and demands for the recreational uses of this resource, (2), Maximize hunter satisfaction with harvest opportunity and regulations, and, (3), Maximize efficiency and simplicity in the regulations process. Subsequently the Council also went through the same exercise. The final fundamental objective rankings, means objectives, and measureable attributes that were developed over the course of a year and a half reflect the combined desires of both the Council and Technical Section. The ranking and weighting exercise formally re-affirmed the collective thinking of the AF, that we need to develop a duck harvest decision framework that takes into account those species that are important across the AF, and that represent the suite of habitats that we are trying to conserve and enhance, and finally the recognition that within the bounds of sustainable harvest, that our harvest management strategies should be geared towards providing satisfaction to the majority of our constituency.

There has also been some progress made on developing some preliminary population models using the discrete logistic model: $N_{t+1} = N_t + rN_t(1 - N/k)$. The discrete logistic was used to estimate r_{max} and K for mallards, black ducks, ringnecks, goldeneyes, and green-winged teal. Similarly, a preliminary model aggregating mallards, black ducks, green-winged teal and ringnecks was also constructed. These initial models provided reasonable output, however there was some discussion about the seemingly high estimates of r_{max} for several species, goldeneyes for instance. The aggregated species model provided very similar estimates of K and r_{max} to the summed and averaged individual species models.

Work has been conducted to assess the effects of bag limit changes on various duck species in the AF and a human dimensions survey was initiated to assess hunter preferences for various regulatory alternatives. Discussions have begun between the committee and the Atlantic Coast Joint Venture to determine what habitat variables (e.g. acres on the landscape, kcal on the landscape) that are annually or periodically assessed might be used in developing an integrated population model.

Nature of Decision Problem

Objective(s) Develop a duck harvest management decision framework that takes into account the status of ducks that represent the suite of habitats and harvest opportunity within the AF.

Action(s) The action associated with this decision problem will be the annual selection of the general duck hunting season in the AF.

Frequency/Timing The regulations for the general duck season frameworks in the AF are made annually.

Spatial Scope The spatial scope of this decision framework is the AF.

Uncertainty Uncertainty associated with this decision problem is manifest in a number of ways. We have much uncertainty about the effects of various regulatory alternatives on duck species and hunter behavior in the AF. There is uncertainty associated with the future monitoring efforts in the AF, particularly the Eastern Survey area. We are very uncertain how climate change will affect duck distribution on both the wintering and breeding grounds, and how habitat changes due to human activities throughout the AF will impact carrying capacity and hunter access.

Constraints Logistical constraints on the development and implementation of a multi-stock decision framework largely revolve around the technical feasibility of development and the continued reliance upon an adequate monitoring program.

The process for the promulgation of annual regulations permitting the hunting of migratory birds is addressed under a newly revised and updated Supplement EIS (2013). This document presents alternatives and preferred alternatives related to schedule and timing of the process, frequency of review of regulatory packages, stock-specific harvest strategies, special regulations, management scale, zones and split seasons, and subsistence harvest. The process outlined in the SEIS can be thought of as a constraint.

Decision Makers The U.S. Fish and Wildlife Service and Atlantic Flyway Council are the ultimate decision makers for this annual decision.

6.2 Objectives (*Greg Balkcom, Min Huang, Paul Padding*)

The harvest management objectives for the Atlantic Flyway can be summarized as:

(1) Sustain Atlantic Flyway duck populations at levels that meet the legal mandates and demands for the recreational uses of this resource.

- No Species Below Level for Sustainability
  - Species Specific BPOP Levels
  - Ratio of N to K
  - Specific Point on yield curve
- Harvest Decision on Representative Species and Habitats
  - Proportion of total harvest represented by species

- Maintain Certain Level for Important Species
  - BPOP levels
- Carrying Capacity Objective for AF
  - Acres of habitat on the ground
  - Available kcal

