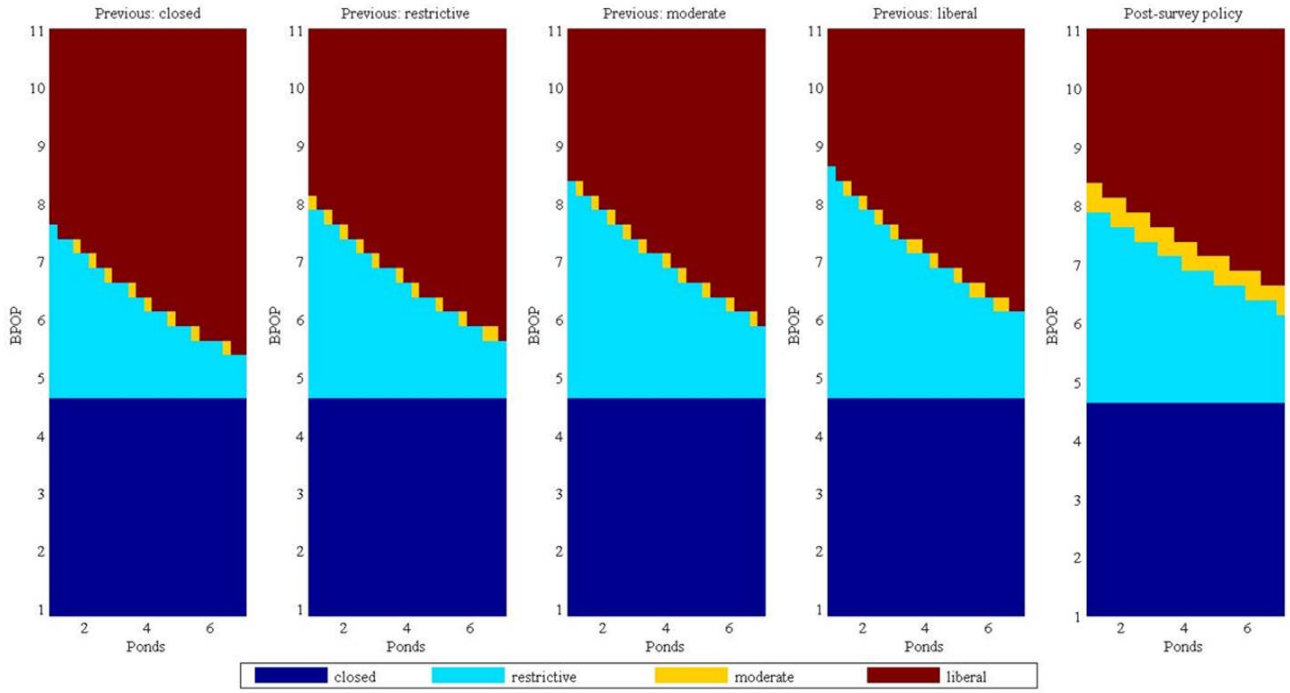
Harvest Management Working Group

2014 Annual Meeting Report



December 2014
Bloomington, Indiana

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This report provides a summary of presentations and discussions that occurred at the 26th meeting of the Harvest Management Working Group (HMWG). The 2014 meeting focused on the evaluation of the harvest management implications of the preferred alternative specified in the Final Supplemental Environmental Impact Statement on the Issuance of Annual Regulations Permitting the Hunting of Migratory Birds (SEIS; U.S. Department of the Interior 2013), 2015–16 SEIS implementation planning and communication needs, continued work related to the double-loop learning process of Adaptive Harvest Management (AHM), and the challenges of coherence associated with the revised North American Waterfowl Management Plan (NAWMP) objectives. For meeting details please refer to the appended 2014 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.

Citation: U. S. Fish and Wildlife Service. 2014. Harvest management working group meeting report. U. S. Department of Interior, Washington, D. C. 36 pp. Available online at http://www.fws.gov/migratorybirds/CurrentBirdIssues/Management/AHM/AHM-intro.htm

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 2014 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 Figure: Putative mid-continent mallard pre-survey harvest policies derived under new optimization methods that account for changes in decision timing associated with AHM protocols specified under the SEIS. Harvest policies were calculated with the 2014 mid-continent mallard model weights. Under the SEIS, harvest decisions for year t will now be made before breeding survey information for year t is available. As a result, current and future harvest values are calculated based on the decision and observations made the previous year. For comparative purposes, the post-survey harvest policy is included based on 2014 AHM protocols.

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 would consider the status of five representative duck species (mallard, black duck, green-winged teal, wood ducks, and ring necked ducks) 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 made great progress in identifying objectives and developing 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, black ducks, ringnecks, and green-winged teal. Wood ducks will be the next and likely 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.

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.

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. We received responses from over 12,000 hunters and will be using these data to further inform the development of our hypotheses regarding regulations, harvest, and hunters. We also hope to use these data to assist us in developing a pertinent suite of Flyway-specific questions for the upcoming National choice survey. We have also completed some preliminary work examining how bag limit changes might affect harvest rates and how that might vary regionally. 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.

We feel that the real difficulty for us in integrating harvest and habitat management will be in the habitat side. We have engaged the two habitat Joint Ventures in our Flyway, the Atlantic Coast Joint Venture and Eastern Habitat Joint Venture and the species Joint Venture, the Black Duck Joint Venture. What may prove elusive is the identification of habitat variables that we can measure periodically or annually that will reflect the collective work of all of the habitat work that is conducted in the Flyway. It may even prove elusive for us to identify a variable similar to May ponds, for instance, that describes in any fashion, the observed system state.

NAWMP Revision

The Atlantic Flyway has not formally met since the revised NAWMP objectives were released. It is generally felt, however, that the duck population objective of maintaining long-term average populations of breeding ducks from 1990 to present in the Eastern Survey area of an aggregate of ducks is congruent with the approach that the Atlantic Flyway is pursuing with its multi-stock framework. The NAWMP objective comprises six species for which adequate BPOP estimates can be derived. Four of the five species that we are using as our representative species are surveyed in the Eastern Survey area so overall population objectives could easily be scaled to reflect that.

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

The Mississippi Flyway approved the 2014 HMWG priority list as presented at the February 2014 meeting in Nashville, TN. The discussion indicated that we feel that the mid-continent mallard double-looping process should remain the highest priority, though it is understood that issues regarding the implementation of the SEIS will continue to arise and will be the highest priority as they do.

SEIS Timing

The Mississippi Flyway feels that the revised regulations setting process should occur as early in the calendar year as possible. While we would prefer that the regulatory Flyway meetings occur in August, we accept that September is a reasonable alternative. This is especially true during the transition to the new schedule, as we recognize that the USFWS would have a difficult time preparing the necessary reports for two regulatory cycles in one month. However, as we move forward, we would like to see the process move as early as possible to allow for any excess time in the process to be used by states in their internal processes.

MCM AHM Double-loop Learning

The Mississippi Flyway's primary focus at this time is working through the double-loop process for mid-continent duck management AHM, in cooperation with the Central Flyway. A small group of representatives (four from each Flyway, plus USFWS representatives) have now met twice and have developed a draft problem statement, a goal statement, draft objectives, and recommendations for meeting those objectives (please see "Mid-continent mallard AHM double-loop learning update," below, for details). These will be reviewed by the Flyways at their winter meetings.

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

A primary focus of the Central Flyway (CF) for the 2015–16 regulation cycle will be the continuing work on mid-continent mallard adaptive harvest management (MCM AHM). The dialogue between the CF and representatives from the Mississippi Flyway and Division of Migratory Bird Management (DMBM) has been open, frank, and cooperative in nature. We hope this continues and will result in meaningful harvest objectives and regulations in the near future. We also are hopeful that information gathered from the upcoming stakeholder survey will provide meaningful results that are incorporated into better harvest and hunter objectives and regulations.

However, during our discussions of MCM AHM, we are concerned about the U.S. Fish and Wildlife Service's (Service) commitment to using "informed decision making" in regards to harvest regulations. As we have expressed in the last two years, we remain concerned about the capacity of the Service's staff time and resources to develop, implement, and update all of the current harvest strategies, let alone new ones.

We know that DMBM staff agree with this assessment. Thus, we continue to struggle to see how this dichotomy can be reconciled, except that the Flyways will not be granted approvals for harvest recommendations without a considerable amount of process, evaluation, and other criteria. The CF and other Flyways need to continue discussion with the Service on the various elements and necessary rigor of informed decision making and possibly even exploring other decision-making processes.

Few changes or advancements have been made in other issues the CF have expressed in previous HMWG meetings. The CF sees waterfowl hunter recruitment and retention and light and resident Canada goose issues as top priorities. The CF hopes to begin to work and solve some of these issues in partnership with the Service. This perspective statement has been reviewed and approved by both the Central Flyway Waterfowl Technical Committee and the Central Flyway Council.

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 2014. The PFC endorsed the following 2015 priority rankings and project leads for the technical work proposed at the 2013 Harvest Management Working Group (HMWG) meeting:

Highest Priorities (Urgent and Important)

- SEIS
  - Evaluation and development of adjustments to harvest strategies based on changes in timing of regulatory decisions in association with the preferred SEIS alternative.
  - Development of strategies and methods for communicating the implications of the SEIS to the harvest management community and general public (HMWG, HMWG Communications Team, Flyway Councils, and FWS).
- 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...).
- Assess implications of NAWMP objectives for waterfowl management

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

- Time dependent optimal solutions to address system change (Scott Boomer, Fred Johnson, Mike Runge).
- Developing methods to communicate with constituents (Dave Case, PHAB, HMWG Communications Team).
- 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 acknowledged that 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 2014. Therefore we reiterate our past priorities, which have not been fully addressed due to these limitations.

Western Mallard Model

In 2008, the Western Mallard Model (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 developments of breeding population surveys in both Washington and British Columbia meet existing standards for inclusion into the WMM. Additionally, Nevada continues refinement of their survey for future inclusion. The PFC encourages further developments in the WMM for these possible inclusions. We recommend exploring options which incorporate mallards and other waterfowl stocks derived from surveyed areas in Canada important to the Pacific Flyway (e.g., Alberta, NWT) into the decision process in the future. We believe that much additional work is needed on western mallards.

