Harvest Management Working Group

2012 Annual Meeting Report

November 26 - November 30, 2012

Buda, Texas

Compiled by:

G. Scott Boomer
U.S. Fish & Wildlife Service
February 22, 2013

$$\bar{V}^*(\hat{x}_t, p_t) = \max_{a_t}\left\{\bar{R}(a_t|\hat{x}_t, p_t) + E_{p_{t+1}|p_t} \times \left[\sum_{x_{t+1}} \bar{p}(\hat{x}_{t+1}|\hat{x}_t, a_t)\bar{V}^*(\hat{x}_{t+1}|\hat{p}_{t+1})\right]\right\}$$

Cover Art: Hamilton-Jacobi-Bellman equation adapted from Williams et al. (2002).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 BACKGROUND

This report provides a summary of presentations, break out groups, and discussions that occurred at the 24th meeting of the Harvest Management Working Group (HMWG). The 2012 meeting focused on the evaluation of the harvest management implications of the preferred alternative specified in the Draft Supplemental Environmental Impact Statement on the Issuance of Annual Regulations Permitting the Hunting of Migratory Birds (SEIS; U.S. Department of the Interior 2010) along with continued work related to the double-looping learning process of Adaptive Harvest Management (AHM). For meeting details please refer to the appended 2012 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.

2 REPORTS FROM PARTNERS

2.1 Atlantic Flyway (*Min Huang and Joe Benedict*)

Eastern Mallard Model

As we continue to assess Eastern Mallard AHM we initiated a Structured Decision Making process to determine the objectives for duck harvest management in the Atlantic Flyway. We have been conducting this double loop since 2010. Our technical assessment of the current Eastern mallard AHM models indicated they were not performing in a satisfactory manner. Too frequently, the observed BPOP decreased when the models predicted an increase, or vice versa. The assessment also indicated that density dependence, at least as a function of productivity, may not be an important factor in Eastern mallard population dynamics at the current scale of analysis. This inability to detect a strong density dependence signal may be due to a number of factors (data bias, monitoring scale, system change).

As a result of this technical assessment and increasingly sharp shifts in model weights, we developed a revised, interim model set to inform eastern mallard harvest decisions until all of the updates to the eastern mallard AHM protocol are completed. This model set included the current strong and weak density dependent recruitment and additive survival models, as well as a compensatory survival model based on the mid-continent mallard parameterization. This model set was used in 2012.

As the next step in this double loop, we solicited input on fundamental objectives from the Technical Section. The Atlantic Flyway identified 3 Fundamental Objectives:

(1) **Maintain an eastern mallard population that meets legal mandates and provides consumptive and non-consumptive uses indefinitely.**

(2) **Provide mallard hunting opportunity in accordance with hunter desires.**

(3) **Accommodate harvest management objectives for other duck stocks in the Flyway.**

Means objectives were then developed for each Fundamental Objective and then ranked and weighted. Overwhelmingly, the member states of the AF were in favor of establishing duck season frameworks and decisions based on multiple stocks of ducks, not just Eastern Mallards. This has been a long standing recurrent theme in the AF. With the more formal SDM that the Flyway has recently undergone, the pending changes in how regulations are set, and the implementation of black duck AHM, it seems that now might be the perfect opportunity to move in a new direction.

Given the overwhelming support for multi-stock management and the high investment of technical capacity that is being spent on Eastern Mallard AHM, the AF would like to request that the HMWG:

(1) Elevate multi stock management to the highest priority for the HMWG (once the SEIS assessments are completed).

(2) Work with the AF to develop a decision framework based on multiple stocks of ducks.

(3) Work with the AF to assess the interim Eastern Mallard model set to ensure that it performs adequately until multiple stock harvest management can be implemented (likely 5–7 year time frame).

(4) Limit the investment of further time and energy on refinement of Eastern Mallard AHM, except as needed to respond to unacceptable consequences of the current approach.

The AF expects to spend a fair amount of time on this issue at its winter meeting, with a more formal recommendation coming from the Council. However, we felt at this time that the momentum within the technical section and Council towards moving in this direction warrants its discussion at this meeting. We understand that this fundamental shift in the way we think about duck harvest management in the AF will potentially have rippling effects across the other 3 Flyways. We also recognize the fact that this will involve a lot of work, both on the technical side and the policy side. We firmly believe, however, that this approach is the best way to satisfy the expressed objectives for duck harvest management throughout the Flyway.

SEIS

SEIS - As we have alluded to in the past, we are in favor of the preferred alternative, and have been giving thought to the implementation of the SEIS with regards to our goose harvest management. Given our potential change in direction with regards to duck harvest management we will await the timelines outlined in the final document to decide how much investment should be made with package changes to the current Eastern Mallard AHM protocols.

NAWMP Revision

NAWMP Revision - We have not had the time to review the Action Plan for the Revision. In principle we continue to agree with the path outlined in the Revision, however, we continue to debate the immediate need for formal inclusion of human dimensions into the process.

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

Discussion of HMWG-related issues by the Mississippi Flyway Council (MFC) and Technical Section (MFCTS) was limited to the winter 2012 meeting and focused primarily on the priority project list and a proposed change to early teal hunting opportunity once the Teal Assessment is completed. Given current uncertainty on the status of the SEIS and content of the NAWMP 2012 Revision Action Plan, our Flyway's perspective on harvest-related aspects covered in those documents remains similar to that reported last year.

HMWG Priority List

MFC endorsement of the 2012 HMWG Priorities list was requested, so the MFCTS considered a recommendation to do so in the AHM Committee. The only highest priority item on that proposed list was adjustments to harvest strategies based on changes in timing of regulatory decisions associated with the preferred SEIS alternative for promulgating annual regulations using a single process. All other items from the 2011 HMWG list fell in priority. Consequently, discussion centered on 2 points: 1) the 2012 priority list presupposes the change in regulations process timing in the SEIS will be implemented despite a lack of support from all 4 Flyways and little information provided thus far addressing concerns regarding impacts of that change on

harvest opportunity, and 2) a product of the NAWMP Revision was 3 fundamental objectives, and a goal was to reassess the way we do waterfowl management in light of those 3 objectives, including the current trajectory of harvest management such as continued use of many species-specific harvest strategies, but this priority list appears to confirm the current trajectory. As a result, the recommendation to endorse the 2012 HMWG Priority list was viewed as premature and was tabled.

In General Session, the issue was revisited to provide some feedback beyond just not endorsing the proposed priority list and express priority concerns of the MF. A recommendation asking MFC support for the following revised priority list was passed.

Highest Priorities (Urgent and Important)

- Evaluation and development of adjustments to Mid-continent, Eastern, and Western Mallard AHM and Black Duck AHM based on changes in timing of regulatory decisions in association with the preferred SEIS alternative (See Table 1, HMWG 2011 report for species action items and technical leads)
- Review harvest management strategies in light of the three proposed fundamental objectives in the NAWMP revision
- Eastern mallard AHM model set Revision (Double-loop process; Bryan Swift, Min Huang, Guthrie Zimmerman, Pat Devers)
- Mid-continent mallard AHM model set Revision (Double-loop process; Mark Vrtiska, Scott Boomer, Nathan Zimpfer, others...)

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

- Multi-stock management (HMWG)
- Time dependent optimal solutions to address system change (Scott Boomer, Fred Johnson, Mike Runge)

Additional Priorities

- Developing methods to communicate with constituents (Dave Case, Pam Garrettson, Communications Team):
  - Planning for communication challenges associated with changing packages
  - Updating Harvest Management Working Group communications plan
- Harvest Management Working Group coordination with monitoring program reviews (e.g. WBPHS, Banding Needs, Nathan Zimpfer, Pam Garrettson)
- Incorporation of U.S. ponds into mid-continent mallard AHM reproduction models (Jim Dubovsky, Nathan Zimpfer, Pam Garrettson)
- Mid-continent mallard AHM objective function (Guy Zenner, Josh Richardson, Mark Vrtiska)

Going through this discussion exposed a timing problem if getting Council feedback on HMWG priorities is desired or needed.

Early Teal Season Opportunities

Although no changes to September teal hunting regulations will be considered until after completion of the Teal Assessment, the MF wants to expand special teal season opportunity to include "production states," which have been excluded since 1969. Concern over take of non-teal species is cited as the reason production states are not allowed to participate in September teal seasons. However, review of experimental season evaluations showed no difference in rates of attempted take of non-teal species between production and non-production states. Consequently, if the Teal Assessment concludes that harvest opportunity beyond the regular duck season is warranted, it should be offered to all MF states equally.