(2) Maximize hunter satisfaction with harvest opportunity and regulations

- No Closed Seasons
  - Frequency of closed seasons
- Maximize Percentage of Satisfied Hunters
  - %age of occasional hunters
  - Age structure of hunters
  - Number of repeat hunters
  - Days spent hunting
  - Duck stamp sales
- Simple Regulations
  - Number of species restrictions
- Seeing Lots of Birds
  - Fall Flight
  - CBC index
- Minimize Year to Year Changes in Regulations
  - Number of regulatory packages
  - Frequency of changes

6.3 Models (*Gutrhie Zimmerman*)

Historically, a balance equation model had been used to support the adaptive harvest management (AHM) strategy for eastern mallards. The Atlantic Flyway (AF) is interested in revising the eastern mallard AHM strategy to include multiple species. However, some of the species of interest for multi-stock management are not banded enough to estimate the parameters used to inform the balance equation model used for eastern mallard AHM. We explored the performance of a discrete logistic model for informing multi-stock management in the Atlantic Flyway. We considered the specific model currently used for western mallard AHM, whereby mortality and recruitment are instantaneous and birds surviving to the next year must not be harvested (i.e., 1- harvest rate). The three important technical issues included (1) incorporating species-specific harvest rates when some species had very few bandings, (2) including age-specific harvest rates into a model that is not age-structured, and (3) deciding how to specify priors for carrying capacity, maximum intrinsic growth rate, and process variance. We presented harvest rates estimated independently for each species and observed a low correlation among species through time. Therefore, we decided to estimate species-specific harvest rates independently rather than pooling data among species and using species-specific offsets or random species effects. Within species, juveniles tended to have higher harvest rates than adults, but the age-specific estimates were correlated through time. Therefore, we decided to pool data within species and estimate age-specific rates with an annual offset. We discussed the possibility of averaging the age-specific harvest rates or adjusting the discrete logistic model to include an age-specific structure, and will compare these potential approaches. We discussed options for priors in the discrete logistic model and agreed to use informed prior distributions. We agreed to use an allometric relationship to estimate maximum survival rates for each species. Then use the maximum survival rates and age at first breeding to estimate a prior distribution for maximum intrinsic growth rate following Johnson et al. (2012). We agree on a uniform prior that assumed that populations were somewhere between one half carrying capacity and at carrying capacity. We decided to use a non-informative prior for process variance.

7 AHM Revisions: Pacific Flyway

7.1 Problem Statement (*Jeff Knetter, Dan Rosenberg, Todd Sanders*)

Since western mallard AHM was implemented in 2008, the geographic delineation of western mallards has been considered temporary until other surveys in Pacific Flyway areas could be brought up to similar standards and an adequate time series of population estimates is available for analysis. The U.S. Fish and Wildlife Service (Service) helped develop operational breeding surveys in British Columbia and Washington. These areas now have time series data available from standardized surveys, with annual abundance and variance estimates since 2006 in British Columbia, and since 2010 in Washington. Incorporating survey results from these areas will address stewardship responsibilities and improve model estimates for mallards in the Flyway. In September 2015, the Pacific Flyway Council (Council) provided guidance for the revision, and recommended the Service proceed with changes for implementation during the 2017–18 season.

7.2 Objectives (*Jeff Knetter, Dan Rosenberg, Todd Sanders*)

In March 2015, Council and the Service agreed to remove the constraint from the objective of maximizing long-term cumulative harvest of western mallards. The removal occurred because there were challenges with implementing the constraint with updated optimization software, and necessary adjustments related to the revised timing of the regulatory process. The constraint was removed for the 2015–16 and 2016–17 seasons, and resulted in a decision matrix with a lower frequency of intermediate (moderate and restrictive) regulatory alternatives between the liberal and closed seasons, and a higher frequency of closed and liberal seasons. The Study Committee is seeking additional guidance from Council on whether it is a Council priority to consider a constraint to minimize extreme changes in regulations with small changes in breeding population size.