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 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, and 3.2 million in 2014; the largest observed breeding populations since 1980. Pintails have increased about 83% in recent years from the low of 1.8 million in 2002. Based upon the 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.

Sea Ducks

Based on involvement with the Sea Duck Joint Venture (SDJV), the PFC is interested in having an assessment conducted to determine the harvest potential for each of the priority sea duck species (e.g., scoters, long-tailed ducks). Initial project funding has been identified as a high priority by the SDJV. If funding is allocated by the SDJV and the HMWG identifies this as a topic to address during 2015, a potential exists for staff from the Population and Habitat Assessment Branch or USGS to conduct the assessment or consult on the project.

1.5 Canadian Wildlife Service (*Joel Ingram*)

Two-Year Stabilized Migratory Birds Hunting Regulations

The new two-year hunting regulation cycle began with the 2014-2015 hunting season and ends with the 2015-2016 hunting season. Environment Canada will continue to publish the November Population Status Report on an annual basis. The December report on proposals to amend Migratory Birds Regulations will now occur every second year. The stable regulation system does not limit the powers of the Minister to vary, at any time, any hunting period or quota set out in the regulations when it is necessary for conservation purposes.

Black Duck Harvest Management

Environment Canada and the United States Fish and Wildlife Service began implementing a Black Duck International Harvest strategy in 2013-14, which specifically recommends optimal hunting regulations (daily quotas and season length) for American Black Ducks in Canada and the U.S. on an annual basis. The Black Duck International Harvest strategy was developed prior to the implementation of stabilized regulations and, therefore, was built as an annual process. Black Ducks are the only species for which there is an annual regulatory recommendation in Canada; the recommendations under the harvest strategy are not binding to the parties.

The optimal regulatory package for the 2014-15 season in Canada was the moderate package, while the optimal package for 2015-16 is the liberal. In keeping with the principles that guided the establishment of a 2-year stabilized regulations system, Environment Canada will not consider changes to the hunting regulations mid-way through the two-year cycle and, therefore, will remain in the moderate package in 2015-16. If the situation was reversed in the future, in that the strategy called mid-way through the two-year cycle for a restricted package, Environment Canada would also not consider changes to the hunting regulations unless a clear conservation issue was identified. Environment Canada will implement this approach for the first 3 cycles of stable regulations (6 years) and will evaluate the impacts of the decision towards the end of that period.

Modernization of the Migratory Birds Regulations

Objectives of the initiative:

- remove unnecessary barriers and irritants to hunters
- clarify Regulations were required, ensure common sense and enforceability
- encourage participation in hunting
- ensure conservation, sustainable hunting of migratory birds and maintain general public support for hunting

Environment Canada completed extensive internal and stakeholder engagement from 2011 to 2013. The process identified a short list of priority issues and options to consider in the Migratory Birds Regulation update. In March 2014, a report entitled Proposals to Modernize Canada's Migratory Birds Regulations to Improve Management of Hunting was published, with a public comment period extending to June, 2014. Environment Canada received 160 comments, which were generally supportive, several expressed concerns about some aspect of the proposals. EC is currently completing an internal review of comments and considering adjustments where appropriate. Next steps will include: legal drafting, development of a Regulatory Analysis Impact Statement; formal publication consultation via the Canada Gazette process.

Light Goose Harvest Management

In response to the Evaluation of Special Management Measures for Midcontinent Lesser Snow Geese and Ross's Geese report Environment Canada designated Ross's geese and western arctic lesser snow geese as overabundant in 2014. Hunting bag and possession limits have been liberalised in several Provinces and Territories. A spring conservation hunt has been extended to the province of Alberta starting in 2015. EC is continuing to focus science efforts to improving our understanding of impacts and reviewing options for additional harvest.

Mourning Dove Hunting Season

In 2013, Environment Canada instated a mourning dove hunting season in southern Ontario for the first time since 1955. During the first season, there were approximately 3,000 successful Mourning Dove hunters in Ontario with an estimated harvest of 18,000 doves. This level of harvest was within the harvest range predicted and is considered sustainable in Ontario. In 2014, CWS received a request to broaden the geographical area of the Ontario Mourning Dove hunting season to include Wildlife Management Units in Northern Ontario and open the season September 1st each year. CWS is currently reviewing these proposals.

Stakeholders in Manitoba have also expressed interest in a mourning dove hunting season. CWS is considering this proposal and a Manitoba season may be proposed in 2015 with a hunting season starting in the fall of 2016.

1.6 Communication Team Update (*Jim Kelley*)

The Communication Strategy for the HMWG was last updated in 2006. At the December 2013 HMWG annual meeting the Communications Team convened to discuss communication issues facing the HMWG and the duck harvest management community at large. There has been a perception that communications efforts had waned the past few years and new issues such SEIS13 implementation, double-looping efforts, and the NAWMP revision have created new communications challenges. At the December 2013 meeting it was decided that a revision of the communications strategy was needed and would be drafted prior to the 2014 for review. A draft was prepared in November 2014 and discussed at the December meeting. The Communications Team decided that two main areas of emphasis for the communications efforts are 1) SEIS13 implementation and 2) re-establishing institutional knowledge of and support for AHM. Due to the timing of SEIS implementation in 2015, a white paper and communication products will be prepared for use by agency personnel by March 2015 (Jim Kelley lead; see subsection 7.1 for more detail). A separate effort will be devoted to developing a white paper and communication tools for re-establishing institutional knowledge and support for AHM (leads are Jim Dubovsky, Min Muang and Joe Sands). A second draft of the communication strategy will be prepared to incorporate discussions held at the December meeting and distributed the working group for review.

2 Old and New Business

2.1 Black duck AHM

Optimal country-specific regulatory alternatives for the 2015-2016 hunting season were calculated using:

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

(2) the harvest parity constraint;

(3) 2015–2016 country-specific regulatory alternatives;

(4) current parameter estimates for mallard competition and additive mortality (based on 1990–2007 data); and

(5) 2014 estimates of 619,000 breeding black ducks and 445,000 breeding mallards in the core survey area.

The optimal regulatory choices are the liberal alternative in Canada and the restrictive alternative in the U.S.

During Fiscal Year 2015 (October 2014 to September 2015) members of the Black Duck Adaptive Harvest Management Working Group (BDAHMWG) will transfer the Black Duck Adaptive Harvest Management (BDAHM) optimization routine from ASDP to MATLAB and revise the model to account for setting regulations using year old data. This transition will align the BDAHM framework with both Environment Canada Canadian Wildlife Service regulatory schedule and the USFWS regulatory schedule under the 2013 SEIS.

The BDAHMWG has identified several technical issues that require additional technical work and assessment. First, the BDAHM framework uses a non-linear relationship between harvest rate and survival to represent the additivity mortality hypothesis; this in in contrast to the mallard frameworks that use a linear relationship. The BDAHMWG needs to re-affirm the use of the non-linear relationship. Second, the current production sub-model incorporates a mallard competition effect on black duck productivity, but we do not have an adequate mallard sub-model. The BDAHMWG needs to reconsider the incorporation the mallard competition hypothesis and if maintained, develop a more realistic mallard sub-model.

2.2 Early goose seasons and hunter participation in the Parts Collection Survey (*Mike Johnson*)

I discussed the need to investigate hunter participation in the U.S. parts collection survey, especially related to current liberal bag limits for Canada and light geese. This issue was raised at the 2013 HMWG meeting, but there has been no action to date. Hunter contributions of duck wings and goose tails to the parts collection survey have declined in recent years and the Service has been working to improve sample sizes. One concern is that liberal bag limits for light geese, since the late 1990's, and more recently Canada geese, has affected both participation rates by hunters and the proportion of the parts submitted in later parts of the season. Currently, some Central Flyway states have daily bag limits of 15 Canada geese during August and September, and 8 Canada geese and 50 light geese during the regular fall season. Some of the more active hunters are known to harvest hundreds of geese (even up to 400 to 700 birds annually) during these seasons. It seems doubtful that these hunters are willing or even able (time and/or inadequate envelope supply) to submit parts from all the birds they take. It also seems likely that they are more likely to submit parts early in the season and less likely to submit parts later in the season - "survey burn-out?" Thus, the proportion of birds in the parts collection survey, and therefore harvest estimates may be biased, especially relative to birds harvested in the later part of the season. This issue is becoming even more critical as some harvest strategies (Arctic nesting white-cheeked geese) are now based on Lincoln estimates of population

size, which, in turn, are based on band recoveries and harvest estimates. During the meeting, it was suggested that Tony Roberts (Atlantic Flyway Representative Assistant) and Kammie Kruse (Central Flyway Representative Assistant) should work with Branch of Harvest Surveys staff to examine this issue.

3 NAWMP Revision and IIC

3.1 Progress Narrative: Implementing the 2012 NAMWP Revision (*Dale Humburg*)

Considerable engagement by the waterfowl management community over the last 18 months is captured in the following narrative that summarizes progress towards implementing the 2012 NAWMP Revision (NAWMP or Plan). This narrative is comprised of excerpts and major themes from more detailed work plans, proposals, and documented dialogue that have developed since the Action Plan was approved in 2012. The following list represents the highest priority actions intended to address the seven recommendations outlined in the Revision (listed below in the order presented in the Plan). In several instances, these efforts still are in progress; thus, appendices and the summary that follow should be viewed as interim yet significant progress towards implementing the Plan.

(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.

An Integrated System of Waterfowl Management Integration has been central to the process of developing the means (actions) necessary to achieve fundamental goals related to waterfowl populations, supporters, and habitat (for details see: http://nawmprevision.org). North American waterfowl management is an inter-related enterprise involving people who advocate for beneficial public policies and help fund conservation programs. These policies and programs protect and restore habitat, resulting in waterfowl populations that can sustain an annual harvest while providing other societal benefits. Yet for the most part, North American waterfowl management has not explicitly integrated population, habitat, and human objectives and management actions.