Other Issues

The MF continues to be concerned about the following:

- That the effectiveness of some species-specific regulations is questionable given the rudimentary duck identification skills of most hunters. Consequently, we question whether those regulations obtain the desired effect.
- That complicating regulations via species-specific harvest strategies, season closures, and partial seasons, may negatively affect hunter participation and satisfaction without clear benefit to population status.
- That maximizing long-term cumulative harvest may not be the best means objective for achieving the MF's fundamental objectives.
- That a time-table for the review and/or revision of regulatory packages continues to be delayed.
- That we still have not developed a strategy for dealing with the difficult communications issues that will likely arise when the duck season becomes Restrictive, especially if the Moderate package is not used.

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

The 2012 regulatory cycle for the Central Flyway was one of frustration. We believe the partnership between the U.S. Fish and Wildlife Service (Service) and the Central Flyway has been seriously damaged and is in need of repair. The damage is reflected in both the Central Flyway Council and Waterfowl Technical Committee questioning our participation in the Harvest Management Working Group (HMWG) and in Service Regulations Committee (SRC) meetings. The resulting frustration also has increased tension between the Central Flyway and Service that jeopardizes cooperative migratory bird management.

One point of frustration is that the Central Flyway perceives that the SRC is not fully engaged in the migratory game bird harvest management process. While we realize that the SRC members are inundated with multiple issues, migratory game bird management issues are important for the Service, the Flyways and our constituents. It appears to us that the SRC's reliance on direction from the Division of Migratory Bird Management staff has become greater in recent years because of this disengagement. We fully understand that the SRC needs to have a level of reliance on their staff, but it now seems that the "cards are stacked" against the Flyways in receiving a fair shake in having discussions and presenting arguments to the SRC about various issues.

A second point is the apparent amount of process needed to make changes in what we see could be simple changes. For example, do we really need a complex and detailed harvest strategy to add one redhead to the daily bag limit when we see a record number of redheads? The process, requirements and "hoops" we to have to jump through seems excessive to us. In our view, we have complicated the harvest regulation process to a point that is not sustainable. Relatedly, we continued to be concerned about the number of harvest strategies in place and our ability to understand as well as transmit them to our constituents. Moreover, we question the capacity of the Service's staff time and resources to promulgate, implement, and update all of the harvest strategies, given the necessary requirements of these strategies. We believe it is not possible to maintain the current trajectory we're on in regards to harvest strategies. We are pleased to learn that several Service HMWG members agree with this assessment.

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

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

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 Pacific Flyway Council (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 mallard.

Northern Pintail

In 2010, the Pacific Flyway Study Committee 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 USFWS. The breeding populations of northern pintails were estimated at approximately 4.4 million in 2011 and 3.5 million in 2012; the largest observed breeding populations since 1980. Pintails have increased 94% in 2012 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 Council continues to support efforts to develop harvest strategies and refine the population model to meet both biological and human dimension goals. Additionally, the Council 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

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

Scaup

Based on the current scaup harvest strategy, an evaluation of selected harvest packages was scheduled prior to the 2013–14 regulatory cycle. The PFC supports an evaluation of the selected regulatory packages. We are interested in reviewing these packages because of the large number of greater scaup in the Pacific Flyway. We also request an evaluation of how model predictions correlate with actual harvest.

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 priority sea duck species (e.g., scoters, long-tailed ducks). Initial project funding has been identified as a high priority by the SDJV. During 2013, a potential exists for staff from the DMBM or USGS to conduct the assessment or consult on the project.

Supplemental Environmental Impact Statement on the Issuance of Annual Regulations Permitting the Hunting of Migratory Birds

The PFC has the following positions on the SEIS:

(1) We are concerned about the potential effects of adopting a single annual decision making process based on previous year's information. The SEIS states that additional uncertainties inherent to the proposed process may result in more conservative harvest. With hunter recruitment and retention issues experiencing increasing importance, needless restriction of harvest seems unwise. Additional work is needed to evaluate effects on regulations for low abundance species (e.g. pintail, mottled duck, black duck, canvasback).

(2) We support review of regulatory packages once every five years while highlighting the importance of maximizing harvest in an adaptive fashion, rather than selecting risk-averse packages that fail to take advantage of increasing stocks that occur within the 5 year cycle.

(3) The PFC reiterates its request for a structured decision-making process to determine the degree of stock-specificity the Flyways and USFWS wish to target. We note that while the SEIS assumes that increases in stock-specific management are a given, this Working Group has discussed at least 8 different levels of detail regarding stock-specificity in harvest management (HMWG, Portland, OR, 2009), some of which examined the reduction of complexity in stocks.

(4) We question the definition of "management scale" for migratory bird harvest in part due to the implication that harvest management and monitoring scales are by necessity the same. Allowance of different harvest packages would assist states in achieving hunter recruitment or retention goals.

(5) We continue to support a five-year cycle for adjusting hunting zones and season splits as defined in the preferred alternative, while also supporting the increased flexibility the Service allowed States in the number of zones and splits.

(6) We continue to support spring-summer subsistence hunting season with regulations necessary to ensure long-term conservation of the migratory bird resource and traditional subsistence harvest practices.

2.5 Canadian Wildlife Service (*Eric Reed*)

(1) Regulatory overhaul

  (a) In the process of revising our regulations to streamline and rejuvenate
  (b) Completed the technical discussion and developed a set of recommendations for change
  (c) Will present those to CWS exec early in the new year for approval
  (d) Can't say much at this time but Flyways will be briefed in more detail at winter meetings

(2) Stabilized regs

  (a) Policy decision to not make regulatory changes during 3 year periods.
  (b) Nothing prevents us from initiating a regulatory update process during that interval and would do so for conservation reasons

(c) Effective 2014

(3) Black duck international harvest strategy and Canadian packages for 2013

(a) Agreement between US and Canada was reached last summer

(b) 1st year of application in 2013–14

(c) Canada will be in the liberal package, up from the moderate it was in previously

(d) Larger bag limits and seasons extended to 107 days in most jurisdictions

(4) Issues with the Eastern Waterfowl survey and BC survey

(a) A review of all waterfowl surveys in the east was underway, with the aim of clarifying objectives and re-allocating resources if needed. Also understood that resources were likely to be lower in the future

(b) 2 year horizon on this review

(c) However, changes in Canadian Coast Guard fees (budget restrictions), increasing costs and stable budgets mean that changes will need to be made to the survey in 2013 (before review is completed)

(d) Reviewing options and trying to determine what we can deliver for next year

(e) Will work with USFWS to predict impact of reduction options

(f) USFWS funding for this survey could be reduced. If that's the case, we would likely not have resources to invest and the survey frequency would need to be reduced (every second year instead of annual)

(g) No changes to WBPHS in 2013

(5) Intent to designate WA SNGO and ROGO as overabundant

(a) Public consultations. Also need to consult with Aboriginals

(b) Hoping to designate by 2014

(6) Considering TUSW season in Sk and a dove season in On (2014).

(7) Proposals to increase possession limits in remaining jurisdictions (removing for overabundant species).

(a) Issues with 3x possession in Atlantic because for sea ducks down this way (where we suspect possession limits may actually influence take for a group of species that likely shouldn't have additional harvest pressure), but look to be going that direction for species encountered while inland duck hunting (e.g., dabblers, ring-necks, etc.). Should have a decision sorted out soon.

2.6 SEIS Status (*Robert Trost*)

As part of the review process, the draft SEIS (U.S. Department of the Interior 2010) is still under evaluation by the USFWS but is expected to be finalized before the new year.

2.7 NAWMP Revision and Action Plan (*Dale Humburg*)

Dale Humburg, the Chairman of the Interim Integration Committee recently appointed by the North American Waterfowl Management Plan (NAWMP) Committee, provided an update regarding the recently released NAWMP Action Plan. He presented an overview of the action plan, discussed possible strategies to coordinate efforts between the key institutions that govern the waterfowl management enterprise, and then introduced some next steps in the implementation of the NAWMP.