7.3 Models (*Guthrie Zimmerman*)

Western mallard adaptive harvest management (AHM) is currently based on two breeding stocks: mallards breeding in Alaska (AK), and mallards breeding in California and Oregon (CA-OR). The Pacific Flyway is interested in re-defining western mallards to also include birds breeding in Washington (WA; surveyed from 2010–current) and British Columbia (BC; surveyed 2006–current). We presented a summary of the WA and BC data (Breeding population, survival, recruitment, and harvest) and discussed some of the main technical issues for including these data in the existing framework. First, how do incorporate the WA and BC data within current geographic definition of our stocks? For example, should WA and BC be added to the AK stock, CA-OR stock, or comprise a third stock? We agreed that adding the birds to an existing stock would be the most appropriate and deciding which stock should consider geographic proximity, trends in breeding population size, and similarities in harvest rates. Second, how do we deal with the relatively short time series? The time series for the two surveys were too short to get reasonable estimates of population parameters for informing harvest management decisions given the logistic model that is currently in use. We discussed the potential of imputing data for the missing years similar to what has been done in the past for the Great Lake States mallards.

8 Progress Reports and Updates

8.1 The spatial and temporal variation of mid-continent mallard survival in relation to climate (*Qing Zhao*)

Understanding the environmental factors that drive the spatio-temporal variation of survival is critical to predicting population responses to climate change. Nichols et al. (1982) found some evidence that the survival of mid-continent Mallards was affected by density dependent processes and wetland availability. We were interested in revisiting this study with (1) longer time series, (2) advanced statistical models, and (3) a focus on the effects of climate variables on survival. We compared two models that estimated survival and the effects of covariates (breeding population density, precipitation, and temperature) on survival simultaneously and three models that estimated survival first and the effects of covariates on survival in a post hoc manner. The estimates of survival and the effects of covariates depended on the modeling approach we used. Based on the model that considered survival as a function of covariates while accounting for spatial autocorrelation through a conditional auto-regressive effect (COV+CAR model), we found temporal variation in survival, which was highly synchronized across space. On the other hand, the spatial variation of survival was only evident for juveniles, but not for adults. We found strong evidence for the effects of climate factors on the survival of adult and juvenile males, but not for females. Our results suggest that climate change may be influencing survival rates, and thus affect changes in Mallard distribution and population dynamics.

8.2 NOPI integrated models (*Erik Osnas*)

We developed an integrated population model of northern pintail to help guide harvest and habitat management. The model is an age- and sex-structured state-space projection of breeding population size from 1960 to 2014 that jointly estimates survival and productivity while accounting for the observation processes of decreased detectability during drought years (pintail overflight) and increased juvenile vulnerability to hunting. We used bandings from pre- and post-hunting season to partition survival into seasonal components and modeled demographic parameters as functions of habitat and population size. We found strong evidence for density- and habitat-dependence on productivity, including a winter habitat effect on productivity (cross-seasonal effects) and small effects of density or habitat effects on post-hunting survival, although habitat covariates were limited to historical rainfall data. In fact, process variance in productivity accounted for 30% of process variation in annual population growth rate while survival accounted for relatively little process variation and was relatively constant across this time period even though estimated harvest rates changed nearly 2-fold. Only for juvenile cohorts was there a trend in survival. When the model was made spatially explicit to include separate parameters for the Pacific Flyway and mid-continent region (Mississippi and Central flyways), there was little evidence for variation in survival but parameter effects on reproduction varied by region. The Pacific Flyway had relatively low productivity with little variation and little density-dependence; whereas, the mid-continent had higher average productivity with high among year variation and strong density-dependence. Habitat effects (winter-ground rainfall) were similar between flyways. In terms of harvest and habitat management, these results suggest that managers should not expect large changes in continent-wide survival with changes in habitats or harvest rates of historical magnitude, but wide-scale changes in breeding or wintering habitats could be expected to fundamentally alter population trajectories through changes in productivity. In addition, the difference in demographic rates between regions suggests that the sustainable harvest rate may be higher in the mid-continent than in the Pacific Flyway.