For example, it is unclear whether, or to what extent, harvest should be regulated to help achieve NAWMP waterfowl population objectives. Conversely, the models used in Adaptive Harvest Management do not directly incorporate the habitat accomplishments of the NAWMP partners. Finally, hunting regulations are not set with regard to any explicit objectives for participation in hunting and viewing. Overall, the size and distribution of waterfowl populations needed to satisfy users is unclear. Lacking clear objectives for hunting, viewing and other waterfowl-related recreation, habitat managers have no objective or systematic

way to balance their programs in consideration of multiple, competing desires of people and the resource needs of the birds.

Over the next 2-3 years the management community will continue to advance an integrated system of waterfowl management with efforts to improve the efficiency, effectiveness, and adaptability of the enterprise. Specific advantages of a deliberate focus on integration include 1) better alignment of conservation actions to ensure they are not "pulling in opposing directions," 2) increased effectiveness of management action and greater efficiencies in process, and 3) enhanced capacity to adapt to changing social and ecological conditions.

A Suite of Shared Objectives Shared objectives are the necessary first step in ensuring that management programs are aligned and work in a complementary fashion. But common objectives are only the first step. An integrated waterfowl management system requires that objectives are linked through the management actions that are undertaken at various scales (e.g., continental, regional, and local). This is a highly complex challenge (Ringelman et al. 2012), and the waterfowl management community has come to realize that integration likely will need to occur at a few key decision linkages at certain vital spatial and temporal scales, rather than by trying to create a comprehensive optimization solution for all elements of waterfowl management.

During the last year, the waterfowl management community has developed a set of "working objectives" for consideration by the NAWMP Committee (for details see the online progress report: Implementing the 2012 NAWMP Progress in Revising Objectives). Throughout the process, increased attention has been placed on explicitly stating key assumptions related to the linkages among the objectives. The working objectives that follow provide an initial basis for moving forward.

Population Objectives *Maintain long-term average populations of breeding ducks [1955 to present in traditional survey area (TSA) and 1990 to present in eastern survey area (ESA)] and periodically, 40 million or more total breeding ducks (TSA).*

> Average populations of ducks over the long term are the results of periodic "boom"and "bust" conditions typical of wetland habitats. In light of the dynamic nature of waterfowl populations, both the long-term averages among species as well as periodic abundance in total numbers are recommended as dual objectives for duck populations. This objective is viewed as preliminary and should be revisited when new data are available from social science efforts currently underway. Stakeholder focus groups and surveys will be used to gain a better understanding of what size populations will be necessary to provide quality hunting, viewing, and other recreational experiences without exceeding social or ecological carrying capacity. Additional focus on geese and other duck species will be required. Further, a critical related task is for the waterfowl management community to define the role of harvest management in achieving population objectives.

Supporter Objective *Increase waterfowl conservation support among various constituencies to at least the levels experienced during the last two decades.*

> Although the recommended objectives for waterfowl populations reflect the entire period of record for available survey data, considerable changes in social systems justify a more contemporary period as a benchmark for supporter objectives. The waterfowl management community has traditionally relied on hunters to provide the foundation of support. In today's environment, it will be more important than ever to engage in conservation the wildlife viewers, photographers, and others who maintain an emotional connection to wetlands through recreation as well as those who benefit from material benefits provided by wetlands. Landowners and those involved with land management are critical partners in determining whether specific habitat management actions can effectively be applied on private lands. Thus, engaging landowners as a distinct group of supporters can have significant benefits.

Habitat Objective *Conserve a [habitat] system with capacity to maintain long-term average waterfowl population levels, that periodically supports 40 million or more breeding ducks, and consistently supports resource users at objective levels.*

> Unlike objectives for waterfowl populations and supporters, which can be expressed in large-scale or even continental terms, quantitative objectives for waterfowl habitat are largely unique to specific landscapes. Habitat protection, restoration, and management strategies are unique to each landscape because the actions that affect waterfowl status (reproduction, survival, movement, body condition) and supporters (access, crowding, opportunity) are as unique as the landscapes involved. Thus, each nation, Flyway, Joint Venture, state, and conservation area will require conservation planning regionally relevant to their location and nature of use.

The working objectives proposed at this juncture are predicated on a number of assumptions that will need to be more fully articulated and evaluated adaptively. Management decisions are made assuming that the actions taken lead to desired conservation outcomes. Among these are assumed relationships between harvest management and population abundance; regulations and waterfowl hunter engagement; habitat capacity to support birds as well as hunters, viewers, and ecological services; and assumptions about the numbers of supporters necessary to ensure future relevance of the system of waterfowl conservation. Efforts to more rigorously explore these assumptions and the tradeoffs among management actions to achieve management objectives have received only initial attention.

Assessing Preferences among Stakeholders Waterfowl managers assume that society expects that North American waterfowl species will be sustained for future generations, and therefore waterfowl populations should be maintained at abundances and distributions that ensure long-term species persistence. Further, and consistent with the Public Trust Doctrine, waterfowl population objectives should reflect societal desires and values. These values, however, have not been well-quantified and undoubtedly vary at different ecological and social scales (e.g., urban vs. rural, avid vs. novice, and other demographics). The ultimate success of NAWMP depends on maintaining relevance to stakeholders and society. In order to be relevant, a first step will be to better understand what people value in regards to waterfowl and their habitats. Without this information, management and policy decisions may lead to actions that could be either irrelevant or counter to stakeholder and societal expectations, and thus ineffective. For example, U.S. harvest objectives presently are set at levels to achieve maximum long-term cumulative harvest. However, despite the longest seasons and largest bag limits in modern history, hunter numbers have not responded. In a broader sense, it is uncertain how current habitat and population management objectives and actions have influenced participation in waterfowl viewing or affected more general support for conservation.

A proposal to explore these basic assumptions about stakeholder preferences represents one of the more ambitious near-term management actions evolving from the Plan Revision. The management community should be prepared to take full advantage of the results of this assessment during the next NAWMP update.

Ultimately, efforts to assess the efficacy of engagement actions will require accurate measures of participant numbers, an understanding of their dynamics, and the activities of participants. In some instances there are long-standing estimates of participation or at least a reliable index to activity. In other cases, however, assumptions about important demographics, such as age structure, churn rates, and actual frequency of participation have not been assessed. More reliable measures of factors leading to recruitment and retention will be needed to first inform assumptions and secondly, to craft effective engagement strategies. Building upon other work, data from automatic license systems can be used to identify the optimal contact points and hunter segments most likely to respond, estimate hunter participation "vital rates" (e.g., attrition, churn), and predict changes in participation patterns (e.g., move from a new recruit or sporadic hunter to regular participant).

Engaging Waterfowl Conservation Supporters For the first time, the Plan explicitly addresses the role of people, including waterfowl hunters, other conservationists, and more broadly, citizens who enjoy

and may actively support waterfowl and wetlands conservation. In doing so, the 2012 Revision challenged the waterfowl conservation community to reconsider and recommit to the core values underlying the waterfowl management enterprise. The Revision questions some existing paradigms and suggests new directions for waterfowl conservation.

Actively engaging people who support waterfowl conservation will require a new focus using expertise and science not entirely familiar to the traditional waterfowl management community. However, that need was anticipated as the NAWMP Action Plan outlined the basic framework for a Public Engagement Team (PET) that would assume these responsibilities. Initial planning by this group has resulted in broad goals that include 1) increasing support for and involvement in the hunting tradition, 2) increased participation and engagement by viewers, and 3) a North American human population that values and understands waterfowl/wetland conservation and takes action to actively support it.

Data from the U.S. and Canada are available to inform actions and evaluation related to public engagement. Wildlife watching remains one of the most popular types of outdoor recreation in the U.S. In 2011, there were 47 million birdwatchers (birders), 16 years of age and older - about 20 percent of the population. Unlike hunting and fishing where men were overwhelmingly in the majority, a larger percent of birders were women - 56 percent in 2011. Seventy-five percent of away-from-home birders reported observing waterfowl (ducks, geese, etc.), making those the most watched type of bird. In Canada, the 2012 Canadian Nature Survey reported that birding and hunting or trapping (4.7 million and 2.1 million participants, respectively) are among the top eight activities of Canadian adults participating in nature-related activities. Watching, feeding, monitoring, filming or photographing birds (birding) had the highest number of participant days near to home, at an average of 109 and 24 days away from home engaged in this activity. More days were devoted to birding over the year than to other individual outdoor activities.

Collaboration of the PET with the Human Dimensions Group is evident in the use of three complementary conceptual models from the 2008 Waterfowl Hunter Recruitment and Retention Strategy to develop a basic foundation in social science theory for much of the PET strategy. Although initially developed to address waterfowl hunter engagement, the conceptual framework can be viewed in a broader context of waterfowl conservation support along a continuum of 1) decision to participate, 2) formation of an identity as a waterfowl conservationist, and 3) greater institutional capacity to support the system of waterfowl conservation.

Midcontinent Mallard "double-looping" In part, the impetus for the 2012 Plan Revision emerged from concerns about use of the NAWMP objective for Mid-continent Mallards in developing annual harvest regulations, a process based on specific objectives, alternative models, and monitoring - i.e., "single-loop learning." Questions about coherence between habitat and population objectives (Runge et al. 2006) have since been expanded to include questions about the relationship between harvest management and hunter satisfaction. One of the seven recommendations from the NAWMP Revision Action Plan was to "adapt harvest management strategies to support attainment of NAWMP objectives," which has many challenges and policy tentacles. An obvious starting point is the current process for recommending annual regulations for duck harvest in the Midcontinent that is well established through Adaptive Harvest Management. Although specifically tied to mallard harvest management, the framework essentially provides much of the season structure for other species as well. Progress on "double-loop learning," essentially a process for re-assessing basic management objectives, already has been made to clarify a problem statement, itemize assumptions, and discuss constraints. This effort presents a relevant opportunity to more explicitly address the role of harvest management with regard to achieving goals for waterfowl populations as well and those who support waterfowl conservation.