2.8 Annual Schedule for Setting HMWG Priorities (*Jim Kelley*)

For the past few years, the HMWG has developed an annual list of priorities to manage its annual workload. Because the HMWG serves in an advisory capacity to the Flyway Councils and FWS, the priorities list is intended to be approved by both of those entities. The draft priorities list is developed early in the fiscal year during the HMWG's annual meeting in November. However, Flyway Councils and the Service Regulations Committee (SRC) typically do not consider approval of the list until March (Councils) or June (SRC). Meanwhile, a large portion of the fiscal year has passed by then and the HMWG must continue work on technical assessments in the absence of an agreed-upon list of priorities.

In July 2012, the SRC and Flyway Consultants from the 4 Flyways agreed to an annual schedule intended to rectify the mismatch in the timing of the HMWG annual meeting and approval of the HMWG priorities list. The schedule would begin with approval of the priorities list by the Councils and SRC during the July SRC meeting in Arlington, VA (year t). The approved list is intended to guide the workload of the HMWG until July of year t+1. In November of year t the HMWG will review work conducted in the preceding year and recommend to the Councils and SRC potential changes (if any) to the priorities list for the next fiscal year (year t+2). The HMWG recommendations will be presented at the February SRC meeting and winter meetings of the Flyway Council Technical Sections. Technical Sections will provide input to the Councils in time for the March Council meetings. Flyway Council recommendations on the priorities list for year t+2 will be transmitted to the SRC following their March meetings. At the June SRC meeting, Flyway Consultants and the SRC will discuss Council recommendations for the year t+2 priorities list. Any revisions to the priorities list resulting from the June SRC meeting will be discussed at the July Technical Section and Council meetings and final Council recommendations will be developed. The priorities list for year t+2 would then be finalized at the July SRC meeting.

3 OLD BUSINESS

The HMWG discussed several issues that were brought up at the last annual meeting. Mark Vrtiska provided an update on a proposal to develop an Alternative Licensing System (Two-tiered) for the Central Flyway. In addition, Mike Johnson described efforts to determine the extent of potential problems in the band recovery database resulting from the harmful effects of "Band Lust." The Central Flyway in coordination with the FWS will be developing a white paper to describe these issues and to scope out potential solutions.

3.1 Sea duck harvest potential assessment (*Chris Dwyer*)

The Sea Duck Joint Venture is working with the Flyways and the Harvest Management Working Group to address the information needs of sea duck harvest management decision-makers. As a first step, a Harvest Management Subcommittee was established to engage the harvest management community, determine priority information needed to support decisions, determine what the SDJV research and monitoring programs can do to support such needs, and incorporate them into the next SDJV Strategic Plan Revision. As initial steps, the Subcommittee will:

(1) Compile relevant survey and demographic information for select species of sea ducks (black scoters, surf scoters, white-winged scoters, long-tailed ducks and American common eiders) for use in conducting an assessment of their harvest potential.

(2) Conduct the harvest potential assessments and compare the results for each species with existing harvest information to determine whether current harvest levels are above, below, or near maximum sustainable levels.

(3) Based on the results, identify key areas of uncertainty that need to be addressed by the SDJV research and/or monitoring programs to improve the assessments and reduce the potential risks of over?harvest. If new monitoring programs, improvements to existing surveys, or targeted research efforts are needed, recommendations will be provided to the SDJV on priority steps for improving harvest management decision?making.

(4) Incorporate recommendations on monitoring and/or research information needs into the next iteration of the SDJV Implementation Plan to provide greater focus of the SDJV in supporting harvest management decisions.

Results from the assessments will be reported at the 2013 Harvest Management Working Group meeting, and updates will be presented at the relevant Flyway meetings for further engagement. This assessment may also contribute to addressing the recommendations of the Draft 2012 Supplemental Environmental Impact Statement (SEIS) on Migratory Bird Hunting (U.S. Department of the Interior 2010). The SEIS considers multiple alternatives regarding the continuance and review of special season structures such as the special sea duck season in the Atlantic Flyway. As discussions regarding the use of the assessments for guiding sea duck harvest management decisions is outside the purview of the Sea Duck Joint Venture, it is anticipated that several overarching objectives can be met using this collaborative approach. Appropriate use of these results as well as final resolution of important policy issues pertaining to harvest management will be determined by the broader harvest management community through normal regulatory processes.

4 NEW BUSINESS

Meeting participants were offered the opportunity to raise new issues for consideration by the HMWG. At this point in the meeting agenda, no new issues were brought to the attention of the HMWG.

5 Maintenance of adaptive decision frameworks within evolving systems

The 2012–2013 HMWG's priority action items reflect large-scale issues that are challenging the waterfowl management community to adapt harvest management decision frameworks in response to evolving systems. It is important to recognize that previous work planning has highlighted the limited technical capacity and ability of the HMWG to balance the maintenance of the annual regulations cycle with the simultaneous demands of maintaining resilient AHM frameworks in the face of rapidly changing environments and social systems. More detailed descriptions of these challenges were included in the following presentations.

5.1 Current priorities and progress (*Scott Boomer*)

In response to last year's action items, several technical solutions were developed in order to make progress on the evaluation of the harvest management implications of the preferred alternative specified in the Draft (SEIS). For example, in developing methods used in the SEIS assessment, it was determined that code adjustments could be made with the current software (ASDP), precluding the need to port optimization code to a new software environment (e.g., Matlab). In addition, the SEIS evaluation continues to use the existing model set as the baseline parameterizations necessary for comparing management performance between existing protocols and any changes resulting from the SEIS. However, it was noted that most decision frameworks may require new models to predict changes in state variable with information that may be available in the early spring. In addition to these factors, we are still struggling with issues related to the most effective methods to reconcile baseline comparisons with these anticipated changes in model sets or pending changes resulting from the double-loop assessments.

5.2 Technical capacity, limited budgets, and evolving needs (*Ken Richkus*)

Ken Richkus described funding and staffing challenges within FWS (PHAB), highlighting the shifting demands placed on staff often in response to non-harvest management issues.

5.3 Banding needs assessment (*Nathan Zimpfer*)

As the management decision making paradigm evolves; monitoring objectives and requirements should be re-evaluated to ensure the most efficient use of limited resources. With respect to the current decision making process, the banding program has two primary objectives; 1) tracking outcomes of annual harvest decisions, which are subsequently used for updating predictive distributions used in the decision process, and 2) maintain databases of band-recovery information for continued model development and science support. From a decision making standpoint, it is important that monitoring efforts be sufficient to achieve both objectives with the resources available. The estimation of harvest or recovery rates when reward band data is unavailable is driven primarily through direct or first-year recovery of bands, while biological models rely on long-term recovery data (i.e., indirect recoveries). Focusing banding effort to address annual information needs is likely to limit long-term recoveries which could result in models with poor predictive capabilities. Focusing banding effort on long-term information needs to allow for models with high predictive ability may be unsustainable given limited resources. So the question for the banding needs assessment becomes how to achieve both functions of the banding program given resources available for banding, and if not achievable; understand the potential consequences to the decision making process.

Finding what level of banding effort is sufficient to meet both monitoring objectives requires an understanding of how the data is incorporated into the regulatory decision process, and how it translates into a regulatory decision. Band-recovery data are used to develop models of harvest capacity, or to identify harvest rates that achieve management objective such as maximize long-term cumulative harvest while maintaining some acceptable population size. The regulatory decision is then to chose the package that will result in harvest rates that equate to those rates derived from models of harvest capacity. However, given the partial control of regulations, harvest rates that result could conceivably be above or below harvest rates identified from the biological model. We must also recognize that harvest rates from the biological model and those resulting form a regulatory decision are estimates of truth. From a monitoring perspective, we want to ensure that our estimates of truth adequately represent truth, that is the relationship between the true harvest rate and the true population harvest capacity. Since truth is unknown we use simulation to understand how changes in banding effort effect our ability to discern this relationship. The outcome of the simulation results in the frequency or probability that for a given level of banding effect we can expect to correctly identify the true relationship between the harvest rate resulting from a particular regulation and the harvest capacity of the population.

The distribution of bands across the landscape is handled as a separate operation to identifying minimum levels of banding effort. This allows for flexibility to address questions specific to banding operations. Specifically, we desire to distribute bands across the landscape in a concerted manner for which we can estimate demographic parameters, with the smallest variance possible, at some desired spatial scale, recognizing that our ability to achieve this is generally limited by population densities, and the number of stations that can be operated at any point in time. We have developed an algorithm which uses existing information regarding survival and recovery rates, along with information about the distribution of the population across the landscape, and estimates of cost to determine the best allocation of banding effort across the landscape.