8.3 Evaluating sea duck harvest potential(*Chris Dwyer*)

In 2010, the Sea Duck Joint Venture (SDJV) identified the need for improved science support for harvest and habitat management of North American sea ducks. In order to prioritize monitoring and research needs

in support of harvest management, we applied a Prescribed Take Level (PTL) framework to assess the influence of uncertainty about sea duck demographic parameters on comparisons of observed and allowable harvest estimates. We focused on 7 populations of North American sea ducks: the American subspecies of common eider (*Somateria mollissima dresseri*), the continental populations of long-tailed duck (*Clangula hyemalis*) and white-winged scoter (*Melanitta fusca*), and eastern and western populations of black (*M. americana*) and surf scoter (*M. perspicillata*).

Prescribed take level (PTL) is an estimate of the allowable harvest of a population. Formulated as total harvest, calculation of PTL requires estimates of population size (N_t) and maximum growth rate (r_{max}), while formulation of PTL as a harvest rate requires only an estimate of r_{max} . We used a total harvest formulation of PTL for all populations, except common eider where banding data were sufficient to formulate PTL based on harvest rate. We defined r_{max} as the maximum growth rate achievable by a population in the absence of harvest under average environmental conditions. We derived r_{max} from the maximum finite growth rate (λ_{max}) using an age-structured population projection matrix. In implementing the PTL framework we: (1) combined information from empirical studies and the opinions of experts to create probability distributions reflecting uncertainty in the individual demographic parameters needed to conduct the PTL; (2) used simulation to propagate that uncertainty into probability distributions of allowable harvest for each species; (3) compared estimates of allowable harvest to observed harvest; and (4) evaluated the sensitivity of the comparison of allowable to observed harvest estimates to uncertainty in the parameters used to derive those estimates.

We relied on a combination of published and unpublished data and estimates as well as the results of a formal expert elicitation to specify probability distributions for the parameters used in this assessment: age-specific survival, fecundity (calculated from reproductive rates such as nest success, clutch survival, and breeding propensity, as well as harvest age ratios), fall population size, observed harvest (sport and subsistence), and for common eiders, observed harvest rate. The probability distributions reflected uncertainty about the true mean value of each demographic parameter for each population. We used Monte Carlo simulations to estimate r_{max}, allowable harvest, and observed harvest for each population. We then used linear regression to assess the sensitivity of the difference between allowable and observed harvest estimates to uncertainty in the component parameters of r_{max}, fall population size, and observed harvest. We identified populations at risk of overharvest by the proportion of simulations where observed harvest exceeded allowable, and categorized demographic information needs into three levels of priority based on their uncertainty and their influence on the comparison of allowable and observed harvest.

Our literature search revealed a dearth of empirical data for most of the populations, and our effort to augment the empirical data by eliciting opinions from subject-matter experts met with limited success. Accurate quantification of uncertainty was a crucial component of the assessment, and our results and conclusions below are conditional on adequate descriptions of uncertainty for each parameter. In general, our allowable harvest (or harvest rate) estimates were very uncertain, much more so than the estimates of observed harvest.

American Common Eider. The median allowable harvest rate for American common eiders was -0.0009 (95% credible interval -0.0812; 0.0692). The percent of simulations where observed harvest rate was less than allowable harvest rate was 20%. The comparison of observed and allowable harvest rates was most influenced by uncertainty in adult survival, as well as several components of fecundity including duckling survival, the ratio of juvenile to adult female wings in samples submitted by hunters (i.e., harvest age ratio), hatching success, and clutch size. Highest priorities for research and monitoring were estimates of age ratios and duckling survival.

Eastern/Western Black Scoter For eastern black scoters, the median allowable harvest was 29,940 (807; 93,753), and the percent of simulations where observed harvest was less than allowable harvest was 52%. For western black scoter allowable harvest was 10,854 (-11,058; 37,219), and observed harvest was less than allowable harvest in 30% of the simulations. Adult survival was highly influential for both populations but due to its low uncertainty was only a medium priority for research and monitoring. For eastern black scoters, the highest priority information need was fall population size, while moderate priority needs included duckling survival, age ratio, and the proportion of hens first breeding at age 2. For western black

scoters, 3 fecundity parameters were the highest priorities for research or monitoring: nest success, duckling survival, and harvest age ratio. Observed harvest was also categorized as a high priority information need though it was less influential on comparisons between allowable and observed harvest than the fecundity parameters.