Multi-species harvest management The Mississippi and Central Flyways' efforts to address Midcontinent mallard harvest management will likely merge into broader discussions about multi-species harvest management. The Atlantic Flyway has already initiated discussions in this regard. Early challenges involve seeking a credible way to combine five species into a single growth model and considering possible

management actions to "test" the new framework (e.g., "splash rule" for bag limits). Surveys to assess constituents' desires related to regulatory alternatives also are being considered - these may be integrated into the choice modeling effort.

Improve conservation delivery for birds and people through application of HD tools Outcomes from stakeholder surveys and pilot studies involving waterfowl conservation supporters in different landscapes will provide insights into the values people place on waterfowl and habitat resources. The challenge then of course, will be to assess the tradeoffs between habitat conservation for waterfowl versus use by waterfowl supporters. Unlike objectives for waterfowl populations and supporters, which can be expressed in large-scale or even continental terms, quantitative objectives for waterfowl habitat are largely unique to specific landscapes. Actions that account for waterfowl habitat delivery are most relevant to both waterfowl and people at local and regional scales. Thus, habitat protection, restoration, and management strategies will be specific to each landscape because the actions that affect waterfowl status (reproduction, survival, movement, body condition) and supporters (access, crowding, opportunity) are as unique as the landscapes involved. Each nation, Flyway, Joint Venture, state, and conservation area will require conservation planning unique to their location and nature of use. With the presence of NAWMP habitat Joint Ventures throughout the United States, Canada, and parts of Mexico, each with a history of conservation planning, the waterfowl community is well-positioned to achieve this. Each will need to assess which landscape features affect waterfowl abundance and vital rates, how supporters are affected by management actions, determine what waterfowl managers can control (actions) through active management or policy, how much of the change in waterfowl status is due to uncontrolled environmental variation, and the nature, frequency and variability of these changes.. The Joint Venture structure should also help ensure that the objectives developed at each local jurisdiction "add up" in a way that achieves the continental support needed to sustain waterfowl populations at continental objective levels.

An initial pilot effort in the Playa Lake Joint Venture region provided confidence that HD tools and processes can add value to conservation delivery strategies. The potential for additional pilot efforts is being assessed and although funding for these efforts is not yet apparent, demonstrated value usually provides the impetus for project support. Confidence in these approaches will be gained through experience and as additional pilot efforts in different landscapes are encouraged.

Fostering a better understanding and application of HD tools The partnership approach of delivering habitat programs by Joint Ventures employs human dimensions perspectives; however, the application of human dimensions tools remains largely foreign to the waterfowl management community. Experience and assistance from experts in the field should reduce uncertainty about the value of these approaches. There are two initial foci for HD training: 1) demonstrate value of social science tools for decision makers (policy/administration) and 2) active application of HD tools by conservation practitioners. Initial approaches being planned and applied are highlighting existing successes and the value of engaging stakeholders in an effective manner, and providing training in the HD tools and resources available. Regional workshops, online resources, formalized training, and integrating HD into actions already planned are obvious candidate actions. These are being delivered by various Joint Ventures and scattered in-house experts in federal and state agencies. We anticipate that HDWG members will begin to participate more extensively in these efforts as well. Despite initial uncertainty about human dimensions in the context of waterfowl management, the community has become increasingly aware of the potential value and need for these approaches. Although no specific funding has been allocated for these initiatives, endorsement of the value of such approaches should be sufficient to encourage emerging projects. Documentation, evaluation and broad sharing of outcomes will be essential for learning and improving programs over time.

Assessing priority landscapes Resources for waterfowl conservation and supporter engagement still are limited, and it will be very important to allocate resources to the most effective management actions. Although difficult, especially at present, to consider the additional element of conservation supporters, this feature must be front and center in the future if waterfowl conservation is to remain relevant. A work plan

already is well developed to refine the process of assessing priority landscapes. This includes both landscapes for waterfowl as well as waterfowl supporters. The value of ecological goods and services would be an obvious element to include in this evaluation; however, there is considerable work needed to more clearly define what expectations are for this particular element, recognizing that this may vary greatly from place to place. The NAWMP Science Support Team (NSST) has played a primary coordination role in assessment of priority landscapes in the past, and with a modest investment in GIS support (possibly through FWS and CWS staff), this work element could be advanced in a timely way. Developing a regional-scale approach to target conservation that achieves all three NAWMP goals is a logical first step, one that may lead to scalable decision support tools useful to state and provincial planners as well as continental-scale decision makers.

Integration is Underway Many "experiments" with greater integration have been initiated since the 2012 NAWMP Revision. The HDWG has been created and is well along in designing and resourcing an important project to probe stakeholder attitudes, values and desires around waterfowl management objectives and integrated management. A Public Engagement Team has begun to translate the theory and science of human dimensions into a framework of coordinated delivery. Several Flyways and the USFWS are engaged in the most penetrating discussions of harvest objectives since the mid-1990s. Several NAWMP Joint Ventures are considering how their habitat delivery work should be modified by more explicit consideration of human interests around waterfowl and beyond waterfowl. Locally-relevant experiments are cropping up in several places with the promise of useful learning and adaptive management. Technical support groups including the NSST, some Flyway Technical Committees, the HDWG and elements of the Harvest Management Working Group are actively considering how they might better communicate and integrate their work to adaptively inform waterfowl management decisions. So even as we continue to seek more formal integrated solutions for waterfowl management, much promising movement in this direction is already occurring.

In summary, and harkening back to the 2012 Action Plan's charge to the IIC to revise NAWMP objectives, it is now time for the waterfowl community to turn attention to the elaboration and adoption of linked decision processes, and the monitoring and assessment capacity to better inform those decisions. Throughout the process of implementation, clearly articulating the objectives, assumptions and uncertainties, alternative management actions, and continually adhering to this deliberate process of adaptive management will be needed to ensure integration. The concepts described above are a starting point, but we will need the continuing engagement and multiple talents of the waterfowl community to firm up these next key steps in the evolution of integrated waterfowl management.

3.2 Group discussion: role of harvest management and integration (*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 Multi-stock harvest management

4.1 Data-poor sustainable harvesting: accounting for objectives, uncertainty, and risk (*Fred Johnson, Guthrie Zimmerman, and Scott Boomer*)

The objectives of this work were to: 1) investigate some simple tools for estimating allowable harvests when confronted with minimal demographic information; 2) demonstrate how to account for management objectives, uncertainty, and risk tolerance in a systematic and transparent manner; and 3) explore how these tools might be useful in waterfowl harvest management. The approach is based on population dynamics as described by the theta-logistic model, which is widely used for assessing sustainable harvests of birds. Management objectives can be described either as: a) a goal for population size, with acceptance of the associated harvest; or b) a goal for harvest as a proportion of maximum sustained yield, with acceptance of the associated population size. Uncertainty concerning parameter estimates of the theta-logistic model, and thus of sustainable harvest, is quantified and the decision maker's tolerance of risk is specified on a 0–1 scale (with 0.0 being completely risk averse, 0.5 being risk neutral, and 1.0 being complete risk seeking). We used the method of Neil and Lebreton (2005) to estimate the intrinsic growth rate (r) based on age at first breeding and adult survival under optimal conditions. Adult survival in turn was estimated based on body mass as described by Johnson et al. (2012). The form of density dependence (i.e., θ in the theta-logistic model) can also be estimated based on the method provided by Johnson et al. (2012), or it can be assumed to be linear ($\theta = 1$), which generally would be a conservative approach for waterfowl. Results for a broad range of waterfowl species were consistent with conventional wisdom, with dabbling ducks, diving ducks, and geese having progressively lower harvest rates associated with maximizing yield. We concluded that the approach has potential as a first approximation for estimating allowable levels of harvest when data are minimal. The approach can also be used to specify a prior distribution on for fitting a logistic model to a time series of population sizes and harvests (e.g., western mallards), or to motivate the refinement of existing models based on empirical estimates of survival and reproduction. Finally, the approach could be used to evaluate the relative harvest potential of species being considered for multi-stock harvest strategies.

4.2 Atlantic Flyway multi-stock harvest management (*Min Huang*)

Since 2000, an Adaptive Harvest Management (AHM) process has been used to set duck hunting regulations for the Atlantic Flyway (AF) based on an objective of maximizing long-term cumulative harvest of eastern mallards and predictions from six eastern mallard population models representing different hypotheses about uncertainty in density dependent recruitment and bias in survival or recruitment estimates. Beginning in 2010, the Atlantic Flyway Council Technical Section and the Division of Migratory Bird Management began a rigorous re-evaluation of all components of the Eastern Mallard AHM decision frameworks. This included an evaluation of the performance of the model set and the sub-models used to support Eastern Mallard AHM. That assessment indicated that the relationships used to predict survival as a function of harvest and recruitment as a function of breeding population size did not perform well, resulting in over-prediction of the eastern mallard population size in 5 of the 6 years from 2006 to 2011. The consequence was that the harvest policies prescribed by the framework rapidly became much more conservative. A decision was made to develop and use a revised model set drawn from the Mid-continent Mallard AHM model set.

During this comprehensive 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 models 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 duck hunting regulations in the AF?

Through a structured decision making workshop in 2012, the Flyway determined that the current Eastern Mallard AHM decision framework did not adequately address the fundamental objectives for duck harvest

management in the Flyway. Eastern mallards are not a good representative species for the Flyway as they constitute less than 25% of overall harvest in the Flyway and are not really biologically representative of any of the other species in the Flyway. The Flyway determined that a decision framework based upon a suite of duck species that better represent the habitats and harvest distribution of ducks in the AF was more desirable than the current Eastern Mallard AHM framework. 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 the winter 2013 Atlantic Flyway Council 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 Flyway. 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 Atlantic Flyway are, (1), Sustain Atlantic Flyway 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 Atlantic Flyway, that we need to develop a duck harvest decision framework that takes into account those species that are important across the Flyway that represent the suite of habitats that we are trying to conserve and enhance, and, finally, that recognizes that within the bounds of sustainable harvest, 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: $N_{t+1} = N_t + rN_t(1 - N_t/K) - qH_t$. 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 r_{max} and K 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 Flyway and a human dimensions survey was initiated to assess hunter preferences for various regulatory alternatives. Bag limit analysis results were presented as were the results of the survey, which received over 12,000 responses from AF duck hunters. 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.