5.4 Adaptive decision frameworks and system change (*Michael Runge*)

Mike Runge presented methods and potential approaches for adapting decision frameworks in the face of system change.

6 SEIS and double-loop learning

6.1 SEIS: evaluating harvest management implications of changes in decision timing (*Fred Johnson, Scott Boomer, Ken Williams, and Mike Runge*)

The draft Environmental Impact Statement (EIS) on Migratory Bird Hunting offers four alternatives concerning the timing of the regulatory process for setting hunting seasons. The no-change alternative involves a process by which most proposals for hunting seasons are developed in response to survey information that becomes available in early summer, such as breeding population size, habitat conditions, and the previous season's harvest. Therefore, the timetable for setting hunting regulations prior to the opening of seasons in September is very tight. The preferred alternative of the EIS is to advance this timetable by approximately two months to allow more time for public input, to provide more advance notice of the season's regulations, and to save time and money in administering the process. However, the extant Adaptive Harvest Management (AHM) process for assessing resource impacts and identifying an optimal set of regulations would require major modifications to account for the absence of current-year survey information. Without a thorough understanding of the nature of these modifications, the potential impacts of the preferred alternative on migratory bird populations will remain largely unknown.

We examined the potential effects of the preferred alternative of the EIS on the AHM process for mid-continent mallards. We began with the passively adaptive approach used in AHM and extended it to account for the lack of current-year monitoring information. Let x_t represent the (unknown) system state (mallard and pond abundance) at time t, and let $\hat{x}_t$ represent the best available estimate of system state at the time the regulatory decision must be made. The optimal (passively adaptive) solution for a system subject to both model uncertainty and partial observability is:

$$V^*(\hat{x}_t, p_t) = \max_{a_t} \sum_i q_i(t) \left[\begin{array}{l} \sum_{x_t} p(x_t|\hat{x}_t) U_i(a_t|x_t) + \\ \sum_{\hat{x}_{t+1}} p(\hat{x}_{t+1}|x_{t+1}) \sum_{x_{t+1}} P_i(x_{t+1}|x_t, a_t) \sum_{x_t} p(x_t|\hat{x}_t) V^*(\hat{x}_{t+1}, q_{t+1}) \end{array} \right]$$

where the two additive components in brackets represent current and future value, respectively, $P_i(x_{t+1}|x_t, a_t)$ represents the model-specific and action-specific transition in actual system states, $p(x_t|\hat{x}_t) = p(\hat{x}_{t+1}|x_{t+1})$ represents the stochastic relation between the actual and estimated states, and $q_i(t)$ are model-specific weights (probabilities) at the time of the decision.

To determine the stochastic relationship between the estimated (unobserved) system state and the true (observed) state, we used observed population size, pond numbers, and harvest rate in year t, along with the balance equation and sub-models described above to predict system state in year *t+1*. Estimated and observed system states for all years were then compared, and a multiplicative, prediction-error variance was estimated by setting:

$$e_t(x_t, \hat{x}_t) = ln(x_t) - ln(\hat{x}_t),$$

then assuming

$$e_t(x_t, \hat{x}_t) \sim N(0, \sigma^2),$$

and estimating

$$\hat{\sigma}^2 = \sum_t \left(ln(x_t) - ln(\hat{x}_t)\right)^2 / (n-1).$$

where n is the number of years being compared. The estimates of prediction-error variance varied little among the four population models so they were averaged for a value of $\sigma(N_t, \hat{N}_t) = 0.1358$. For the pond model $\sigma(P_t, \hat{P}_t) = 0.3377$. We note this procedure assumes no error in the observed abundance of mallards and ponds, which seems reasonable given that coefficients of sampling variation are typically < 0.04 for mallards and < 0.05 for ponds. We calculated optimal harvest policies for each population model in turn (no structural

uncertainty), and for a passive adaptive strategy for model probabilities of 0.0501, 0.6104, 0.0110, and 0.3285 for the additive-strong (AS), additive-weak (AW), compensatory-strong (CS), and compensatory-weak (CW) models, respectively.

For a partially observed system, optimal policies for the two models in which survival was unaffected by hunting mortality continued to prescribe the maximum harvest rate for all non-zero (estimated) system states. For the models with additive hunting mortality, the optimal policies tended to be slightly more liberal than the corresponding policies for a completely observed system. Differences in optimal harvest rates between those for completely and partially observed systems were most pronounced at high numbers of ponds and low populations of mallards. The passive adaptive policy based on current model weights was also more liberal for a partially observed than a completely observed system, although the differences tended to occur more uniformly throughout the state space.

The lack of current-year survey information adds considerable ambiguity to optimality patterns. With partial observability there are 3-way interactions that can influence the optimal strategy, namely the structure of the objective function, the model transition probabilities, and the joint probability distribution $p(\hat{x}_t, x_t) = p(x_t|\hat{x}_t)p(\hat{x}_t) = p(\hat{x}_t|x_t)p(x_t)$. These three factors almost certainly interact in complex ways and produce complex patterns in optimal strategies and values. We therefore suggest that it will be difficult to make broad inferences about their marginal effects. The loading of model-specific transition probabilities with additional variation [by weighting them with and $p(x_t|\hat{x}_t)$ and $p(\hat{x}_t|x_t)$] has the general effect of flattening the probabilities, with several potential results:

- By flattening the transition distributions and making all the models look the same, the weighting dampens the potential effect of a model that otherwise would produce a restrictive change in strategy. A potential result is to weaken the propensity of the optimization to target more restrictive actions for system declines.
- The weighting can lead to much heavier tails in the transition probability distributions $p(\hat{x}_{t+1}|\hat{x}_t, a_t)$, which for skewed distributions can lead to an increased influence of large returns (and thus the identification of more liberal harvest strategies).
- The weighting tends to homogenize the transition probabilities across models, reducing the differential effects of Bayesian updating and thereby slowing the rate of change in the model confidence measures (the posterior probabilities), unless the model-weight updating is done offline based on observed system states. Even so, that strategy in any given year will not be based on current model weights (which cannot be known prior to the regulatory decision), but the weights from the previous year.

In some ways the above patterns seem a bit counter-intuitive: They suggest the addition of a new source of uncertainty can actually result in a more liberal strategy, which appears to be at variance with the precautionary principle of conservatism in the face of uncertainty. Of course, these patterns are only speculative, and they almost certainly depend on the interactions of the objective function, transition probability structure, and the nature of the joint probabilities $p(\hat{x}_t, x_t)$. The generic point here seems to be that adding additional variation into the optimization algorithm can have important and unintended consequences.

6.2 Fix-it (*HMWG*)

The HMWG broke up into Flyway-specific break-out groups to participate in a rapid prototyping exercise to offer alternative approaches to waterfowl harvest management.

6.2.1 Atlantic Flyway

Trigger: Eastern mallards are not a good representative species for the AF; they constitute less than 20

Objectives:

(1) Long-term conservation of eastern duck species

   (a) Include all duck species
   (b) Cumulative NAWMP population goal across all eastern species
   (c) A subjective population goal for eastern ducks
   (d) Carrying capacity goal
   (e) Number of acres on the landscape
   (f) Abundance of certain sensitive species

(2) Maintain hunting tradition (provide opportunity)

   (a) Number of hunting days
   (b) Bag limits
   (c) Access to hunting-acres of wetlands in public ownership
   (d) Simple regulations
   (e) Seeing birds

(3) Logistics

   (a) Minimize operational costs
   (b) Number of new monitoring data streams needed

Alternatives:

(1) Five primary species in the AF from a harvest standpoint-prescribed strategy (Mall, Wodu, Agwt, Rndu, Buff)

(2) Five primary species in the AF from a harvest standpoint-prescribed strategy (Mall, Wodu, Agwt, Rndu, Buff)+Abdu as separate regulation

(3) All duck species

(4) All duck species - Abdu - sea ducks

(5) Regulatory options-various combinations of days/bag limits (splash rule)

   (a) 0/0, 30/3, 60/6
   (b) 0/0, 30/3, 50/5

Modeling:

(1) Prescribed approach

(2) Balance equation weighted by BPOP or across all species

(3) PBR to inform threshold limits, weighted by BPOP or across all species

Tradeoffs:

(1) Use model simulations to estimate tradeoffs

(2) Potential for increased conservatism

Monitoring:

(1) Maintain extant monitoring systems

(2) Drop banding if using PBR, except for Wodu

(3) No info on Rndu or Buff

(4) No pop est for Wodu, but can develop one without having to set up surveys in South

6.2.2 Mississippi Flyway

Trigger: Current harvest management decision frameworks are too complicated, inefficient, and do not address the key issues of waterfowl management.