Eastern/Western Surf Scoter. For eastern surf scoters, the median allowable harvest of 23,149 (-9,308; 78,894) was less than the median observed harvest by approximately 15,000 birds. The percent of simulations in which observed harvest was less than allowable harvest was 25%. High priority information needs based on the sensitivity analysis were harvest age ratios and population size. Adult survival, nest success, and differential vulnerability were classified as moderate information needs. For western surf scoters, the median allowable harvest was 14,354 (-61,985; 82,110). Observed harvest was less than allowable harvest in 59% of the simulations. Population size and clutch size were categorized as highest priority information needs, while adult survival, juvenile survival, and differential vulnerability were moderate priorities.

White-winged Scoter. Median allowable harvest was 13,054 (-68,824; 61,072). The percent of simulations in which observed harvest was less than allowable harvest was 36%. Observed harvest was a high priority information need, although its influence on the harvest comparison (based on absolute slope) was less than the 4 parameters that were ranked as moderate priority information needs (differential vulnerability, nest success, hatching success, and adult survival) as a result of a larger relative uncertainty surrounding observed harvest.

Long-tailed Duck. Median allowable harvest for long-tailed ducks was -48,966 (-202,663; 60,561). The percent of simulations in which observed harvest, 43,044 (32,151; 57,589), was less than allowable harvest was only 5%. Reproductive rate estimates for long- tailed ducks from the literature were very low compared to all populations other than common eiders. Population size was the only high-priority information need identified according to our criteria. Four parameters were categorized as moderate priority information needs: adult survival, nest success, proportion of first time breeders breeding at age 2, and survival of second- year birds.

In general, this assessment highlights the high degree of uncertainty associated with simulated values of allowable harvest for all populations. We have particularly low confidence in the assessment for long-tailed ducks and the assessment for American common eider may apply only to the segment of this population breeding in Maine and the Maritimes. Comparisons of our simulated median values of intrinsic growth rates were lower than theoretical maximum values indicating that these populations were experiencing sub-optimal environmental conditions or that input parameter values were not consistent with growth unconstrained by density or harvest.

Conclusions from this assessment include: (1) reductions in uncertainty in the high and moderate priority parameters could most significantly improve harvest inferences and decision making; (2) uncertainty about overall fecundity had more influence on comparisons of allowable and observed harvest than adult survival or observed harvest, however, individual components of fecundity can be difficult to study at a population scale; (3) adult survival, though characterized by less uncertainty than individual components of fecundity, is a high priority information need given the sensitivity of growth rate and allowable take to this parameter, and (4) uncertainty about population size was a high priority information need for four of the six populations. We recommend that the SDJV (1) prioritize research and monitoring efforts on the long-tailed duck and American common eider; (2) prioritize research and monitoring on high priority parameters identified for each population; (3) continue efforts to integrate the operating procedures and analysis of presently disparate breeding population surveys for sea ducks; and (4) conduct PTL assessments periodically, incorporating new information in order to revise priority information needs.

8.4 Preparation for future reward banding (*Pam Garrettson, Mike Szymanski, Nathan Zimpfer*)

Since February 2015, DMBM, the Flyways and the USGS Bird Banding Lab have been working together to address concerns and issues associated with the poor performance of the 1-800 number call center, and issues with the current band reporting website (reportband.gov), and potential BBL budget constraints. In addition, the BBL has raised concerns that the increasing proportion of bands being reported via the website represents decreased phone traffic and profit margins for vendors, which may limit its attractiveness for quality bidders, perpetuating existing issues with data quality. Moreover, band recovery data reported via the website are of much higher quality, with fewer data quality issues requiring follow-up by BBL staff. The joint committee explored potential modifications to the 1-800 call center (e.g., automated voice systems), but informal surveys, and the experiences of state partners, suggested that these options were unpalatable to band reporters, and still present issues with data quality. Thus the committee outlined a series of steps or actions necessary, that assumes the possible closure of the 1-800 call center (as early as the 2018-19 hunting season). These actions were:

(1) Develop a version of the band reporting site, that functions correctly on mobile phones, to be publically available in the 2016–17 hunting season.

