Harvest Management Working Group

2013 Annual Meeting Report

December 2 - December 6, 2013

Boise, Idaho

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$$V^*(x_{t-1}, d_{t-1}, q_{t-1}) = \max_{a_t}\left\{\sum_i q_{i,t-1}\left[p_i(x_t|x_{t-1}, d_{t-1})R_i(a_t|x_t) + \sum_{x_{t+1}} p_i(x_{t+1}|x_t, a_t)\sum_{x_t} p_i(x_t|x_{t-1}, d_{t-1})V^*(x_{t+1}, q_t)\right]\right\}$$

Cover Art: A proposed value function to derive optimal harvest management strategies that account for decisions made prior to observations from monitoring programs. The optimal value (V^*) is conditional on the state (x), decision (d), and model weights (q) observed in the previous year (*t-1*). Notation adapted from Williams et al. (2002).

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1 BACKGROUND

This report provides a summary of presentations and discussions that occurred at the 25th meeting of the Harvest Management Working Group (HMWG). The 2013 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), continued work related to the double-looping learning process of Adaptive Harvest Management (AHM), and the North American Waterfowl Management Plan (NAWMP) Revision. For meeting details please refer to the appended 2013 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*)

Multi-stock Harvest Management

The Atlantic Flyway, through the double looping process for Eastern Mallard AHM, has determined that the current Eastern Mallard AHM decision framework does not adequately address the fundamental objectives for duck harvest management in the Flyway. Eastern mallards are the most abundant bird in the harvest, but they may not be a good representative for other species for the Flyway as they constitute less than 25% of overall harvest in the flyway and they do not originate from important waterfowl breeding areas such as boreal forests in eastern Canada, bottomland and coastal wetlands in the Southeast, and the western (mid-continent) region. The Flyway believes that a decision framework based upon a suite of ducks that better represent the habitats and harvest derivation of the Flyway would be more desirable (if feasible) 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 Council meeting the Atlantic Flyway Council 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. Towards that end, the technical section tasked itself with a number of items to accomplish prior to the 2013 summer meeting, (1), finalize fundamental objectives for duck harvest management, (2), USFWS and AF coordination with PHAB and USGS to lay some preliminary groundwork for the technical work that will be required, (3), a determination of the quality and types of data that exist for the various duck species in the flyway (e.g. BPOP estimates, time series for those estimates, harvest rate, survival rate, midwinter data, and banding data).

In May 2013 the Atlantic Flyway 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 (Table 1).

The technical section ranked sustainability as the highest ranked fundamental objective, followed by maximizing hunter satisfaction and then maximizing efficiency and simplicity in the regulations process. Weighting indicated a clear priority for sustainability, whereas standard deviations around the mean weights for fundamental objectives 2 and 3 overlapped, indicating somewhat equal value (Table 2). Ranks and weights

Table 1 – Table 1. Summary of individual state rankings of means objectives resulting from discussions of harvest management objectives in the Atlantic Flyway.

	CT	DE	FL	GA	ME	MD	MA	NH	NJ	NY	NC	PA	RI	SC	VT	VA	WV	Mean	North	South	Mid	SD
Means Objectives-Ranks																						
Harvest Decision on representative species and habitats	2	2	1	1	6	2	4	2	1	6	4	3	4	1	4	1	2	2.71	3.67	1.75	1.50	1.687
NAWMP Objectives stepped down across all AF species	6	3	8	7	7	6	7	8	9	4	9	6	8		5	7	9	6.81	6.67	8.00	6.25	1.759
NAWMP Objectives for AF species individually	7	10	9	6	8	7	5	5	3	9	8	8	9		3	6	6	6.81	6.67	7.67	6.50	2.105
Carrying CapacityObjective for AF Habitats	3	7	10	8	2	9	6	4	10	10	10	9	2	8	2	5	5	6.47	4.78	9.00	7.75	3.064
No species below level for sustainability	1	1	5	4	1	4	1	1	2	1	1	1	1	2	1	2	1	1.76	1.00	3.00	2.25	1.300
Maintain certain level for 'important' species	8	4	7	3	3	1	2	10	6	5	5	2	3	5	6	4	3	4.53	4.67	5.00	3.75	2.348
Reduce/eliminate adverse effects on certain species	9	8	6	9	5	5	3	3	8	8	6	5	7	6	7	8	7	6.47	6.00	6.75	7.25	1.841
Account for 'important' species in framework	4	5	2	2	4	3	8	9	7	3	2	4	6	7	8	3	4	4.76	5.56	3.25	4.50	2.306
Incorporate prairie duck population status into decision	10	6	3	10	9	8	9	6	5	7	3	7	10	4	9	9	10	7.35	8.56	5.00	7.00	2.473
Harvest all species with a right shoulder strategy	5	9	4	5	10	6	10	7	4	2	7	10	5	3	10	10	8	6.76	7.44	4.75	7.25	2.751
Simple Regulations	4	5	5	6	4	6	6	1	6	5	2	6	3	1	7	3	5	4.41	4.56	3.50	5.00	1.839
Minimize year to year changes in regulations	8	6	4	4	2	8	7	4	5	7	4	5	4	2	2	5	3	4.71	4.67	3.50	6.00	1.961
Maximize percentage of satisfied hunters	2	3	7	1	3	7	3	5	4	8	7	2	2	5	5	4	1	4.06	3.44	5.00	4.50	2.221
Seeing lots of birds	3	7	6	2	5	3	4	3	3	3	3	3	1	6	3	2	4	3.59	3.22	4.25	3.75	1.583
No closed seasons	1	1	1	8	1	1	1	1	1	1	1	1	5	4	1	1	2	1.88	1.56	3.50	1.00	1.965
Maximize equity of harvest opportunity across flyway	7	8	8	7	4	5	2	6	7	6	8	8	8	8	4	7	6	6.41	5.67	7.75	6.75	1.770
Reasonable opportunity to harvest bag limit	5	4	3	5	8	2	8	8	8	4	5	4	6	7	6	8	8	5.82	6.33	5.00	5.50	2.007
Maintain or increase traditional regional species harvest opportunities	6	2	2	3	7	4	5	7	2	2	6	7	7	3	8	6	7	4.94	6.22	3.50	3.50	2.193
Minimize costs relative to status quo	5	4	3	2	6	6	4	4	1	3	5	4	1	4	4	5	3	3.76	3.78	3.50	4.00	1.480
Simple framework for hunter understanding and accepta	1	5	6	4	3	2	5	5	2	1	1	1	3	2	1	1	5	2.82	2.78	3.25	2.50	1.811
Simple framework for AFCTS implementation	3	1	1	5	4	1	6	1	3	4	2	3	4	1	2	3	1	2.65	3.11	2.25	2.00	1.579
Facilitate Learning	6	2	2	1	2	3	3	2	4	6	3	5	6	5	3	2	4	3.47	4.11	2.75	2.75	1.625
Utilize existing monitoring programs	2	3	4	3	1	5	1	3	5	2	4	2	2	4	5	4	2	3.06	2.22	3.75	4.25	1.345
Easily understandable and enforceable regulations	4	6	5	6	5	4	2	6	6	5	6	6	5	3	6	6	6	5.12	5.00	5.00	5.50	1.219