Objectives:

(1) Provide the maximum hunting opportunity desired by hunters (while maintaining waterfowl populations and the habitat that support them).

(2) Having regulations that hunters understand.

(3) Doing it within our resources (any reduction in activity meets this objective).

(4) Easing identification burdens on hunters.

Alternatives:

(1) Population triggers are used for Teal Seasons and have been proposed by the MFC for redheads and canvasbacks. (2, 3)

(2) Make a decision using existing frameworks and stick with it for 3 years. (1, 3)

(3) Or do the technical work to generate a matrix that we use for 3 years, but make a decision annually based on ponds/bpop using that same matrix. (1, 3)

(4) Point system with tiers of birds with separate harvest potential. (2, 4)

(5) Splash Limit (2, 4)

Modeling:

(1) Create simple threshold strategies based on past population and harvest levels

(2) Maintaining long-term hunter opportunity requires a modeling framework to assess that.

(3) Do the technical assessment every 3 years and use the resulting matrix for 3 years.

Tradeoffs:

(1) Triggers assume that system does not change.

(2) Simplicity may reduce long-term hunting opportunity but does allow rapid response.

(3) Loss of opportunity and lag times in response is a consequence of 3-year time frames.

(4) Reduction in monitoring not realized if long-term maximization of harvest opportunity is desired

Monitoring:
Reduction in monitoring is not desired. Have we learned anything about mallard populations that would allow us to not do the math every year (eg. re-evaluating model weights)? We still have a matrix, but we don't revise the matrix every single year. Population surveys, banding, etc. needed to evaluate system change even under a trigger system.

6.2.3 Central Flyway

Trigger: Current harvest management decision frameworks are too complicated, inefficient, and do not address the key issues of waterfowl management.

Objectives:

(1) Maintain duck hunter numbers at current levels

(2) Maintain duck populations at current levels

(3) Maintain habitat at current levels

Would like to increase all, but may be difficult enough to maintain what we currently have. We also discussed a recruitment objective, which tried to maximize the number of young in a given year.

Alternatives:

(1) "Experimental" Splash limit

(2) Within Flyway Options

(3) Hunter's Choice or 2 stocks (high vs. low harvest pressure) of ducks

(4) Mallard season and a duck season

(5) Two-Tier Experiment

Modeling:
Discussed the need for informed-decision making frameworks. There was a suggestion to use just prescriptive levels/strategies for changes in regulations. Changes in the prescriptions may occur once/5 year cycle, to eliminate annual negotiations for changes in regulations. Further discussion about why an informed-decision making and predictive models was beneficial or needed.

Tradeoffs:
Did not get much discussion regarding trade-offs primarily as our alternatives were not specific enough to explore the trade-offs.

Monitoring:
There would have to be some human dimensions and/or compliance issue data collection efforts that would be more of short-term efforts. There would have to be programs/efforts to establish baseline and monitor changes in waterfowl hunter numbers. Use of electronic databases would allow this to occur at least on a state level.

6.2.4 Pacific Flyway

The primary objective of the PF is to sustain or increase current populations while maintaining a high level of harvest opportunity, at minimum, equivalent to current levels.

We support gathering additional human dimensions data to allow hunters to provide input into any process that considers alternate strategies. We want these to be informed decisions, both biological and user based.

While we recognize the importance of hunter recruitment and retention, we believe that much of hunter attrition is driven by societal changes outside our control and efforts through hunter education programs etc., while important, may have limited success.

We support the concept of simplifying regulations, but lack good information in our Flyway to adequately assess how current regulations effect hunter recruitment, satisfaction and retention. Additionally, when assessing various trade-off scenarios of alternate harvest strategies (splash limits, tiered systems, multi-stock) we believe at present the PF is best served by the current system for allocating harvest. All else being equal, we prefer a higher overall bag limit and were not in favor of implementing strategies that simplified regulations but sacrificed opportunity. Basing a harvest strategy on splash limits or multi-stock are potentially driven by "the lowest common denominator," (i.e. northern pintails). This could reduce overall bag limits, a trade-off we find less desirable.

However, we provide a few caveats to the current system: 1) allowing greater Flyway flexibility to make slight modifications to the "continental system" which would allow Flyways to take advantage of additional opportunity. In the PF we envision an example where we could increase pintail bag limits in years of abundance; and 2) exploring the option of removing hen mallard restrictions through the western mallard model. The utility and rationale behind the hen mallard restriction may have no conservation value and removing it would be a step to simplify regulations.

We support the continuation of monitoring programs while recognizing the need to evaluate for improved efficiencies. Monitoring programs (population and harvest) provide a basis for conservation efforts, establishing population objectives and allowing for sustainable and desirable harvest allocation strategies that can maintain or increase opportunity.

6.3 SEIS and Double-loop Assessments (*HMWG*)

The HMWG broke up into Flyway-specific break-out groups to work and plan for SEIS and double-loop assessments.

6.3.1 Atlantic Flyway

The eastern mallard AHM model set was revised (compensatory model added) in time to use for the 2012–13 regulations cycle. When the model set was revised, Guthrie Zimmerman also updated prediction variances associated with the models. The mechanics of eastern mallard AHM are similar to those of mid-continent mallard AHM, so Guthrie will do the same assessment of eastern mallard AHM that Fred Johnson et al. did on mid-continent mallard AHM (see Fred's presentation). Guthrie will get the code used in that assessment from Scott Boomer - hopefully he will have the assessment completed by the AF's winter meeting in late February.

Due to Canada's regulatory cycle, black duck AHM will have to be retooled to predict one year ahead regardless of whether we implement the SEIS preferred alternative or not. This needs to be completed by September 2013. Pat Devers has the technical lead on this work - Guthrie and Scott will help.

The AP and NAP Canada goose harvest strategies are both prescriptive, based on 3-year running averages of BPOP. Assessment of impacts of the preferred alternative will not take long. Min Huang will work with the chair of the AF Tech Section's Canada Goose Committee to complete the assessments and report results at the AF's winter meeting. AF would hope to see assessments of impacts on scaup, pintail, teal, and canvasback strategies at the winter meeting if possible and by the summer meeting at the latest.

We discussed whether assessments like the one presented by Fred provided enough information for the Flyway to recommend "yea" or "nay" on implementing the preferred alternative. The indication that the change will result in more uncertainty (as expected) which will in turn result in somewhat more liberal harvest policy seems counterintuitive at first blush. Mike Runge suggested that one possible way to examine this further would be to compare results of assessments using normal vs lognormal prediction distributions (Johnson et al. assessment assumed lognormal distribution). We have asked Guthrie to include that in the eastern mallard AHM assessment.

6.3.2 Mississippi Flyway

Update on Progress

- Mallard - Fred has outlined how process would work for mid-continent mallards
- EPP - currently uses running avg with current year
- MVP - currently uses running avg with current year
- SJBP - currently uses running avg with current year
- WF - uses fall count
- Crane - no revision needed
- Teal seasons - need to revise criteria for when/how long teal seasons will be offered; incorporate work of teal assessment group and develop H strategy
- Pintail, canvasback...

Process

- State perspective: folks would prefer to wait for implementation of SEIS until objective function, regs packages, double-looping has been completed
- Federal perspective: administrative/timing needs override the need to complete all the above
- Technical: Pond model - new approaches to modeling/predicting and decide when those results are available for use in determining optimal H strategies; coordinate with Central Flyway on tech assessments
- Communication: What are the messages that need to be brought to Flyways?; if timing/admin reasons trump desire to complete obj function/regs package/double looping then we need to be able to effectively communicate that to Flyways and public; e.g. if we don't implement SEIS ASAP, are Flyways willing to risk not being able to open up on framework opening date (northern states impacted most for duck seasons but southern states may have goose openers impacted). MF requests Laurel staff to attend Feb Tech Section meeting. Need to assess impact on frequency and timing of Flyway meetings.