(2) Revise band inscription to show only the website address (www.reportband.gov). These bands are planned to be available to banders for 2017 pre-season banding operations.

(3) Work with States and Flyways to encourage hunters to report via the web rather than the 1-800 number, similar to what occurred with the institution of the 1-800 number.

(4) Develop a plan for assessing the potential effects of these changes on band reporting probabilities, via reward banding.

Pam Garrettson and Nathan Zimpfer conducted a preliminary assessment that projected a potential drop in reporting probability of 10–20% relative to the current estimate of 80%. Under the broad objective of detecting this expected drop in reporting probability, they provided rough estimates of sample sizes needed to achieve a 10% coefficient of variation (CV) on the annual estimate of reporting probability. They presented this work to the HMWG, along with projected costs under a few simple scenarios, recognizing that an optimal design would require discussions of management goals, as well as multiple and possibly competing objectives. Mike Syzmanski indicated that he planned to work with Paul Link and John Brunjes to develop a proposal for Flyway funding of a limited reward banding effort for mid-continent mallards for presentation at the Mississippi and Central Flyway tech section meetings in February.

9 Updating HMWG Priority Actions and Work Plan

The Working Group reviewed progress on the 2015 priority action items and opened up a discussion to identify the highest priority technical work for 2016. The continued work focusing on revising the AHM frameworks that govern each Flyway's season frameworks was identified as the highest priority for technical work in 2016. The scope of this work was then compared to other high priority rankings discussed at the HMWG meeting and a new priority list was developed for review by the SRC and the Flyway Councils in preparation for discussions during the 2016 regulations cycle (see attached 2017 Priorities). 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.

9.1 2016 HMWG Meeting

The 2016 HMWG meeting will be hosted by the Central Flyway somewhere in a southern state and is scheduled for the week of 5 – 9 December 2016.

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Harvest Management Working Group
2015 Meeting Agenda
Laurel, Maryland

Monday (November 30) ***Travel Day***

[1700] State Technical Representatives meeting (Vrtiska)

Tuesday (December 1) ***Welcome, Reports from Partners, New Business***

[0800] Welcome, introductions, logistics, agenda (Case, Richkus, and Boomer)

[0830] Flyway reports/perspectives

- Atlantic, Mississippi, Central, Pacific (State Technical Representatives)
- USFWS (Flyway Representatives)
- CWS (Ingram)
- USFWS Budgeting and Monitoring Priorities (Richkus)
- Communication Team Update (Kelley)

[1000] **Break**

[1020] 2017 Regulation Cycle

- Meeting and reporting schedules
- Black duck AHM (Devers)
- Teal
- Other Issues

[1100] New Business...

[1200] **Lunch**

[1300] Partner updates

- IIC Workplan (Humburg)
- Human Dimensions Working Group (Vrtiska)
- National Science Support Team (Devers)
- Species integration updates (black duck, scaup, pintail)
- Group Discussion: HMWG and partner engagement during AHM revision process

[1500] **Break**

[1515] 2017 Canvasback harvest strategy development

- Problem framing, objectives, regulatory alternatives, models
- Implementation process

[1700] **Adjourn**

[1900] AHM Communications Team Meeting-communication strategy development

Wednesday (December 2) ***AHM Revisions***

[0815] SEIS recap and outstanding issues... (Boomer)

[0830] Mid-continent mallard optimization details and decision points (Johnson)

[0900] AHM Revisions: Mississippi and Central Flyways

- Problem statement (Phelps, Reynolds, Szymanski, Vrtiska, Dubovsky, Kelley)

- Objectives (Phelps, Reynolds, Szymanski, Vrtiska, Dubovsky, Kelley)
- Regulatory alternatives (Phelps, Reynolds, Szymanski, Vrtiska, Dubovsky, Kelley)
- Models (Boomer et al.)
- Implementation process (Group discussion)

[1000] **Break**

[1020] AHM revisions - continued

[1100] AHM Revisions: Atlantic Flyway

- Problem statement (Huang, Balkcom, Padding)
- Objectives (Huang, Balkcom, Padding)
- Regulatory alternatives (Huang, Balkcom, Padding)
- Models (Johnson et al.)
- Implementation process (Group discussion)