5 SEIS

5.1 Informing decisions in the absence of an observed state (*Fred Johnson, Paul Fackler, Scott Boomer, Guthrie Zimmerman, Ken Williams, and Bob Dorazio*)

We first briefly reviewed the history of AHM for midcontinent 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 the 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 (Figure 1). 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 mid-continent mallards with implementation of the SEIS.

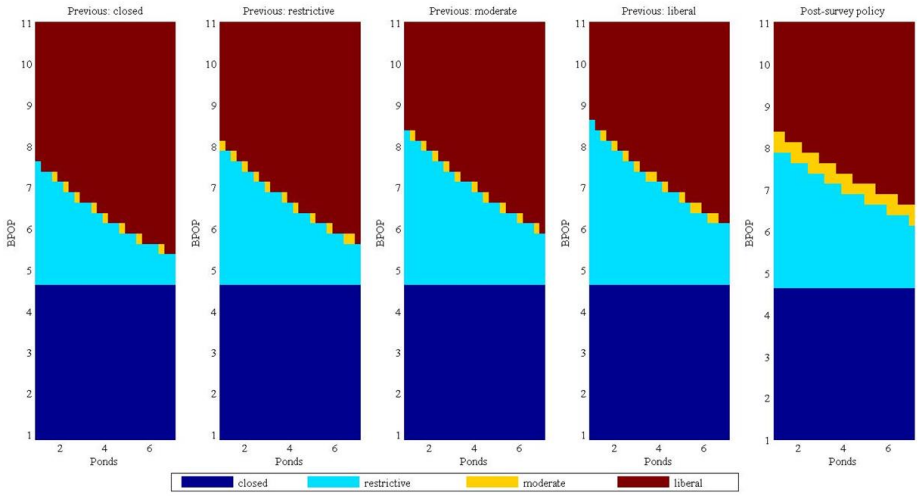


Figure 1 – Mid-continent mallard harvest policies (model averaged based on 2014 weights) derived under pre-survey optimization methods associated with changes in decision timing specified under the SEIS. A policy was derived for each of the possible decisions that could have been made the previous year with all possible combinations of BPOP and Canadian Pond values that could have been observed the previous year. For comparison purposes, we have included the 2014 harvest policy derived under post survey AHM protocols.

5.2 Effects of SEIS on Eastern and Western Mallard AHM (*Guthrie Zimmerman, Fred Johnson, and Scott Boomer*)

We provided an assessment of the potential influence of the sport harvest SEIS schedule for making harvest management decisions on the performance of eastern and western mallard AHM strategies. We began with an overview of the currents strategies and a brief review of their history, including objectives, management alternatives, and population models. Eastern mallard AHM was initiated in 2000, whereas western mallard AHM was initiated in 2008. Both strategies have an objective of maximizing long-term cumulative harvest, while western mallard AHM has an additional constraint to avoid large changes in regulations over small changes in population size. Eastern mallard AHM is based on a single state variable; eastern mallard breeding population size based on USFWS fixed wing survey data from strata 51-54 and 56, and ground

plot data from the Atlantic Flyway Breeding Waterfowl Survey data from VA, MD, DE, NJ, PA, NY, CT, RI, MA, VT, and NH. Eastern mallard population dynamics are described by four balance equations representing alternative combinations of weak and strong density dependence, and additive and compensatory harvest mortality. Western mallard AHM includes 2 state variables; Alaska mallard breeding population based on USFWS fixed wing data from strata 1-12 and California/Oregon breeding population data based on state aerial survey data. Both strategies include closed, restrictive, moderate, and liberal regulatory alternatives and expected harvest rates under each can be found in (U.S. Fish and Wildlife Service 2014).

The pre-survey policy for eastern mallards was slightly more liberal than the post-survey policy (Table 1). Similar to mid-continent mallards, the pre-survey policy became slightly more liberal as the previous season regulations became more restrictive. Simulations indicated that expected performance of the policies as measured by equilibrium population size and percent of regulatory alternatives were similar between the post- and pre-survey policies for eastern mallards (Table 2). For western mallard AHM, the pre-survey policy had slightly fewer closed seasons and more intermediate (restrictive and moderate) seasons than the post-survey policy (Figure 2). Similar to the other stocks, the policy became slightly more liberal with more restrictive previous seasons under a pre-survey decision framework, and the expected performance of the strategies were almost identical between the pre- and post-survey framework. We did note some differences between the western mallard post-survey policy when comparing ASDP and MDPSolve, particularly when the constraint was included in the optimization. We will continue to investigate potential causes of the disparity between the two programs for this stock. Nonetheless, these assessments suggest that there should be very little influence of the SEIS on eastern and western mallard AHM strategies.

Table 1 – Comparison of post-survey policy to pre-survey policies for eastern mallard AHM

		Pre-survey (SEIS)			
BPOP	Post-survey	Liberal	Moderate	Restrictive	Closed
0.1	C	C	C	C	C
0.125	C	C	C	C	C
0.15	C	C	C	C	C
0.175	C	C	C	C	C
0.2	C	C	C	R	R
0.225	C	R	L	L	L
0.25	C	L	L	L	L
0.275	C	L	L	L	L
0.3	R	L	L	L	L
0.325	L	L	L	L	L
0.35	L	L	L	L	L
0.375	L	L	L	L	L
0.4	L	L	L	L	L
0.425	L	L	L	L	L
0.45	L	L	L	L	L
0.475	L	L	L	L	L
0.5	L	L	L	L	L

5.3 Effects of SEIS on Northern Pintail and Scaup AHM (*Scott Boomer, Fred Johnson, and Guthrie Zimmerman*)

We briefly reviewed the objectives, regulatory alternatives, and models used in the AHM frameworks that inform pintail and scaup harvest regulations. Similar to the technical changes to the mallard AHM frameworks discussed previously, we needed to adjust optimization methods with new software to account

Table 2 – Comparison of the expected harvest strategy performance for eastern and western mallard AHM between post- and pre-survey decision frameworks.

	EMALL		WMALL	
Variable	Post-survey	Pre-survey	Post-survey	Pre-survey
Mean BPOP EMALL	1.2889	1.2797	-	-
Mean BPOP AK	-	-	0.5729	0.5759
Mean BPOP CO	-	-	0.4376	0.4396
% Closed	0.1726	0.1693	0	0
% Restrictive	0.0308	0.0257	0	0
% Moderate	0	0	0.001	0.0006
% Liberal	0.7966	0.805	0.999	0.9994

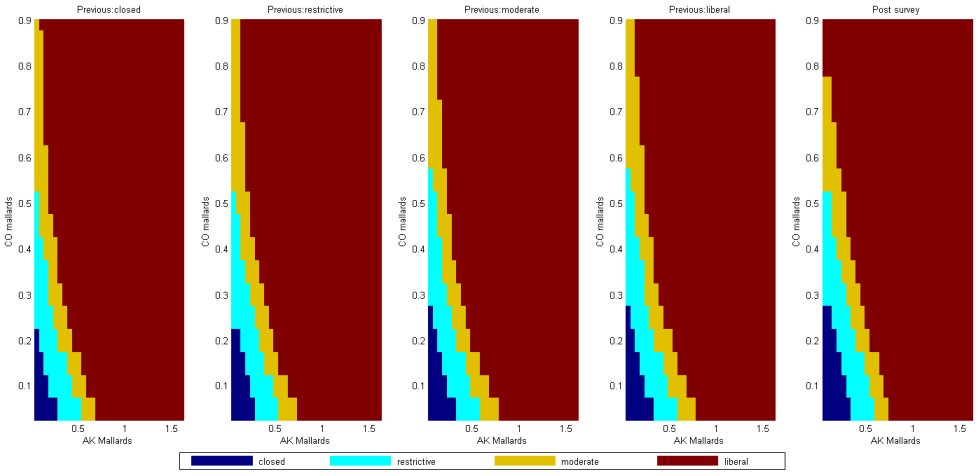


Figure 2 – Comparison of post- and pre-survey policies for western mallards

for the changes in decision timing associated with the SEIS. Based on current AHM protocols (post-survey decisions), pintail and scaup optimal policies derived with current software (ASDP) and new software (MDPsolve) were similar. After adjusting the optimization code to account for pre-survey decisions, the optimal policy for pintails is conditioned on breeding population and latitude observed the previous year and the three possible regulatory alternatives under consideration the previous year (Figure 3). Similar to the results for mallards under the pre-survey protocols, the pintail policy becomes more restrictive (more Liberal 1 cells) the more liberal the decision was the previous year. In addition, the higher the latitude observed in the previous year results in a policy with more Liberal 1 cells. Pre-survey policies for scaup followed the same pattern, where the higher the harvest observed the previous year resulted in a lower optimal harvest level. Unfortunately, the scaup harvest will not be observable at the time the decision is made (pre-survey). As a result, scaup harvest levels for each regulatory alternative (Restrictive, Moderate, and Liberal) will have to be specified in the optimization so that the resulting scaup harvest policy is conditioned on the regulatory package selected the previous year.