of fundamental objectives didn't vary by region of the Flyway (North, Mid-Atlantic, South). Ranking and weighting of means objectives did vary a bit by region, but for the most part, the same 3 or 4 means objectives were identified as being important by all members of the technical section.

For the fundamental objective of sustainability, the highest ranking and weighted means objectives were (1), Ensure that no species of waterfowl falls below population levels necessary for long-term sustainability, (2), Base harvest management decisions on species that are representative of other species and habitats important in the AF, (3), Account for 'important' species (e,g., important in harvest; species that support traditional duck hunting methods; species that provide trophy or high quality hunting values, etc.) in decision framework. Another means objective, to maintain certain population levels for 'important' species, was weighted and ranked nearly identical to the third means objective, and should be considered the same means objective.

Table 2 – Table 2. Summary of weights applied to harvest management, means objectives specified by each state in the Atlantic Flyway.

	CT	DE	FL	GA	ME	MD	MA	NH	NJ	NY	NC	PA	RI	SC	VT	VA	WV	Mean	North	South	Mid	SD
Means Objectives-Weights																						
Harvest Decision on representative species and habitats	90	90	95	100	50	100	80	90	100	50	60	65	80	100	85	100	80	83.24	74.44	88.75	97.50	17.315
NAWMP Objectives stepped down across all AF species	40	80	5	50	50	75	40	60	5	75	0	30	40		80	40	5	42.19	46.67	18.33	50.00	27.747
NAWMP Objectives for AF species individually	30	30	5	70	50	60	40	80	70	0	10	15	40		90	50	15	40.94	40.00	28.33	52.50	27.882
Carrying CapacityObjective for AF Habitats	90	70	5	50	90	80	70	80	5	0	0	5	90	50	95	60	20	50.59	60.00	26.25	53.75	36.652
No species below level for sustainability	100	100	80	80	100	100	100	100	80	100	100	100	100	90	100	90	80	94.12	97.78	87.50	92.50	8.703
Maintain certain level for 'important' species	20	90	70	90	80	100	90	50	25	50	50	65	80	75	75	70	60	67.06	63.33	71.25	71.25	22.435
Reduce/eliminate adverse effects on certain species	20	40	60	40	70	90	90	90	10	10	10	35	60	75	80	30	15	48.53	52.22	46.25	42.50	30.247
Account for 'important' species in framework	80	80	95	100	80	100	75	50	10	75	80	55	60	60	75	80	50	70.88	66.67	83.75	67.50	22.096
Incorporate prairie duck population status into decision	0	70	90	40	20	50	30	70	25	25	70	25	30	80	70	20	5	42.35	30.56	70.00	41.25	27.620
Harvest all species with a right shoulder strategy	80	40	80	70	0	80	10	60	50	100	20	0	80	85	60	10	20	49.71	45.56	63.75	45.00	33.563
Simple Regulations	70	70	65	65	70	70	40	95	50	50	90	25	80	100	60	60	15	63.24	56.11	80.00	62.50	22.703
Minimize year to year changes in regulations	20	70	60	80	80	20	50	90	60	25	70	35	80	90	90	50	15	57.94	53.89	75.00	50.00	26.579
Maximize percentage of satisfied hunters	90	70	0	100	80	50	100	85	70	0	40	65	90	70	85	60	80	66.76	75.00	52.50	62.50	29.893
Seeing lots of birds	85	50	50	100	70	100	80	90	70	75	80	45	100	60	80	70	15	71.76	71.11	72.50	72.50	22.565
No closed seasons	100	100	95	50	100	90	100	100	100	100	100	100	80	80	100	100	80	92.65	95.56	81.25	97.50	13.477
Maximize equity of harvest opportunity across flyway	50	50	0	60	70	70	100	80	50	50	0	5	30	45	70	20	15	45.00	52.22	26.25	47.50	29.422
Reasonable opportunity to harvest bag limit	60	70	60	70	10	100	20	75	30	50	60	40	70	50	60	20	5	50.00	43.33	60.00	55.00	25.800
Maintain or increase traditional regional species harvest opportunities	50	80	70	90	40	100	50	80	80	75	60	5	50	85	50	40	5	59.41	45.00	76.25	75.00	27.265
Minimize costs relative to status quo	45	80	70	95	60	75		90	100	75	60	45	100	70	70	30	50	69.69	66.88	73.75	71.25	20.694
Simple framework for hunter understanding and accepta	100	60	5	75	80	80		80	75	100	100	100	70	90	100	100	10	76.56	80.00	67.50	78.75	29.873
Simple framework for AFCTS implementation	70	100	85	75	80	100		100	50	50	80	50	70	100	90	70	100	79.38	76.25	85.00	80.00	18.518
Facilitate Learning	10	100	80	100	90	80		95	50	25	75	45	60	60	80	80	50	67.50	56.88	78.75	77.50	26.331
Utilize existing monitoring programs	90	80	70	90	100	75		90	40	100	70	60	90	80	50	30	50	72.81	78.75	77.50	56.25	21.445
Easily understandable and enforceable regulations	50	50	45	60	70	80		80	25	50	50	35	60	85	50	30	10	51.88	50.63	60.00	46.25	20.726