[1200] **Lunch**

[1300] AHM revisions - continued

[1330] AHM Revisions: Pacific Flyway

- Problem statement (Huang, Balkcom, Padding)
- Objectives (Huang, Balkcom, Padding)
- Regulatory alternatives (Huang, Balkcom, Padding)
- Models (Johnson et al.)
- Implementation process (Group discussion)

[1500] **Break**

[1515] Progress reports and assessment updates

- Model development to support adaptive responses to climate change (Zhao)
- Modeling NOPI productivity (Osnas)
- Mid-continent mallard band recovery analysis 1987-2013 (Boomer et al.)

[1700] Adjourn

Thursday (December 3) ***Progress Reports and 2016 Planning***

[0800] Recap and Discussion (Case)

[0830] Progress reports and assessment updates

- Modeling the spatial variation in mid-continent mallard survival probabilities (Zhao)
- NOPI Integrated population models (Osnas)
- Evaluating sea duck harvest potential (Dwyer)

[1000] **Break**

[1015] Progress reports and assessment updates

- Preparation for future reward banding (Zimpfer and Garrettson)
- Group Discussion: Harvest surveys and the future of parts collection(Richkus)
- Adjustments to monitoring programs for 2017 (Richkus)

[1200] **Lunch**

[1300] Plans for 2016: Action items, Priorities for 2016–17, Task assignments (Case)

- Plans for next meeting: location, dates, topics

[1515] Meeting summary and parting thoughts (Case)

[1600] Adjourn

Friday (December 4) ***Travel Day***

2017 Harvest Management Working Group Priorities

Priority rankings and project leads identified for the technical work proposed at the 2015 Harvest Management Working Group meeting.

Highest Priorities (Urgent and Important)

- Adaptive Harvest Management Revisions (*aka, Double-looping*)
  - Multi-stock management (*Atlantic Flyway, PHAB, HMWG*)
  - Mid-continent mallard (*Mississippi and Central Flyways, PHAB, others...*)
  - Western mallard(*Pacific Flyway, PHAB, others...*)
  - Consideration of NAWMP objectives for waterfowl management (*HDWG, Flyway Councils, FWS, NAWMP Interim Integration Committee, Joint Technical Committee, others...*)
- Re-invigorate institutional support for AHM (*PHAB, and HMWG Communications Team*)

Long-range Priorities (Non-urgent, but Very Important)

- Time dependent optimal solutions to address system change (*Scott Boomer, Fred Johnson, Mike Runge*)
  - Habitat change
  - Hunter dynamics
  - Climate change
- Northern pintail AHM Revision (Double-looping) (*Pacific Flyway, PHAB, others...*)

Additional Priorities

- Waterfowl harvest potential assessment methods case study development (*PHAB, Tech Sections, others...*)
- 2017 Canvasback harvest strategy development (*PHAB, Tech Sections, others...*)

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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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Mark Vrtiska	Central Flyway Council	Nebraska Game and Parks
Jim Dubovsky	Central Flyway Representative	U.S. Fish & Wildlife Service
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Dan Rosenberg	Pacific Flyway Council	Alaska Department of Fish and Game
Todd Sanders	Pacific Flyway Representative	U.S. Fish & Wildlife Service
Joel Ingram	Canadian Wildlife Service	Canadian Wildlife Service
Ken Richkus	PHAB Branch Chief	U.S. Fish & Wildlife Service
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Sean Kelly	Region 3 Bird Chief (Designee)	U.S. Fish & Wildlife Service
Erik Osnas	Region 7 Bird Chief (Designee)	U.S. Fish & Wildlife Service
Fred Johnson	USGS	U.S. Geological Survey
Mike Runge	USGS	U.S. Geological Survey
Other Participants		
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Qing Zhao	Post Doctoral Researcher	Colorado State University
Distinguished Guests		
Jim Nichols		U.S. Geological Survey (Retired)
Bob Blohm		U.S. Fish & Wildlife Service (Retired)
Ken Williams		The Wildlife Society