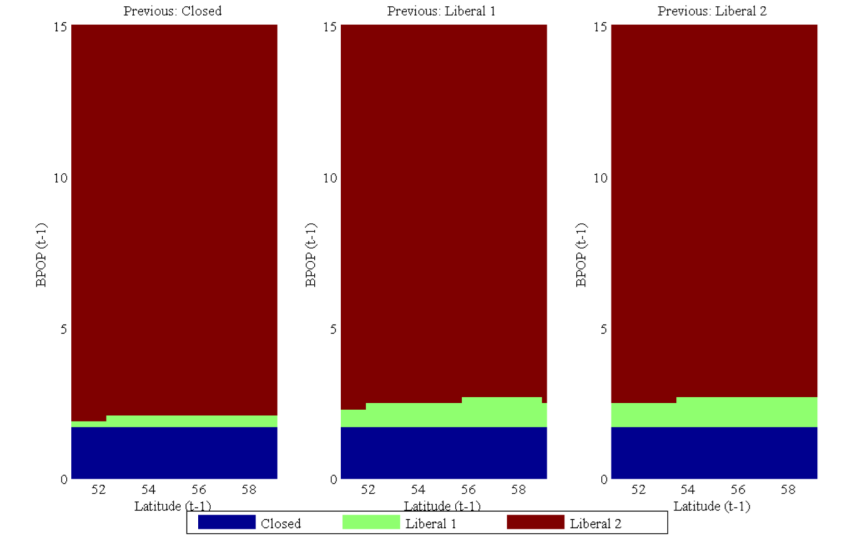


Figure 3 – Pintail harvest policies derived under pre-survey optimization methods associated with changes in decision timing specified under the SEIS. Each policy is conditional on the breeding population and latitude observed the previous year and the regulatory alternatives considered the previous year. Each policy was derived with the 2014 model weights.

6 Progress Reports and Updates

6.1 Model development to support adaptive responses to climate change (*Qing Zhao*)

Spatial autocorrelation (SAC) is commonly found in ecological data such as the distributions of organisms. While numerous approaches have been developed to account for SAC in model structure, most of them focus on model fit and parameter estimation. The forecast ability of spatial models in compare with non-spatial models is still poorly understood, due to the fact that forecast uncertainty has rarely been considered in model evaluation. We developed a spatial dynamic population model that incorporates density dependence, environmental effect, and SAC simultaneously. SAC is accounted in the model structure through a conditional autoregressive (CAR) effect. The model was analyzed and evaluated using thirty-seven year (1974–2010) time series of waterfowl abundance, habitat, and climate data. Our study shows that incorporating CAR effect in the model removed the residual SAC in 96.8% cases. The spatial model has better model fit than the non-spatial model, indicated by smaller DIC values ($\Delta DIC = 613.9$–1737.6). The spatial and non-spatial models are consistent in the direction and significance of parameter estimates, but the spatial model has large standard error than the non-spatial model in 83.3% cases. Although incorporating SAC reduced the standard deviation of residuals for 12.3–26.3%, the sum of the standard deviations of spatial effect and residuals in the spatial model was 72.3–95.8% larger than the standard deviation of residuals in the non-spatial model. Cross validation shows that the spatial and non-spatial models have similar forecast accuracy ($\Delta bias = -0.1$–0.1%, Wilcoxon signed-rank test : $P_{Holm} > 0.99$), but the spatial model has higher forecast uncertainty than the non-spatial model ($\Delta uncertainty = 0.3$–0.5%, Wilcoxon signed-rank test : $P_{Holm} < 0.001$). Consequently, while the observations never fell into the 5% critical region of the simulations based on the spatial model, they fell

into the 5% critical region of the simulations based on the non-spatial model in 0.9–1.8% cases. Our study demonstrates that the spatial model provides a better presentation of forecast uncertainty than the non-spatial model. This is essential for conservation decision-making that explicitly consider forecast uncertainty.

6.2 Modeling northern pintail productivity (*Erik Osnas*)

We estimated the effects of cumulative winter precipitation in the California Central Valley and the Mississippi Alluvial Valley on pintail and mallard reproduction, respectively, using hierarchical Bayesian methods to correct for sampling bias in productivity estimates and observation error in covariates. We applied the model to hunter-collected parts survey and band recoveries using data from 1961 to 2012. We found a large and consistent effect of population size and wetland conditions in prairie Canada on mallard productivity, and a large effect of population size and mean latitude of the observed breeding population pintail productivity. We found a large amount of uncertainty in the estimated effects of winter precipitation on both pintail and mallard productivity, with considerable uncertainty in the sign of the estimated main effect, although median estimates of precipitation effects were consistent with past studies. We found more consistent estimates in the sign of an interaction effect between population size and precipitation, suggesting that winter precipitation has a larger effect in years of high population size, especially for pintail. When the estimated effects were used in a population model to derive a sustainable harvest and population size projection (a "yield curve"), there was considerable uncertainty in the effect of increased or decreased winter precipitation on sustainable harvest potential and population size. These results suggest that "cross-seasonal effects" of winter habitat in ducks works by reducing the strength of density-dependence in years of above average winter precipitation. Because of the observational nature and uncertainty in the effect estimates, we suggest additional investigation of the underlying mechanisms and that habitat managers and decision-makers take a risk analysis approach that incorporates uncertainty and risk tolerance of when attempting to integrate habitat management and harvest management decisions.

6.3 Mid-continent mallard band recovery analysis 1987–2013 (*Scott Boomer, Guthrie Zimmerman, Nathan Zimpfer, and Jim Nichols*)

The double-loop learning phase of adaptive management provides opportunities to reconsider the models used to predict the consequences of management actions. Often, model development requires updated parameter estimates. To support this process, we performed an analysis of mid-continent mallard band recovery data to estimate harvest and survival probabilities and vulnerability ratios of birds banded during the pre-hunting season from 1987-2013. Estimating harvest rates for this time period is problematic because of the known increases in band reporting probabilities that occurred with changes in band inscriptions and reporting methods. As a result, we used all reward, control, and standard bandings and recoveries with a multi-level, Bayesian model to represent changes in band reporting rates within a Brownie band recovery estimation framework. We explicitly modeled sources of variation in reporting rates according to time (year), sex, and band inscription, while harvest and survival rates varied by age, sex, and time. Within this framework, we also explored different parameterizations to formally model the relationship between harvest and survival probabilities. Our initial results suggest that the reward and standard band data set provides sufficient information to estimate mid-continent mallard band reporting rates for the years without reward band releases. Reporting rates of birds marked with Avise, Zip, and Toll-free band inscriptions have all increased since 1995. Harvest rates have increased since liberal seasons were first adopted in 1995, and there is some evidence suggesting that survival rates have declined over this same time period. These estimates provide a time series of contemporary survival and harvest probabilites that will be useful when developing updated models for mid-continent mallard AHM.

6.4 Sea Duck Joint Venture, Harvest Management Subcommittee Progress (*Chris Dwyer, Guthrie Zimmerman, Kathy Fleming, Paul Padding, Mark Koneff*)

In 2012, a SDJV Harvest Management Subcommittee was formed to engage the harvest community and determine priority information needs to support decision-making for sea ducks. The Subcommittee is conducting a harvest assessment; contrasting estimates of sustainable take with contemporary harvest estimates. It is important to emphasize that the assessment is being conducted to determine key areas of uncertainty that need to be addressed and assist the SDJV in prioritizing monitoring and research needed to resolve them. Any regulatory implications of the assessment results are beyond the purview of the SDJV and will be considered through normal administrative processes. The harvest assessment is focusing on the southern subspecies of common eider (*Somateria mollissima dresseri*), eastern and western populations of black scoter, and continental populations of long-tailed ducks, surf scoter, and white-winged scoter. Species/populations were selected based on SDJV priorities/NAWMP recognition, their regional significance as game birds, and conservation concern.

The assessment utilizes the Prescribed Take Level (PTL) framework to assess sustainable and/or allowable take limits. PTL is a generalization of the Potential Biological Removal framework to accommodate various forms of take, including sport harvest. In the absence of direct estimates of harvest rate, PTL requires, at a minimum, estimates of the intrinsic rate of increase (r_{max}), population size (N), and the form of density-dependent response (θ) exhibited by a population. Programming to support modeling and simulation has been completed. Code is in place to compare and contrast estimates of sustainable take based on three alternative methods for estimation of (r_{max}), depending on the demographic data available for a species/population.

In the assessment, input parameters are expressed as probability distributions that reflect uncertainty in parameter estimates. Monte Carlo simulation is being used to propagate uncertainty in multiple parameter estimates into a probability distribution for PTL. The sustainability of contemporary harvest levels is being assessed through comparison of the probability distribution of PTL with probability distributions for contemporary harvest. We are examining the sensitivity of sustainable harvest estimates to uncertainty in individual parameter estimates with the intent of assisting the SDJV in prioritizing monitoring and research needs for individual species/populations.

The assessment is being conducted in several stages. In the initial phases of this work, we concentrated on development of the modeling and simulation framework and tested the framework against published results for other species. Code preparation is complete and has been tested against published take assessments of the northern common eider subspecies and black vulture. Several species-focused working groups formulated probability distributions for input parameters based on published empirical studies, general allometric or ecological relationships, and expert opinion. These values (i.e., distributions) are being used in initial PTL assessments and comparisons with contemporary harvest levels. Simple analyses will demonstrate the sensitivity of sustainable harvest estimates to uncertainty in input parameters and offer prioritization guidance to the SDJV. Reports are expected to be completed and distributed in advance of the 2015 winter Flyway technical meetings.

6.5 Nebraska harvest data evaluation (*Matthew T. Haugen, Larkin A. Powell, and Mark P. Vrtiska*)

We examined the U.S. Fish and Wildlife Service Parts Collection Survey (PCS) database to assess various harvest characteristics and duck hunter behaviors, as well as duck species co-occurrence in daily bags in the Central Flyway. For hunter behaviors and harvest characteristics, we separated hunters into harvest level categories based upon their seasonal bag of ducks. We focused our analyses on the regular duck season for three time periods with different regulations; 1975–1984 (i.e., moderate), 1988–1993 (i.e., restrictive), and 2002–2011 (i.e., liberal). We examined frequency of different sizes of daily harvests among duck hunters, and hunters' contributions to duck harvest in the Central Flyway. These data sets also were used to

calculate average days hunted, percent mallard composition for individual seasonal bags, average daily bag, and average counties hunted for each harvest level category within a state in the Central Flyway. A conditional probability matrix was developed to delineate relationships among duck species harvested together in the Central Flyway, 2002–2011. Conditional probabilities were defined as the probability a hunter harvested some species B given the same hunter also harvested some species A. For example, knowing the probability a hunter harvested a pintail (*Anas acuta*) given a hunter also harvested a mallard (*A. platyrhynchos*) was 0.0776.