Next Steps

(1) Need for Flyway to decide at what point they are willing to sign off on new regs schedule (i.e. does timing issue trump need for double-looping, obj function revision, etc)

(2) Need to identify potential timeline of meetings based on availability of results of technical assessments Flyway meeting dates, SRC date Where does Jan/Feb SRC meeting fit in? Will the timing and role of that meeting change? Could it become more like the old Denver status meeting where results of tech assessments are presented and then Flyways hold their meetings to develop regs recommendations to the Service

Leads Two State reps to HMWG report to Flyways in February/ Flyway Rep give Fed perspective; Goose committee chairs need to lead revision of goose H strategies; State reps to teal assessment group convey results/implications of final report

Schedule February SRC meeting - SRC and Flyway Consultants begin discussion of implications of SEIS implementation; February Tech Section meeting - give marching orders for H strategy update

6.3.3 Central Flyway

Update on Tasks

- Hi-Line Canada goose management plan does not need to be revised. The plan uses the most recent 3 years of data, so the Flyway will simply not use the current year's data in its management decisions
- The Flyway has not discussed teal beyond the issues that already have been discussed (additional opportunity if the teal assessment due in January determines it's warranted)
- RMP and MC crane plans already do not use current year survey data, but rather the most recent 3-year average of abundance data to determine management actions

Process

- Regarding policy, the Flyway is dissatisfied with the complexity of the current regulations-setting process, and the amount and extent of analyses required to justify allowing additional harvest opportunities on stocks of birds. They feel the process needs to be greatly simplified. The Flyway would like to begin the double-loop process and begin investigating changes to management objectives, models and management alternatives prior to implementation of the SEIS, rather than implementing the SEIS under the current framework and then incorporating the new framework afterward.
- For technical issues, the Flyway questions whether the current pond model would need to be revised to implement the preferred alternative in the draft SEIS. Given the workloads that currently exist, they question whether investigating additional gains in predictive ability that might be associated with a revised pond model is a good use of staff time. They prefer that the current pond model be examined to see how well it would work in the new system before efforts are expended to revise the model.
- The Flyway is concerned about communications once the SEIS is released. Although the SEIS may indicate a new process for setting regulations, that process would not necessarily be implemented quickly. Therefore, what will the messages to the public be? The Flyway would like assistance in formulating messages related to (1) when the change in process is likely to occur, (2) what will be involved (e.g., new harvest-management objectives, regulatory alternatives, etc.), and whether we envision that additional information would be made available before changes are implemented. The Flyway also recognizes the need to immediately begin planning to work with the Mississippi Flyway regarding changes to management objectives, etc., and envisions the formation of a small working group comprised of members from

the Central and Mississippi Flyway Technical Committees and the Service's Population and Habitat Assessment Branch. We also believe it would be useful to have some tools developed by PHAB to assist this working group in assessing different alternatives.

Next Steps

- The Flyway HMWG members will present the information from this meeting, particularly in regards to the assessment of mid-continent mallards relative to a change in the regulatory cycle (Fred Johnson's presentation) at the December meeting of the Waterfowl Technical Committee. The Technical Committee will inform the Central Flyway Council of implications of the SEIS as we currently know them, and will advise them of new information as it becomes available (e.g., assessments for other stocks of ducks).

- The Flyway will work with the Service and the Mississippi Flyway to identify individuals to serve on the working group mentioned above and determine when and where they should hold their first meeting.

6.3.4 Pacific Flyway

SEIS assessments: planning, coordination, and communication

Flyway specific harvest strategies generally can accommodate the proposed change in the timing of the decision making process with little or no change given the retrospective nature of the state variable used in these strategies (e.g., recent 3-year mean abundance) or existing early timing of data collection and assessment. However, the Pacific brant harvest strategy is currently under review and may need to be recast considering current challenges to complete winter inventories in Mexico and potential use of other inventory surveys at more northern latitudes. This work is currently scheduled for the December meeting of the Pacific Flyway Study Committee.

There are three harvest strategies that have more national implications and will require national coordination including scaup, northern pintail, and western mallards. All three of these strategies will require modification to account for additional uncertainty associated with predicting state variables. For this work we rely on a common solution based on the work currently underway by Scott Boomer and Fred Johnson modified accordingly for each harvest strategy. Additionally, we will need to predict the mean latitude of the breeding population for the pintail harvest strategy. Todd Sanders in conjunction with a working group of the Pacific Flyway Study Committee will explore precipitation and other habitat variables available for the prairie region that may be helpful in predicting mean latitude. This effort will be coordinated with Scott Boomer and others working on predicting prairie pond numbers or recruitment for the mid-continent harvest strategy assessment as there may be certain similarities in use of predictive data or models. This work is expected to begin at the December meeting of the Pacific Flyway Study Committee and may be completed by spring. Additionally for pintails, the Pacific Flyway will work with Mike Runge to conduct simulations to assess the expected performance of the pintail harvest strategy with predictive state variables. This work depends on completing the model to predict the mean latitude of the breeding population.

7 Assessment Updates

7.1 Eiders (*Chris Dwyer*)

Chris Dwyer described plans for an assessment of North Atlantic common eider band-recovery data.

7.2 Teal Assessment (*Kathy Fleming*)

(1) The teal assessment group was formed in 2009, with these 5 tasks given to us by the SRC; we are set to complete the assessment by mid January of next year, which will be a bit longer than the 3 years originally set for the assessment. This is a summary of our work to date; however, the final form of the assessment may differ from this update.

(2) For a description of the population dynamics of each species, we used the banding and recovery data to estimate survival and recovery rates - this was done for blue-winged, green-winged, and cinnamon teal with a set of models using age and sex effects. This was the extent of the analysis we did for cinnamon teal. For blue and green winged teal we also included models with a banding reference group effect, and additive models containing a covariate representing the history of early and regular harvest seasons.

We also estimated production indices for blue and green winged teal only - Paul Padding and Jim Dubovsky calculated male and female age ratios using fixed and annual differential vulnerabilities - Nathan helped us by estimating these in a hierarchical model framework in WinBUGS - using Bayesian estimation to estimate the standard errors as well. Jim and Paul found that both teal species showed an increasing male sex ratio over time, and recommended using the female age ratios to avoid bias, and with a fixed DV to avoid the high variance associated with the annual DV.

We developed a population model for both species - a balance equation that predicts BPOP in year t + 1 from BPOP in year t, using cohort specific survival rates, age ratio, the ratio of male to female summer survival and the male fraction in the population.

(3) The second SRC task was to summarize the derivation of the harvest, and how harvest is distributed. When the assessment was started most of this work had already been done; by Mike Szymanski and Jim Dubovsky for blue-winged teal, and by Jim D. for green-winged teal. The BWTE derivation and distribution of the harvest will be published as a FWS technical report series in 2013. The derivation of the harvest helped to provide information on how to allocate the bandings and recoveries to potential banding reference groups, or birds that share a similar exposure to harvest. These groups were used in the survival and recovery models.

(4) The 3rd task was to provide a summary of past and current harvest pressure. I used recovery rates from the Brownie models for blue and green winged teal and adjusted them with a composite reporting rate to estimate harvest rates. The composite rate is an annual weighted average of the reporting rates of each region, band type, and reporting method combination. For blue-winged teal a substantial portion of recoveries are from south of the US border, where reporting rates are unknown but likely are less than the US. I used high and low estimates of reporting rates to calculate two sets of composite rates: 0.02 and 0.1. For green winged teal there were very few south of the border recoveries, I used the average of these two reporting rates for those recoveries.

(5) These are the resulting harvest rates for blue-winged teal, to show how the estimates differ based on choice of reporting rate.

(6) For the 4th task, assessing population response to harvest pressure, we fit the survival and harvest rates (converted to kill rates) to models representing two hypotheses of how harvest affects survival: additive, where all harvest reduces survival, and compensatory, where harvest to a point does not affect survival, and after that point (the compensation threshold) becomes additive.

This is the adult male bwte survival and kill rates -kill rates are below the compensatory threshold, so there isn't much information to support choosing between the two models. This is true for all the cohorts of BWTE, and most of the cohorts of GWTE.