The means objectives ranked and weighted highest for the fundamental objective of maximizing hunter satisfaction were (1), No closed seasons, (2), Seeing lots of birds, (3), Maximize percentage of satisfied hunters as indexed through hunter surveys. The technical section thought and interpreted this last objective as best measured through assessing hunter behavior, not through annual or even periodic opinion surveys. There was variance in regional preferences under this fundamental objective. The Mid-Atlantic and South regions both indicated a preference in their top three for 'maintain or increase traditional regional species harvest opportunities'. The South region also indicated a preference for simple regulations and in addition, minimizing regulatory changes from year to year. The latter was not identified by the North region or Mid-Atlantic as being important.

Means objectives associated with the efficiency fundamental objective that were identified as important were (1), Keep decision framework as simple as possible so that AFCTS can implement annually, (2), Keep decision framework as simple as possible so that hunters can understand and accept the regulation setting process, (3), Utilize existing monitoring programs. The means objective of facilitating learning was a priority for the Mid-Atlantic and South regions, but not for the North.

The ranking and weighting exercise formally re-affirmed the collective thinking of the Atlantic Flyway technical section, that we need to develop a duck harvest decision framework that is simpler than what we currently use, that takes into account those species that are important across the Flyway, and that represent the suite of habitats that we are trying to conserve and enhance, and finally the recognition that within the bounds of sustainable harvest, that our harvest management strategies should be geared towards providing satisfaction to the majority of our constituency. How to define and measure that satisfaction is one of the many challenges that face us as we move towards a new decision framework.

Before formally endorsing the objectives and associated rankings and weights that the technical section developed, the Atlantic Flyway Council wants to undertake their own ranking exercise prior to their winter meeting. Many Council members went through the ranking and weighting exercise with their respective technical committee staff, so hopefully we will not see any sweeping changes to the objectives and rankings already at hand.

Defining the geographic boundary and the species that would be used in a multi-stock approach is integral to beginning the technical work that will be required for implementation. The technical section feels that using the Eastern Survey area is an appropriate geographic range as a starting point for discussion. We have a time series of data for the Eastern Survey area that runs back to 1990. This time series provides estimates for total ducks as well as for six major species, mallards, black ducks, American green-winged teal, ringnecks, goldeneyes, and mergansers. Once the Northeastern Plot survey is integrated into the Eastern Survey area we will have a survey that covers the majority of breeding habitat for the major harvest species in the Flyway, except for wood ducks breeding in the Southeast, and an assemblage of species derived largely from the mid-continent region. The total harvest of ducks from the latter region is relatively small, but may be important to consider in some way. Several southern states have a desire for a component of the Mid-Continent to be included in the decision framework, specifically some component of Great Lakes ducks. The technical section overall, however, continues to feel that from a duck harvest regulation standpoint the Atlantic Flyway should remain autonomous from the Mississippi Flyway.

The SEIS dictates that we pursue an adaptive framework, not a prescribed strategy that would be the simplest way forward. Given this, there are several potential approaches to developing the competing models that will have to be incorporated into the framework. Utilizing a discrete logistic population model modeling a small number of 'important' and/or representative species is one logical way to approach the problem. Whether this modeling approach uses these species individually and then aggregates them into a single duck population or aggregates them first is another technical question to address. Approaching the issue using all ducks is another option to consider.