Successful hunters, respectively, attained the 5-duck (1975–1984), 3-duck (1988–1993), or 6-duck (2002–2011) daily limit in 8%, 28%, and 13% of daily harvests reported to the PCS. The hunter groups did not equally contribute to duck harvest; for all the time periods examined, the hunter group comprising the lowest season bag only contributed 0.98–1.48% to the total duck harvest in the Central Flyway, whereas the largest hunter group contributed 31.26–38.41% to the total duck harvest. Trends in hunter behaviors were similar among the three time periods, although hunters in the restrictive period hunted more days proportionally than the moderate and liberal periods. Hunters did not appear to be selective in mallard harvest, and declined with higher seasonal bags. Hunters with higher seasonal bags traveled to more counties than hunters with lower seasonal bags. Diving and dabbling ducks were likely to be harvested with other diving and dabbling ducks, respectively, and ducks of similar species were likely to be harvested together.

We conclude that successful hunters were unlikely to achieve large daily limits and hunters disproportionately contribute to Central Flyway duck harvest. Differences between harvest levels within a time period and differences between harvest levels among all time periods were examined. Traditionally, managers would focus on single stock assessments when considering management changes, but harvest regulation changes may affect multiple duck stocks. Because duck stocks are not independent in regards to harvest, examination of the relationships among duck species during harvest provides better insight into developing appropriate regulations for multi-stock management.

6.6 Mid-continent mallard AHM double-loop learning update (*Adam Phelps*)

Personnel from the Central Flyway, Mississippi Flyway, and the US Fish and Wildlife Service began meeting in May 2014 to begin the process of double-loop learning for the two central Flyways, where duck seasons are set based on the status of mid-continent mallards. A basic problem statement was developed at that meeting, which was presented to the Flyway technical sections at their July meetings. Feedback from those meetings, as well as comments from the DMBM, was incorporated into a more formal document at a September 2014 meeting in Kansas City, Missouri.

The goal for federal frameworks identified at the September 2014 meeting is sustainable duck populations that maximize long-term hunting opportunity while minimizing regulatory change. Draft objectives related to these goals were also derived. These goals (below) will be reviewed by the Flyway technical sections at their winter meetings. Draft objectives:

- Minimize restrictive duck seasons as a satisficing objective to encourage hunter retention (hypothesis).
- Maximize long-term hunting opportunity (days).
- Develop policies that reduce potential impediments to recruitment. Some examples might include:
  - Common bag limit for guilds that varies little among years.
  - Regular season packages that reduce the need for special seasons (e.g., framework changes that would allow short seasons before a certain date).
- Duck populations sufficient to sustain hunting opportunity.
  - Maximize frequency of current liberal duck seasons/minimize restrictive duck seasons.

  - Maintain desired equilibrium population size.
  - Sustainable harvest: At MSY or other point on yield curve (reconsider NAWMP population goal coherence).
- Policies and regulatory processes that are less resource intensive. Examples of considerations might include:
  - Number of regulatory packages
  - Number of harvest strategies
  - Revised objectives for current stock-specific strategies
  - Number of species restrictions

In light of these objectives, specific recommendations were also made:

(1) Maintain focus on MCM for duck harvest management in the Mississippi and Central Flyways: Mallard population status will determine season length for all ducks.

(2) Start developing the details of how low-harvest guild regulations would function (fall 2015). This does not preclude considering other species in establishing packages and point on the yield curve, nor does it preclude further work on special seasons or elimination of special seasons to incorporate into regular seasons.

(3) Remove NAWMP constraint from objective function. The double-looping process should drive establishment of a revised NAWMP population objective.

(4) Do policy-level trade-off analysis to determine point on the yield curve and help establish packages. This will require updated models and so will be delayed by the implementation of the SEIS until summer 2016. Related tasks include:

  (a) developing consequence table rows and columns at the winter 2015 Flyway meetings-requires specification of relationships between multiple objectives and the different strategies/management actions proposed to achieve them;

  (b) populating cells of consequence table at a later date (winter 2017?).

(5) Formally incorporate an objective for maintaining duck hunter numbers at current (1999-present) levels along with duck populations into the AHM process. This will require several steps, including:

  (a) determination of whether to include duck hunter numbers as a state variable (model explicitly) or a constraint;

  (b) develop models relating harvest rates to hunter metrics; and

  (c) the Central and Mississippi Flyways working together to develop a plan for hunter management beyond regulations.

Next steps include presenting draft objectives and recommendations at the winter Flyway meetings, development of consequence table rows and columns, and potentially drafting hypotheses about relationships between our objectives, state variables and constraints.

7 Communications

7.1 SEIS (*Jim Kelley*)

The current schedule for setting migratory bird hunting regulations faces severe time constraints and is becoming increasingly untenable. Biological information used to establish duck hunting seasons does not

become available until approximately the same time that recommendations by the Flyway Councils must be made in the existing late season process. The time constraint was exacerbated when Congressional action prompted the Service to alter season framework opening (earlier) and closing dates (63 FR 63580). These factors have compressed the time available for public review required by NEPA. The Service addressed this situation during implementation of SEIS13 by adopting the preferred alternative of combining early and late season regulations processes and modifying the AHM framework to allow development of regulatory recommendations based on biological data from the previous year. This new process will be implemented for the 2016-17 regulatory cycle and will begin in June 2015. Thus, there will be a one-time overlap in the regulatory processes for the 2015-16 and 2016-17 seasons. An effective communications plan will be necessary to make stakeholders aware not only of this overlap, but also the change in timing of when public input to the 2016-17 process will be solicited.

A strategic approach will involve engaging USFWS External Affairs and partners in developing and implementing the communications plan for SEIS13 implementation. Although web/social communications channels should be utilized, the importance of face-to-face communications with leadership of target audiences should be recognized. Communication efforts should address why the change in the regulations schedule is being made and what are the benefits of the new system. The changes brought about by SEIS13 represent an opportunity to communicate about duck harvest management successes and the need for continued support (monitoring programs, etc.). Communications products should be developed in a timely manner (e.g. launch in association with North American Wildlife Conference) so that all partners have tools in hand well in advance of implementation. The following timetable represents the major administrative steps to be taken over the next 8-9 months to promulgate migratory bird hunting regulations for both the 2015-16 and 2016-17 seasons:

- September 2014 - Service announced intent to implement new regulatory timetable for the 2016-17 seasons
- January 28, 2015 - Service Regulations Committee meeting (non-decisional) for 2015-16 hunting seasons
- Feb-March 2015 - Flyway Council and Technical Section meetings (2015-16 seasons)
- 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
- September to early October 2015 - Flyway Council and Technical Section meetings for the 2016-17 seasons
- TBD Fall 2015 - Service Regulations Committee meeting for all 2016-17 seasons
- TBD Fall 2015 - FWS publishes proposed rule for all 2016-17 seasons (30 day comment period)
- No later than April 1, 2016 - FWS publishes final frameworks for all 2016-17 seasons
- May/mid-June 2016 - FWS publishes season selections for all 2016-17 seasons

8 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 2015 regulations cycle (see attached 2015 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.

8.1 2015 HMWG Meeting

The 2015 HMWG meeting will be hosted by the Atlantic Flyway somewhere in a southern state and is scheduled from 30 November through 4 December 2015.

LITERATURE CITED

Johnson, F. A., M. A. H. Walters, and G. S. Boomer. 2012. Allowable levels of take for the trade in Nearctic songbirds. Ecological Applications 22:1114–1130.

Neil, C., and J.-D. Lebreton. 2005. Using demographic invariants to detect overharvested bird populations from incomplete data. Conservation Biology 19:826–835.

Ringelman, J., M. Anderson, B. Clark, J. Eadie, M. Koneff, A. Raedeke, and G. Soulliere. 2012. NAWMP Action Plan A companion document to the 2012 North American Waterfowl Management Plan. URL http://www.nawmprevision.org/sites/default/files/NAWMP%20Action%20Plan%20Dec%202012-final%20w%20memo%20and%20cover.pdf.

Runge, M. C., F. A. Johnson, M. G. Anderson, M. D. Koneff, E. T. Reed, and S. E. Mott. 2006. The need for coherence between waterfowl harvest and habitat management. Wildlife Society Bulletin 34:1231–1237.

U.S. Department of the Interior. 2013. Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Hunting of Migratory Birds. U.S. Fish & Wildlife Service, Washington, D.C. 418pp. URL http://www.fws.gov/migratorybirds/pdfs/FSEIS%20Issuance%20of%20Annual%20Regulations%20Permitting%20the%20Hunting%20of%20Migratory%20Birds.pdf.

U.S. Fish and Wildlife Service, 2014. Adaptive harvest management: 2014 duck hunting season. U.S. Department of Interior, Washington, D.C. 63pp., URL http://www.fws.gov/migratorybirds/NewReportsPublications/AHM/Year2014/AHMReport2014.pdf.