(7) The next step with this task was to use the balance equation to simulate how the population would respond to different levels of harvest pressure under equilibrium conditions (that is, keeping habitat conditions static, and harvesting the population year after year until it reaches some equilibrium level - this gives us the optimal harvest level, which is the rate that leads to the highest harvest that can be sustained by the population under a given set of habitat conditions (pond counts). To run the balance

equation simulations it is necessary to create models to predict survival and recruitment in each year - the survival models predict survival each year as a function of harvest rate, based on the compensatory or additive models - and recruitment as a function of ponds and BPOP.

We ran the equilibrium models for 3 different pond scenarios: highest pond count, average pond count, and lowest pond count. Because there wasn't any more support for either additive or compensatory harvest, we also ran simulations under both scenarios. And to determine how equilibrium dynamics and predictions of optimal harvest would change given the reporting rate south of the border, we ran the simulations for high and low reporting rate for blue-winged teal only.

- The compensatory models were not affected by high and low reporting rate so we only ran one set of those.
- The reporting rate does affect the predictions of optimal harvest rate under the additive model assumption - optimal harvest rate is higher if reporting rate is low, because a low reporting rate means that the survival rate observed occurs with a higher harvest rate than if the reporting rate were higher.
- The optimal harvest given the compensatory assumption is higher than under the additive model, as expected.

(8) The last task was to assess how the changes in early teal season have affected the teal harvest. This analysis was done separately as a set of regressions analyzing the relationship between both early season harvest or harvest rate in each Flyway and the structure of the early season.

- Used direct recovery rates (US recoveries only) adjusted with composite reporting rates to estimate harvest rates;
- Compared multiple regression models using early season days, early season states as predictor variables, along with AR and BPOP;
- We had trouble fitting some models due to lack of variation in season structure, but for some Flyways there were significant relationships between either # season days or # season states. But the little variation in the history of the early season makes it difficult to predict what the effect of additional changes to the number of early season days or the addition of states would be.
- Ultimately harvest is related to hunters and hunter effort, but this is only partially controllable by season structure variables.

(9) In the assessment we provide a summary of the information currently available for the 3 species of teal - survival and harvest rates, harvest, BPOP; for blue and green winged teal, age ratio estimates, compensatory vs additive harvest.

- We provide estimates of the optimal sustainable harvest and harvest rates under a variety of habitat conditions and assumptions;
- We found evidence of some relationships between harvest and the changing early teal season;
- Inferences are limited by the quality and quantity of information available on the 3 species;

We do not provide any recommendations for harvest strategies, but the assessment document may provide some information useful in the process of developing strategies.

7.3 Scaup AHM Performance (*Scott Boomer*)

When the AHM protocol for scaup was implemented in 2008, the FWS worked closely with the Flyways to determine acceptable regulatory alternatives for the restrictive, moderate, and liberal packages. This process included the development of Flyway-specific harvest models for predicting harvest levels as a function of different bag limits and season lengths. After the 2008 season, the FWS provided further guidance regarding the specification of hybrid seasons for the restrictive and moderate packages, specifying how daily bag limits

could vary over continuous portions of the overall scaup season. As a result, the FWS allowed Flyways to adjust scaup regulatory alternatives for the 2009 season. At this time, it was agreed that these alternatives would remain fixed for a period of 3 years after which Flyways would have the opportunity to re-consider scaup regulatory alternatives.

After the 2011 harvest season, we performed a preliminary assessment to characterize the performance of the scaup AHM decision framework from 2008–2012 and to compare observed scaup harvest levels with predictions from the models that were used to establish the scaup regulatory alternatives. This work included a description of scaup population parameters form 2008–2012 along with a comparison of harvest policies resulting from the scaup AHM protocol (Table 1). In addition, we plotted scaup harvest estimates observed in each Flyway with predictions from Flyway-specific harvest models (Figure 1).

Our initial results indicate that annual updates of population parameter estimates track changes in scaup status, suggesting modest increases in harvest potential. Assessment model predictions are consistent with observed population increases and the resulting scaup harvest policies have become more liberal as scaup status has improved. Observed harvest levels were similar to Flyway specific harvest predictions (at least under the moderate alternatives) and in general are consistent with allowable harvest thresholds.

Table 1 – Harvest policies from the scaup AHM decision framework from 2008–2012. Regulatory alternatives enclosed in a border represent the harvest management decision for each year under the scaup AHM protocol.

BPOP	2008	2009	2010	2011	2012
≤ 3.2	R	R	R	R	R
3.4	R	R	R	R	R
3.6	R	R	M	M	M
3.8	$\boxed{R^H}$	M	M	M	M
4.0	M	M	M	M	M
4.2	M	$\boxed{M}$	$\boxed{M}$	M	M
4.4	M	M	M	$\boxed{M}$	M
4.6	M	M	M	M	M
4.8	M	M	M	M	M
5.0	M	M	L	M	M
5.2	M	M	L	L	$\boxed{L}$
≥ 5.4	L	L	L	L	L

R refers to restrictive, R^H refers to Hybrid season, M refers to moderate, and L refers to the liberal scaup regulatory alternative.

8 UPDATING HMWG PRIORITY ACTIONS AND WORK PLAN

The Working Group reviewed progress on the 2013 priority action items and opened up a discussion to identify the highest priority technical work for 2014. The continued evaluation of the harvest management implications resulting from the changes in the timing of regulatory decisions specified under the preferred alternative of the draft SEIS (U.S. Department of the Interior 2010) was identified as the highest priority for technical work in 2014 (Table 2). 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 2013 regulations cycle (see attached 2014 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.

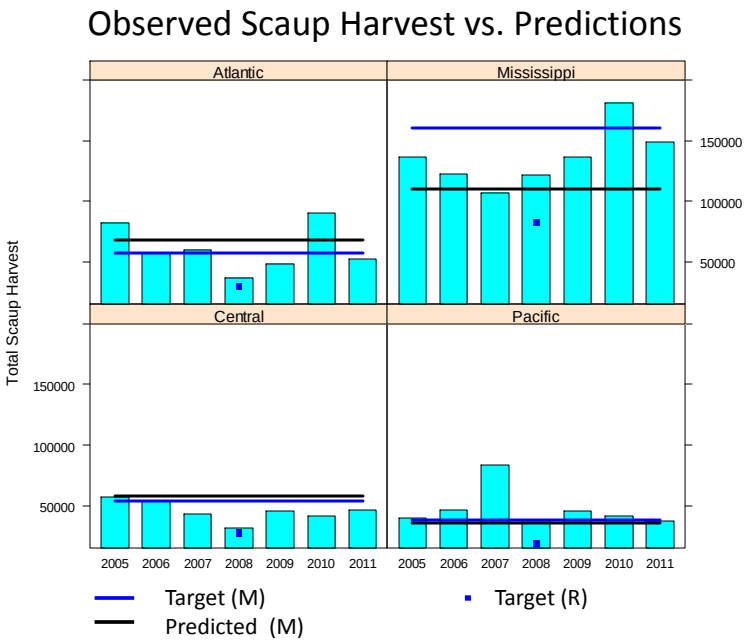

Figure 1 – Observed scaup harvest levels for each Flyway from 2005–2011 compared to model predictions and target thresholds for restrictive (R 2008) and moderate (M 2008–2011) seasons specified under the scaup AHM protocol

8.1 2013–2014 Work Planning

During the work planning discussions, the HMWG identified key outcomes from the high priority technical work in preparation for the development of the 2013 HMWG meeting agenda. These anticipated results highlight the priority assessments to be completed with the expectation that the working group will report back on the following topics:

(1) A full set of results from SEIS assessments for each decision making framework with formal comparisons to 2013 decision results (i.e., practice round comparison)

(2) An update describing the double-looping process for each mallard AHM framework

(3) An evaluation of the harvest management implications of NAWMP implementation

(4) An update describing research developing adjustments to mid-continent mallard AHM in response to climate change (PHAB post doctoral researcher)

(5) An update describing teal harvest potential and harvest management considerations

(6) An update describing sea duck harvest potential and harvest management considerations

8.2 2013 HMWG Meeting

The 2013 HMWG meeting will be hosted by the Pacific Flyway in Boise, Idaho and is scheduled from 2–6 December 2013.

Table 2 – Harvest management decision frameworks, technical issues, project leads, deadlines, and action items identified at the 2012 HMWG working group meeting, resulting from discussions about the implications of changes in timing of regulatory decisions associated with the preferred alternative specified in the draft SEIS.