To begin this exploration we have developed a simple model using the existing scaup model machinery to test the efficacy of such an approach. We used BPOP and harvest data from mallard, black duck, ring-necks, and green-winged teal for this first model.

Ultimately, the objective function of the optimization will be key in how the framework might perform. An objective of maximizing cumulative long-term harvest is certainly not the most desired. We need to work with the USFWS and this body to determine whether other metrics such as a targeted range of harvest rates or hunter days afield could be used for the optimization.

SEIS

The Atlantic Flyway feels that there is a need for an annual face to face meeting with the Council and that there is a need for an additional technical meeting (current winter meeting) as well. An early March meeting with the Council and an early fall technical meeting seems like it would work best.

We have not seen the most recent iteration of the assessment for Eastern Mallard AHM with regards to using prior year's data to inform our decision. Given the current framework of Eastern Mallard AHM we are not overly concerned that the change will result in any more of a conservative framework. We will, of course, be assisting with and reviewing the assessments as they are completed.

The AF has discussed the need to begin the dialogue with the USFWS and the other Flyway Councils for when we would change the regulatory packages under eastern mallard AHM. The USFWS has indicated that although preferable that all 4 flyways agree upon a common starting point for the 5-yr regulatory package it is not a requirement. The AF feels that enough technical work has been done previously in the mallard committee and through the double looping process that it was reasonable to expect that the TS would be able to craft new packages by the summer 2014 meeting for potential implementation in the 2015 season. The AF has also discussed that depending upon the timetable for implementation of a multi-stock approach that we consider holding off on any package changes if such changes would only result in packages used for a couple seasons. The AF feels that it is prudent to begin the process of developing package changes and evaluate the multi-stock development timeline at our winter 2014 meeting.

NAWMP Revision

The Atlantic Flyway has not spent sufficient time reviewing or digesting the work plan of the Interim Integration Committee (IIC). We plan on providing input by March 2014. At first glance there were a few harvest management related questions that the draft work plan posed. These included; (1), to what degree harvest management should serve to achieve population goals, (2), that given the recent experience from 1997-2012 of high duck populations and liberal harvest policies that perhaps a less risk averse harvest management philosophy could be considered.

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

Discussions of HMWG-related issues by the Mississippi Flyway Council (MFC) and Technical Section (MFCTS) took place at both winter and summer 2013 meetings and focused primarily on the priority project list, SEIS, changes to early teal hunting opportunity following the completion of the Teal Assessment, and double-looping revision of the Mid-Continent Mallard AHM.

HMWG Priority List

The process for approving the annual priority list of work tasks approved by the SRC and Flyway consultants was reviewed at the winter meeting and the proposed priority list for July 2013 through July 2014 was considered. The highest priority items from the November 2012 HMWG meeting included 1) adjusting harvest strategies based on changes in timing of regulatory decisions associated with the preferred SEIS alternative and developing a strategy for communicating the implications of the SEIS to the harvest management community

and general public; and 2) double-loop revision of the Mallard AHM model sets including consideration of NAWMP objectives. Those priorities corresponded closely to those communicated by the MFC in 2012, and they include a number of "other issues" listed in past MF perspectives such as, review and/or revision of AHM harvest packages and objective function. Consequently, a recommendation was passed supporting the proposed priority list.

Early Teal Season Opportunities

The final report from the Teal Assessment Committee was reviewed, and it showed there was opportunity for expanded teal hunting. The MF had previously expressed support for expanding special teal seasons to include production states, which have been excluded since 1969, through a recommendation that if harvest opportunity beyond the regular duck season is warranted, it should be offered to all MF states equally. The DMBM also provided a document titled *Considerations for Teal Harvest Management* that outlined the USFWS position on potential regulatory actions that might be used to expand September teal hunting. There was much discussion about approaches, many not supported in the *Considerations* document, that might be used beyond inclusion of production states such as increased bag limits and season lengths, inclusion of a "mistake" duck in the bag, bonus teal, addition of teal-only days to seasons in states with teal/wood duck seasons, changes in shooting hours, and required date collection and evaluation. A recommendation was passed at the winter meeting requesting the Service work cooperatively with the Flyway in developing plans for establishing and evaluating:

(1) Experimental teal seasons in production states (MN, WI, MI, and IA).

(2) Additional teal-only hunting days in non-production states with combined teal/wood duck seasons (KY and TN).

(3) Increasing the daily limit for special teal seasons.

(4) Increasing the season length for special teal seasons.

(5) Including additional species during special teal seasons.

At the July meeting, a Flyway subcommittee consisting of 2 members from the Upper and Lower Regulations Committees was established to begin work on those plans, and urges the USFWS to be open to considering approaches not supported in the Considerations document.

At the July meeting there was also discussion about increasing the bag limit from 4 to 6 for the 2013–14 hunting season. That was not supported by the USFWS and was seen as something that might make it more difficult to garner support for and implement other changes in the September teal season being considered, and was not passed by the MFCTS. In light of Atlantic and Central Flyway Technical Committees passing that recommendation, the Council reconsidered the issue and passed a recommendation to increase the bag limit for the 2013-14 hunting season.