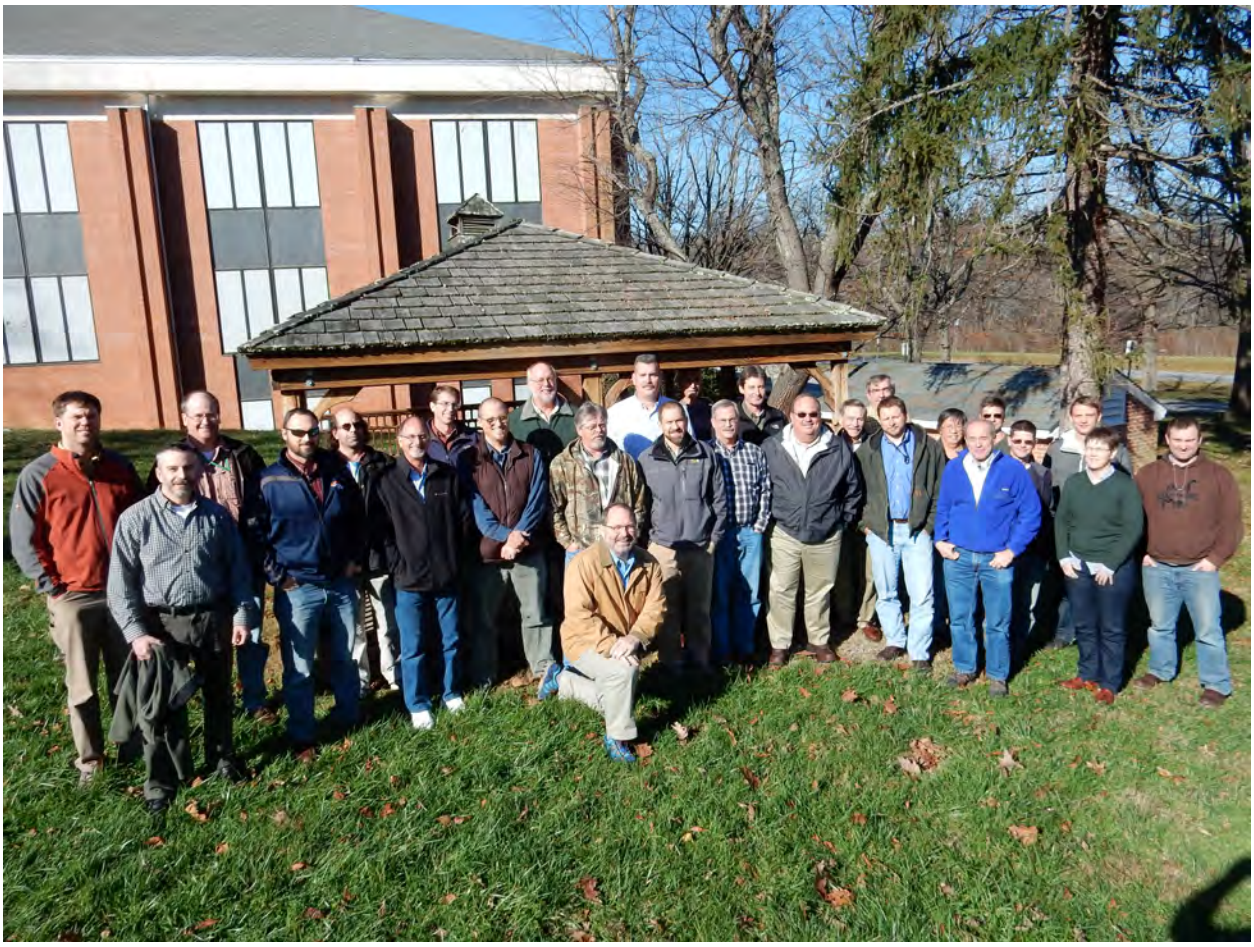

Figure 2 – The participants of the 2015 Harvest Management Working Group meeting at the Patuxent Wildlife Research Refuge in Laurel, MD.