Decision Framework	Issue	Leads	Deadline	Priority
National				
Mallard stocks	Optimization, model weight updating, etc...	Johnson, Boomer	12/2013	High
	Re-tooling of model sets to predict relevant state variables	PHAB, Flyway Reps	12/2013	High
	Formation of committees for modeling and communication	PHAB, Flyway Reps	12/2013	High
Pintail	See mallards	Sanders, Runge	12/2013	High
Scaup	See mallards	Boomer, PHAB	12/2013	High
Canvasback	Adjust harvest strategy	PHAB	12/2013	High
Teal	Adjust triggers for special teal seasons	Fleming and Teal group	12/2013	High
Shared				
MCP Cranes	Adjust management plans	CF Tech Comm and MN	12/2013	High
RMP Cranes	Adjust management plans	CF and PF	12/2013	High
Black duck	See mallards	Devers, PHAB, and CWS	9/2013	High
Pacific Flyway				
Cacklers, Dusky, Aleutian, Wrangel Island, PF Brant, BT Pigeons, PF WFG	Adjust management plans	PF Tech Comm	12/2013	High
Central Flyway				
Hi-Line	Adjust management plans	CF Tech Comm	12/2013	High
Mississippi Flyway				
EPP, MVP, SJBP	Adjust management plans	MF Tech Comm	12/2013	High
Atlantic Flyway				
AP, NAP	Adjust management plans	AF Tech Comm	12/2013	High

LITERATURE CITED

U.S. Department of the Interior, 2010. Draft Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Hunting of Migratory Birds. U.S. Fish & Wildlife Service, Washington, D.C. 305pp., URL http://www.fws.gov/migratorybirds/NewReportsPublications/Hunting/SEIS%207%20June%20b%202010.pdf.

Williams, B. K., J. D. Nichols, and M. J. Conroy. 2002. Analysis and Management of Animal Populations. Academic Press, San Diego, CA.

Harvest Management Working Group
2012 Meeting Agenda
Buda, Texas

Monday (November 26) ***Travel Day***

[1700] State Technical Representatives meeting (Vrtiska)

Tuesday (November 27) ***Orientation, Reports from Partners, New Business***

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

[0830] Flyway reports/perspectives

- Atlantic, Mississippi, Central, Pacific (State Technical Representatives)
- USFWS (Flyway Representatives)
- CWS (Reed)
- SEIS Status (Trost)
- NAWMP Revision and Action Plan (Humburg)
- Communicating HMWG priorities (Kelley)

[1000] **Break**

[1015] *Old* Business

- Band lust (Mike Johnson)
- Two-tiered licensing (Vrtiska)
- Sea ducks (Dwyer)
- *New* Business...

[1200] **Lunch**

[1300] Maintenance of adaptive decision frameworks within evolving systems

- Current priorities and progress (Boomer)
- Technical capacity, limited budgets, and evolving needs (Richkus)
- Banding needs assessment (Zimpfer)

[1500] **Break**

[1515] Adaptive decision frameworks and system change (Runge)

[1615] Group discussion: steps toward progress in the face of dwindling resources, shifting priorities, and system change (Case)

[1700] **Adjourn**

Wednesday (November 28) ***SEIS and Double loop learning***

[0800] SEIS: evaluating harvest management implications of changes in decision timing (Johnson and Boomer)

[1200] **Lunch**

[1300] Flyway breakout groups

- Progress with "double loop" assessments
- Reporting back
- **Break**
- SEIS assessments: planning, coordination, and communication
- Reporting back

[1700] Adjourn

Thursday (November 29) ***Assessment Updates and Planning***

[0800] Recap (Case)

Group discussion: policy considerations for implementing multi-stock harvest management (AF)

[0900] Assessment updates

- Eiders (Dwyer)
- Teal (Fleming)
- Teal - next steps (Group discussion)
- **Break**
- Scaup AHM performance (Boomer)
- Redheads (Mike Johnson)

[1200] **Lunch**

[1300] Assessment updates (if needed) and Plans for 2013

- Action items
- Priorities for 2013
- Task assignments

[1500] **Break**

[1515] Meeting summary (Case)

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

[1600] Adjourn

Friday (November 30) ***Travel Day***

2014 Harvest Management Working Group Priorities

Priority rankings and project leads identified for the technical work proposed at the 2012 Harvest Management Working Group 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 (*See Table 2. for specific action items and technical leads*)
  - Development of strategies and methods for communicating the implications of the SEIS to the harvest management community and general public (*HMWG, Flyway Councils, and FWS*)
- Mallard AHM Revisions (Double-looping)
  - Eastern (*Atlantic Flyway, PHAB, others...*)
  - Mid-continent (*Mississippi and Central Flyways, PHAB, others...*)
  - Western (*Pacific Flyway, PHAB, others...*)
  - Consideration of NAWMP objectives in the development of harvest management objective functions (*Flyway Councils, FWS, NAWMP Interim Integration Committee, others...*)

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

- Multi-stock management (*HMWG*)
- 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*)
  - Planning for communication challenges associated with changing packages
  - Updating Harvest Management Working Group communications plan
- Harvest Management Working Group coordination with monitoring program reviews (e.g., WBPHS, Banding Needs,... *Nathan Zimpfer, PHAB, Flyway Ad Hoc committees*)
- Teal assessment and harvest management considerations (*Flyway Councils, PHAB, others...*)
- Northern pintail AHM Revision (Double-looping) (*Pacific Flyway, PHAB, others...*)

Additional Priorities

- Sea duck harvest potential assessment (*Seaduck Joint Venture, HMWG*)

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

Jane West (Region 3)
U.S. Fish & Wildlife Service
5600 American Blvd West
Bloomington, MN 55437-1458
phone: 612-713-5432
fax: 612-713-5393
e-mail: jane_west@fws.gov

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

Sherry Morgan (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: sherry_morgan@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

Vacant (Region 7)
U.S. Fish & Wildlife Service
1011 East Tudor Road
Anchorage, AK 99503-6119
phone:
fax: 907-786-3641
e-mail:

Marie Strassburger (Region 8)
U.S. Fish & Wildlife Service
2800 Cottage Way, W-2606
Sacramento, CA 95825
phone: 916-414-6464
fax: 916-414-6486
e-mail: marie_strassburger@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
fax: 301-497-5885
e-mail: paul_padding@fws.gov

Jim Kelley (Region 9)
U.S. Fish & Wildlife Service
1 Federal Drive
Fort Snelling, MN 55111-0458
phone: 612-713-5409
fax: 612-713-5393
e-mail: james_r_kelley@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

Bob Trost (Region 9)
U.S. Fish & Wildlife Service
911 NE 11^{th} Ave.
Portland, OR 97232-4181
phone: 503-231-6162
fax: 503-231-6228
e-mail: robert_trost@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

Joe Benedict (Atlantic Flyway)
FL Fish and Wildlife Conservation Commission
8932 Apalachee Parkway
Tallahassee, FL 32311
phone: 850-488-5878
fax: 850-488-5884
e-mail:joe.benedict@myfwc.com

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

Melanie Weaver (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

2012 Harvest Management Working Group Meeting Participants

HMWG Member	Representation	Affiliation
Min Huang	Atlantic Flyway Council	Connecticut Dept. of Environmental Protection
Joe Benedict	Atlantic Flyway Council	Florida Fish and Wildlife Conservation Commission
Paul Padding	Atlantic Flyway Representative	U.S. Fish & Wildlife Service
Adam Phelps	Mississippi Flyway Council	Indiana Dept. of Natural Resources
Larry Reynolds	Mississippi Flyway Council	Louisiana Dept. of Wildlife and Fisheries
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
Bob Trost	Pacific Flyway Representative	U.S. Fish & 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
Eric Reed	Canadian Wildlife Service	Canadian 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
Todd Sanders	PHAB	U.S. Fish & Wildlife Service
Guthrie Zimmerman	PHAB	U.S. Fish & Wildlife Service
Dale Humburg	NAWMP	Ducks Unlimited
Kathy Fleming	PHAB	U.S. Fish & Wildlife Service
Nathan Zimpfer	PHAB	U.S. Fish & Wildlife Service
Shawn Oldenburger	Central Flyway	Texas Parks and Wildlife