MCM Double-Looping

We initiated discussions at the winter meeting after Scott Boomer's presentations on the effect of the SEIS on MCM AHM and sub-model performance. Scott made the point, which was reiterated by a number of people that this effort is not just a technical tweaking of the models to increase predictive performance, but a clean start that might include reconsidering what is driving mallard populations, addressing system change (loss of CRP and climate change), including hunter participation more explicitly, etc. This also involves a number of concerns expressed by the MF at this meeting over the past 5 years such as reconsidering the MCM AHM harvest management objective, review of the harvest packages, and the role of the NAWMP population goal. This effort involves a complete review of the fundamentals of our current harvest management in light of the

3rd fundamental objective and desire for more cohesive population and habitat management expressed in the NAWMP Revision.

However, that also appears to come with substantial confusion. First, recent personnel changes have resulted many new people without a historical background in AHM, but even the most experienced are having difficulty articulating what specifically we want to accomplish with revised population objectives, reconsideration of harvest packages, or changes to the AHM objective function. One of the driving forces in considering these revisions is that hunter numbers are declining nationwide while duck populations have been high and harvest opportunities liberal for an extended time. But that is not true in all states, and we lack reliable knowledge about the effects of changes in regulations packages, population goals or objective functions on hunter participation and if or how strongly they are related. There are fundamental clarifications needed about dissatisfaction with the current harvest management system, and what is to be accomplished through the double-looping process. Current discussions have been vague.

MCM AHM double-looping requires participation from Tech Reps from both the Central and Mississippi Flyways as well as PHAB participation and other groups such as the NSST and HDWG. An ad hoc committee consisting of Adam Phelps and Dave Luukkonen from the MF and Mark Vrtiska and Mike Johnson was established to begin organizing the technical work, and they will have an initial meeting on Friday of this week.

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.
- Little emphasis on goose harvest management despite large management concerns about over-abundant populations.
- Black Duck AHM model software conversion and changes in regulations the last 2 years after a decade without changes.

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

The Central Flyway (CF) believes there is a widening disconnect in the long-standing partnership between the Flyway and the U.S. Fish and Wildlife Service (Service). The issues the CF identified last year - lack of engagement by the Service Regulations Committee (SRC) and the SRC's almost absolute reliance on Division of Migratory Bird Management (DMBM) - appear to remain. This devaluing of our influence on SRC decisions and forces the CF to continue to question the value of our component in the "process." The advancement of the daily bag limit increases for regular Canada goose seasons and September teal seasons for the 2013/14 hunting seasons has provided some optimism in the continued cooperation between the CF and the Service.

The question also remains about the capacity of the Service's staff time and resources to develop, implement, and update all of the harvest strategies, given the necessary requirements of these strategies. It appears that DMBM staff agrees with such an assessment, yet DMBM has stated they are committed to using "informed decision making" in regards to harvest regulations. The CF struggles 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 for things that simply do not require that level of effort that strains already limited resources. This has created an atmosphere, where it appears to us that DMBM does not engage the CF as full partners in open discussions about potential harvest options. In particular, the CF remains frustrated with the lack of response from the Service regarding our draft proposal to evaluate a two-tiered licensing system.

Finally, the concerns that the CF have expressed in previous HMWG meetings still remain. The CF sees waterfowl hunter recruitment and retention, band issues, mid-continent mallard adaptive harvest management, and light goose issues as top priorities. The CF hopes to begin to work and solve some of these issues in partnership with the Service, rather than as adversaries. This perspective statement has been reviewed and approved by both the Central Flyway Waterfowl Technical Committee and the Central Flyway Council.

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

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.

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, 3.5 million in 2012, and 3.3 million in 2013; the largest observed breeding populations since 1980. Pintails have increased 83% in 2013 from the low of 1.8 million in 2002.

The Pacific Flyway encourages a review of the pintail harvest strategy models 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). This project has been identified as a high priority by the SDJV. We support the continued involvement by staff from the Population and Habitat Assessment Branch and USGS to conduct the assessment and consult on the project.

3 Old and New Business

3.1 Updating 2014 Eastern mallard model weights (*Guthrie Zimmerman and Scott Boomer*)

We use the preceding year's observed BPOP as the starting point to make model-specific population estimates for the current year. The comparisons of the predicted BPOP to the observed BPOP for the current year are used to update model weights and the policy for eastern mallard AHM. Because of a structural defect in the exhaust system of Kodiak aircraft used to fly the eastern survey area, we do not have an observed BPOP for 2013 which is needed for the starting point to make model predictions for the 2014 regulations cycle. Therefore, we offered two potential actions to the working group for consideration:

(1) Use the 2012 policy, which represents the most recent policy that was derived using observed BPOP, as the 2014 policy; and use the 2014 observed BPOP to inform the harvest management decision.

(2) Use a model-predicted BPOP (weighted average of the 4 models) for 2013 as the starting point to make model-specific predictions for each model for 2014.

While discussing these issues, the group identified a 3rd option - imputing data for 2013 and using the imputed values as the starting point. We had considered imputing data for the 2013 regulations cycle, but could not decide upon a satisfactory approach given the large area with missing data (i.e., we didn't miss a single stratum; we missed all strata in the eastern areas). The group decided that Guthrie Zimmerman and Scott Boomer would work with the AF to decide on the best approach for the 2014 regulations cycle.