Harvest Management Working Group
2014 Meeting Agenda
Bloomington, Indiana

Monday (December 1) ***Travel Day***

[1700] State Technical Representatives meeting (Vrtiska)

Tuesday (December 2) ***Welcome, Reports from Partners, New Business***

[0800] Welcome, introductions, logistics, agenda (Case, Phelps, 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**

[1015] Old and New Business

- Black duck AHM (Devers)
- Evaluating the effect of large resident Canada goose bag limits on participation in the Parts Collection Survey (Johnson)

[1200] **Lunch**

[1300] IIC workplan update (Humburg)

- IIC Workplan (Humburg)
- Human Dimensions Working Group (Vrtiska)
- National Science Support Team (Devers)
- Species integration updates (black duck, scaup, pintail)
- Group Discussion: Role of harvest management and integration? (Richkus)

[1500] **Break**

[1515] Multi-stock Harvest Management

- Data-poor sustainable harvesting: accounting for objectives, uncertainty, and risk tolerance (Johnson et al.)
- Update: Atlantic Flyway multi-stock harvest management (Huang)
- Group Discussion: Multi-stock harvest management: practical limitations and implications: revised AHM frameworks, packages, others

[1700] **Adjourn**

Wednesday (December 4) ***SEIS***

[0800] SEIS evaluations: where we left off... (Boomer)

[0830] An alternative approach to informing decision in the absence of an observed state (Johnson)

[0900] Species-specific assessments

[1000] **Break**

[1015] Species-specific assessments

[1200] **Lunch**

[1300] SEIS and prescribed strategies (canvasbacks, teal, brant, cranes, others) (Richkus)

[1400] SEIS Implementation Planning (Richkus)

- Meeting scheduling (HMWG, Flyway Tech Sections)
- Sequence of steps for implementation

[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 29) ***Progress Reports, Communication and 2015 Planning***

[0800] Recap and Discussion (Case)

[0830] Progress reports and assessment updates

- Evaluating sea duck harvest potential (Dwyer)
- Nebraska harvest data evaluation (Vrtiska)
- Update: mid-continent mallard AHM revisions (Phelps)

[1000] **Break**

[1015] SEIS Communications Issues

[1200] **Lunch**

[1300] Plans for 2015 (Case)

- Group Discussion: relevance of HMWG and AHM
- Group Discussion: action items
- Priorities for 2016

[1515] Meeting summary (Case)

- Plans for next meeting: location, dates, topics
- Parting thoughts

[1600] Adjourn

Friday (December 30) ***Travel Day***

2016 Harvest Management Working Group Priorities

Priority rankings and project leads identified for the technical work proposed at the 2014 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

- Sea duck harvest potential assessment (*Seaduck Joint Venture, HMWG*)
- Waterfowl harvest potential assessment (*PHAB, Tech Sections, others...*)

Harvest Management Working Group Members

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.

Coordinator:

Scott Boomer
U.S. Fish & Wildlife Service
11510 American Holly Drive
Laurel, Maryland 20708-4017
phone: 301-497-5684; fax: 301-497-5871
e-mail: scott_boomer@fws.gov

USFWS Representatives:

Nanette Seto (Region 1)
U.S. Fish & Wildlife Service
911 NE 11TH Avenue
Portland, OR 97232-4181
phone: 503 231-6159
fax: 503 231-2019
e-mail: nanette_seto@fws.gov

Greg Hughes (Region 2)
U.S. Fish & Wildlife Service
500 Gold SW - 8th Floor
Albuquerque, NM 87103
phone: 505-248-6639
fax: 505-248-7885
e-mail: greg_hughes@fws.gov

Sean Kelly (Region 3)
U.S. Fish & Wildlife Service
5600 American Blvd West
Bloomington, MN 55437-1458
phone: 612-713-5470
fax: 612-713-5393
e-mail: sean_kelly@fws.gov

Vacant (Region 4)
U.S. Fish & Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345
phone: 404-679-7188
fax: 404 679-4180
e-mail:vacant_@fws.gov

Pamela Toschik (Region 5)
U.S. Fish & Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-9589
phone:413-253-8610
fax: 413-253-8293
e-mail:pamela_toschik@fws.gov

Casey Stemler (Region 6)
U.S. Fish & Wildlife Service
P.O. Box 25486-DFC
Denver, CO 80225-0486
phone: 303-236-4412
fax: 303-236-8680
e-mail:casey_stemler@fws.gov

Eric Taylor (Region 7)
U.S. Fish & Wildlife Service
1011 East Tudor Road
Anchorage, AK 99503-6119
phone: 907-786-3446
fax: 907-786-3641
e-mail: eric_taylor@fws.gov

Eric Davis (Region 8)
U.S. Fish & Wildlife Service
2800 Cottage Way Suite, W-2606
Sacramento, CA 95825
phone: 916-414-6462
fax: 916-414-6189
e-mail: eric_davis@fws.gov

Khristi Wilkins (Region 9)
U.S. Fish & Wildlife Service
10815 Loblolly Pine Drive
Laurel, Maryland 20708-4028
phone: 301-497-5557
fax: 301-497-5581
e-mail: khristi_wilkins@fws.gov

Ken Richkus (Region 9)
U.S. Fish & Wildlife Service
11510 American Holly Drive
Laurel, Maryland 20708-4017
phone: 301-497-5994
fax: 301-497-5871
e-mail: ken_richkus@fws.gov

Paul Padding (Region 9)
U.S. Fish & Wildlife Service
11510 American Holly Drive
Laurel, MD 20708
phone: 301-497-5851

Jim Kelley (Region 9)
U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, MN 55111-0458
phone: 612-713-5409

fax: 301-497-5885
e-mail: paul_padding@fws.gov

Jim Dubovsky (Region 9)
U.S. Fish & Wildlife Service
P.O. Box 25486-DFC
Denver, CO 80225-0486
phone: 303-236-4403
fax: 303-236-8680
e-mail: james_dubovsky@fws.gov

fax: 612-713-5393
e-mail: james_r_kelley@fws.gov

Todd Sanders (Region 9)
U.S. Fish & Wildlife Service
1211 SE Cardinal Court, Suite 100
Vancouver, Washington 98683
phone: 360-604-2562
fax: 360-604-2505
e-mail:todd_sanders@fws.gov

Canadian Wildlife Service Representatives:

Eric Reed
Canadian Wildlife Service
351 St. Joseph Boulevard
Hull, QC K1A OH3, Canada
phone: 819-953-0294
fax: 819-953-6283
e-mail: eric.reed@ec.gc.ca

Joel Ingram
Canadian Wildlife Service
Suite 150, 123 Main Street
Winnipeg, MB R3C 4W2, Canada
phone: 204-984-6670
fax: 204-983-5248
e-mail: joel.ingram@ec.gc.ca

Flyway Council Representatives:

Min Huang (Atlantic Flyway)
CT Dept. of Environmental Protection
Franklin Wildlife Mgmt. Area
391 Route 32 North Franklin, CT 06254
phone: 860-642-6528
fax: 860-642-7964
e-mail: min.huang@po.state.ct.us

Greg Balkcom (Atlantic Flyway)
Georgia Dept. of Natural Resources
1014 Martin Luther King Blvd.
Fort Valley, GA 31030
phone: 478-825-6354
fax: 478-825-6421
e-mail:greg.balkcom@dnr.state.ga.us

Larry Reynolds (Mississippi Flyway)
LA Dept. of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898-9000, USA
phone: 225-765-0456
fax: 225-763-5456
e-mail: lreynolds@wlf.state.la.us

Adam Phelps (Mississippi Flyway)
Indiana Division of Fish and Wildlife
553 E. Miller Drive
Bloomington, IN 47401
phone: 812-334-1137
fax: 812-339-4807
e-mail: APhelps@dnr.IN.gov

Mike Johnson (Central Flyway)
North Dakota Game and Fish Department
100 North Bismarck Expressway
Bismarck, ND 58501-5095
phone: 701-328-6319
fax: 701-328-6352
e-mail: mjohnson@state.nd.us

Mark Vrtiska (Central Flyway)
Nebraska Game and Parks Commission
P.O. Box 30370 2200 North 33^{rd} Street
Lincoln, NE 68503-1417
phone: 402-471-5437
fax: 402-471-5528
email: mark.vrtiska@nebraska.gov

Dan Rosenberg (Pacific Flyway)
California Department of Fish and Wildlife
1812 9th St. Suite 300
Sacramento, CA 95814
phone: 916-445-3717
fax: 916-445-4048
e-mail: mweaver@dfg.ca.gov

Jeff Knetter (Pacific Flyway)
Idaho Dept. of Fish and Game
600 Walnut Street, P.O. Box 25
Boise, ID 83707
phone: 208-287-2747
fax: 208-334-2114
e-mail: jknetter@idfg.idaho.gov

USGS Scientists:

Fred Johnson (USGS)
Southeast Ecological Science Center
U.S. Geological Survey
P.O. Box 110485 Gainesville, FL 32611
phone: 352-392-5075
fax: 352-846-0841
e-mail: fjohnson@usgs.gov

Mike Runge (USGS)
Patuxent Wildlife Research Center
U.S. Geological Survey
12100 Beech Forest Rd. Laurel, MD 20708
phone: 301-497-5748
fax: 301-497-5545
e-mail: mrunge@usgs.gov

2014 Harvest Management Working Group Meeting Participants

HMWG Member	Representation	Affiliation
Min Huang	Atlantic Flyway Council	Connecticut Dept. of Environmental Protection
Greg Balkcom	Atlantic Flyway Council	Georgia Dept. of Natural Resources
Paul Padding	Atlantic Flyway Representative	U.S. Fish & Wildlife Service
Adam Phelps	Mississippi Flyway Council	Indiana Dept. of Natural Resources
Jim Kelley	Mississippi Flyway Representative	U.S. Fish & Wildlife Service
Mike Johnson	Central Flyway Council	North Dakota Fish and Game
Mark Vrtiska	Central Flyway Council	Nebraska Game and Parks
Jim Dubovsky	Central Flyway Representative	U.S. Fish & Wildlife Service
Jeff Knetter	Pacific Flyway Council	Idaho Department of Fish and Game
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
Sean Kelly	Region 3 Bird Chief (Designee)	U.S. Fish & Wildlife Service
Chris Dwyer	Region 5 Bird Chief (Designee)	U.S. Fish & Wildlife Service
Joe Sands	Region 1 Bird Chief (Designee)	U.S. Fish & Wildlife Service
Fred Johnson	USGS	U.S. Geological Survey
Mike Runge	USGS	U.S. Geological Survey
Other Participants		
Scott Boomer	PHAB	U.S. Fish & Wildlife Service
Dave Case	Facilitator	D.J. Case & Associates
Patrick Devers	BDJV	U.S. Fish & Wildlife Service
Tony Roberts	Atlantic Flyway Representative's Office	U.S. Fish & Wildlife Service
Guthrie Zimmerman	PHAB	U.S. Fish & Wildlife Service
Dale Humburg	NAWMP	Ducks Unlimited
Erik Osnas	Post Doctoral Researcher	U.S. Geological Survey
Qing Zhao	Post Doctoral Researcher	Colorado State University

Figure 4 – The participants of the 2014 Harvest Management Working Group meeting met on the campus of Indiana University in Bloomington, IN.