3.2 Black duck AHM (*Pat Devers*)

American black duck regulations are established under an international strategy between Canada and the U.S., which establishes annual regulations one year in advance of the specific hunting season. Therefore, the optimal country-specific regulatory strategies for the 2014-15 hunting season were calculated in September 2013 using:

(1) The black duck harvest objective (98% of long-term cumulative harvest);

(2) 2014-15 country specific regulatory alternatives;

(3) parameter estimates for mallard competition and additive mortality; and

(4) 2013 breeding population estimates for black ducks and mallards.

The optimal regulatory choices were the moderate package in Canada and the restrictive package in the United States.

The International Black Duck Adaptive Harvest Management framework was first implemented in fall 2013. The Black Duck Adaptive Harvest Management Working Group (BDAHMWG) in cooperation with the Atlantic and Mississippi Flyways, Canadian Wildlife Service and the U.S. Fish and Wildlife Service developed two communication products to facilitate the implementation and understanding of the new framework by the hunting public. The first product was a tri-fold document entitled "Black Duck Management Strategy in North America." The second product was a 1-page document entitled "Black Duck Management Strategy in North America: Hunter Fact Sheet." These documents were provided to partners and made available to the hunting public through agency websites and regulation booklets.

Technical priorities for the BDAHMWG include transitioning the state-space model used to estimate key parameters from Python programming language to R and WinBUGS; transitioning the optimization routine from ASDP to MATLAB; and incorporating 1-year prediction as recommended in the Supplemental Environmental Impact Statement. The BDAHMWG is also re-assessing the model structure for predicting fall age ratios as a function of black duck abundance and mallard competition.

4 NAWMP Revision and IIC

4.1 IIC Workplan (*Dale Humburg*)

Conservation planning for waterfowl in North America has, for the better part of the last century, emphasized continental scale and a balance among goals for populations, habitat, and users. These three features are not new to wildlife conservation in general and certainly not to waterfowl management. The North American Waterfowl Management Plan (NAWMP or Plan) became the ultimate reflection of the urgency for coordinated waterfowl planning that became acute as habitat conditions deteriorated and waterfowl populations declined beginning in the early 1980s and only worsened during the decade to follow. The NAWMP was unique as it established continental scale, numeric objectives for waterfowl populations. This was perhaps best captured in the summary statement by the plan's authors, who projected that meeting the plan's population goals,

> " ... would provide the opportunity for 2.2 million hunters in Canada and the United States to harvest 20 million ducks annually. The harvest would include 6.9 million mallards, 1.5 million pintails and 675,000 black ducks. It would also provide benefits to millions of people interested in waterfowl for purposes other than hunting" (U.S. Department of the Interior and Environment Canada 1986, p. 6)."

The waterfowl community has been advocating for some time that the NAWMP objectives be reviewed, and now with the 2012 revision and the explicit addition of waterfowl supporters, the need is even more relevant. The management community will be developing input between now and March; however, initial discussions with the HMWG involved the overall question of NAWMP objectives and more specifically, the context of scale and decisions.

The following were offered to initiate discussions (reviewed in more detail below).

(1) How important is it to have a numeric objective at a continental /national scale?

(2) If a number is important - what should it be?

(3) What is the management / policy decision related to each objective and at what scale?

The 2012 NAWMP lists 3 roles that objectives can serve - how important is a numeric objective to each of these?

- Operate as a communication & marketing tool to demonstrate the need for conservation ("inspire")

- Provide a biological target and plan foundation ("plan")
- Function as a performance measure for assessing conservation accomplishments ("decide")

In addition to the possible functions of an objective, it is important to address:

(1) whether a numeric (measurable) objective is necessary,

(2) what specific decisions are involved related to each objectives,

(3) the management actions that will be used (and the degree of control managers have), and

(4) the scale at which these will be applied.

The following can be used as a way to initiate discussions about potentially revised objectives:

(1) The 1986 plan's objectives were based on 1970s' levels of waterfowl populations and at least implied, were 1) habitat to support those populations and also 2) populations to support hunters and hunting. These objectives from the 1986 plan largely have been used to inspire waterfowl conservation action at continental and national scales.

   (a) The question we should ask at this point is ***"How important is it to have a numeric objective at a continental /national scale?"*** To date, this has been primarily used as an aspirational objective used to communicate waterfowl conservation needs and inspire action (and largely, these are what are included as draft objectives / measurable attributes in the IIC work plan - 15 July 2013).

      i. Waterfowl populations (and/or harvest)

      ii. Waterfowl supporters (hunters vs. viewers vs. general public)

      iii. Habitat to support waterfowl populations and habitat to support users

   (b) ***If a number is important - what should it be*** (currently proposed as the 1997–2012 range for populations and supporters - as proposed in the attached)?

(2) ***What is the management / policy decision related to each objective and at what scale?*** The decision context is key to this discussion, and this is where the issue of scale presents complexity and confusion. It will be important to be clear about the specific decision and the scale at which the decision applies relative to the revised objectives. The specific management actions and the scale at which management actions will be applied is important to acknowledge. For the most part, waterfowl managers are limited to 1) habitat-related actions (acquisition, restoration, management, and policies affecting the landscapes), 2) harvest management actions (affecting both population status and hunting opportunity), and 3) a degree of marketing and communication to affect participation as well as policy actions. The following are included among these (as well as others):

   (a) "Allocation" of habitat dollars among priority landscapes:

      i. How important is a numeric population objective for habitat conservation planning among priority landscapes?

   (b) Habitat planning within a priority landscape (acknowledge that each landscape has a unique contribution to achieving goals for populations and supporters):

      i. Within a priority landscape (e.g., Joint Venture or at a state level); how important is a numeric population objective (likely stepped down from a continental objective) to guide conservation planning at this scale?

      ii. Within a priority landscape, habitat management decisions are focused both on habitat for waterfowl populations and habitat to support waterfowl users. How important is a numeric "user" objective at the landscape (or local) scale? Again, recognizing that this is vastly different from one region to another.

(c) Harvest management:

i. How important is a numeric population objective (or harvest rate) to setting harvest regulations?

ii. To what degree are harvest regulations intended to manage waterfowl populations and to what degree are they intended to "satisfy" hunters?

4.2 Human Dimensions Working Group (*Dave Case*)

A brief overview of the status of the newly formed Human Dimensions Working Group (HDWG) and the newly-formed Public Engagement Team (PET) was presented. The HDWG met in May and produced a summary report and relevant presentations were made at the July 2013 Flyway meetings. The July 15 IIC work plan also incorporates HDWG progress. The PET has a new Chair, Gray Anderson (Assistant Chief of Wildlife and Forestry, TN); and Mark Vrtiska and Scott Boomer have joint membership status in the Harvest Management Working Group and the HDWG.

4.3 NSST (*Pat Devers*)

The NSST established a Net Landscape Change Working Group which was tasked to assess the current and future ability of Joint Ventures to monitor net landscape change. The working group is currently working on the development of a web-based survey instrument to obtain information from habitat JVs, and is in discussions with NASA, USGS, and the Yellowstone Environmental Research Center and NABCI to organize a conference on assessing net landscape change.

The NSST established a Working Group to summarize existing information on the issue of ecological goods and services provided by waterfowl habitat conservation. However, the task was viewed as daunting and perhaps unnecessary because similar efforts have already been completed and are available (e.g., Gulf of Mexico Ecosystem Services Valuation Database) to the conservation community.

Anne Bartusvevige of the NSST, has spearheaded an effort to organize a joint technical meeting of the Harvest Management Working Group, Human Dimensions Working Group, Interim Integration Committee and the NSST to discuss technical aspects of an integrated waterfowl management system. The goal of the workshop will be to increase participants' understanding of the current mission, mandates, memberships, and operations of each group and to identify areas of potential integration.

4.4 Considerations for a Joint Technical Committee Meeting (*Ken Richkus*)

The HMWG discussed the potential opportunities to learn from the NSST and the HDWG at a Joint Technical Committee Meeting. The HMWG agreed to participate at the upcoming meeting with with commitments from Min Huang (AF), Mark Vrtiska (CF), Pat Devers (BDJV, NSST Chair), Ken Richkus (HMWG) and Scott Boomer (HMWG Coordinator).

5 Assessment Reports

5.1 Modeling pintail population dynamics to link habitat and harvest (*Erik Osnas*)

Northern pintail have been selected as a priority species for implementing the integration of harvest management with habitat management policy. The mathematical framework has been developed for pintails in previous work (Mattsson et al. 2012). Efforts now underway are attempting to parameterize this model

from existing data and test assumptions (i.e., functional relationships) made during the development of that model. A key assumption of the developed model is that density-dependence in survival occurs during the post-hunting (winter) period, where resources are hypothesized to be limiting. Because little data is available to directly inform this process, the approach used is to build a hierarchical Bayesian "integrated population model" that simultaneously uses data from band recoveries, breeding population counts, and fall age ratios to estimate parameters of an annual population projection model. This allows for estimation of process and observation error variances in addition to survival, reproduction, and population count parameter estimates that are logically consistent with each other and with the mathematical structure imposed through the population model. The main findings so far are that while there is considerable evidence for density-dependent recruitment in pintail, we were unable to find evidence of density-dependence in the post-hunting season period over the range of population sizes from 1960-2012. Instead, there is remarkable consistency in hunting and non-hunting season survival rates across years that varied substantially in harvest rates, a pattern more consistent with density-dependence or mortality compensation occurring during the hunting season. The habitat management implications of this pattern suggest that habitat improvements through management interventions, agricultural practices, or climate will have much greater population impact when applied to the breeding grounds, at least at current demographic rates and within the range of historical experience. Thus, in terms of integrating habitat and harvest policy, higher harvest yields may be achieved through improved breeding habitat as compared to wintering habitat. Massive habitat loss on the wintering ground-beyond anything experienced during the last several decades-could of course reverse the expected payoff of habitat improvements.

5.2 The effects of weather and habitat on waterfowl populations - forecasting the implications of climate change (*Qing Zhao, Emily Silverman, Kathy Fleming, and Scott Boomer*)

Current decision-making frameworks in wildlife conservation often assume system stationarity. Yet climate change has already caused, and is likely to continue causing, shifts in ecosystem composition and function that impact population distributions and dynamics. Therefore, reliable forecasting of population responses will play a key role in adapting conservation and management activities to anticipate and respond to climate change. Population dynamics are driven by both endogenous (e.g., density-dependent) and exogenous (e.g., climate, habitat) factors that vary spatially and lead to local differences in population trajectories. We examined the population dynamics of three species of ducks, Mallard (*Anas platyrhynchos*), Blue-winged Teal (*A. discors*), and Northern Pintail (*A. acuta*), as they relate to habitat and weather conditions in the North American prairies using three-decades (1979–2009) of population, habitat, and weather data. We used Multivariate Auto-Regressive State-Space (MARSS) models to characterize the spatial and temporal relationships between waterfowl abundance and ecological region, pond availability, precipitation, and temperature. We quantified how weather conditions drive pond availability, which in turn significantly affect waterfowl population dynamics. Our results demonstrate evident spatial variations of the relationships between weather, habitat, and waterfowl populations. After comparing a number of candidate models, we trained the best model with data from 1979 to 1999, and used resulting parameter estimates and observed climate data to simulate wetland and waterfowl population dynamics from 2000 to 2009. Simulated trends were compared with observations to evaluate the forecasting ability of our models, and the results suggest that our models have promising forecasting abilities. We also forecasted population responses to different climate change scenarios and identified areas where populations may be resilient or vulnerable to future climate change. We anticipate that these results will be useful for developing adjustments to current adaptive harvest management decision frameworks in response to large-scale system shifts associated with climate change.

5.3 Sea duck harvest potential assessment (*Chris Dwyer, Mark Koneff, and Guthrie Zimmerman*)

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 con-

ducting a harvest assessment; contrasting estimates of sustainable take with contemporary harvest estimates. A prospectus describing proposed methods was developed and circulated prior to the winter 2013 Flyway meetings. 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 (*S. m. dresseri*), eastern and western populations of black scoter, and continental populations of long-tailed ducks, surf scoter, and white-winged scoter. Methods will also be applied to the northern subspecies of common eider (*S.m. borealis*) for comparison to a previously published population model and harvest assessment. Focal species/populations were selected based on SDJV/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 will be expressed as probability distributions that reflect uncertainty in parameter estimates. Monte Carlo simulation will be used to propagate uncertainty in multiple parameter estimates into a probability distribution for PTL. The sustainability of contemporary harvest levels will be assessed through comparison of the probability distribution of PTL with probability distributions for contemporary harvest. We will examine 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 on testing the framework against published results for other species. Code preparation is largely complete and has been tested against published take assessments of the northern common eider subspecies and black vulture. Several species-focused working groups have been formed and are in the process of formulating probability distributions for input parameters based on published empirical studies, general allometric or ecological relationships, and expert opinion. These values (i.e., distributions) will be 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. In December 2013, we are planning a workshop to focus on the selection of parameter estimates and running the model to determine allowable take levels and key areas of uncertainty that need to be addressed. Results from the workshop will be presented at the winter flyway meetings. The need for further analyses will then be determined in conjunction with the SDJV Harvest Management Working Group, the flyway technical committees and the Harvest Management Working Group at their 2014 meeting.

6 SEIS

6.1 SEIS Evaluation: where we left off and revisiting the harvest management decision problem (*Scott Boomer*)

In response to last year's action items, several technical solutions were evaluated in order to determine the harvest management implications of the preferred alternative specified in the Final (SEIS). For example, in developing methods used in the SEIS assessment, it was determined that code adjustments could not be

made with the current software platform (ASDP), demonstrating the need to develop optimization code in a new software environment (e.g., Matlab). In addition to describing last year's high priority technical work for the SEIS evaluation, background information describing the harvest management decision problem was presented to set the stage for a revised approach to dealing with the technical challenges associated with the implementation of the SEIS preferred alternative.

6.2 An alternative approach to informing decisions in the absence of an observed state (*Fred Johnson, Scott Boomer, Guthrie Zimmerman, Ken Williams, and Bob Dorazio*)

Our concern is with the adaptive management of resource harvesting, subject to partial system observability. Partial observability often stems from sampling or measurement error in monitoring programs, but here we focus on the lack of monitoring information about system state at the time a decision must be made. This perspective was motivated by a supplemental environmental impact statement (SEIS) issued by the United States Fish and Wildlife Service concerning the timing of the annual process for regulating the harvests of migratory birds. The preferred alternative of the EIS is to advance the timetable for regulatory decisions by approximately two months to allow more time for public input, to provide earlier notification of the season's regulations, and to save time and money in administering the process. The Adaptive Harvest Management (AHM) process for assessing resource impacts and identifying an optimal harvest regulation thus requires modifications to account for the absence of current-year monitoring information. Information presented at last year's meeting of the Harvest Management Working Group suggested that you could condition on the expected system state at the time of the decision. This led to some theoretical problems, however, and a revised approach evaluates policy value V by conditioning directly on the previous year's (*t-1*) system state x, regulatory decision d, and model weights q:

$$V^*(x_{t-1}, d_{t-1}, q_{t-1}) = \max_{a_t}\Bigg\{\sum_i q_{i,t-1}\Bigg[p_i(x_t|x_{t-1}, d_{t-1})R_i(a_t|x_t) + \sum_{x_{t+1}} p_i(x_{t+1}|x_t, a_t)\sum_{x_t} p_i(x_t|x_{t-1}, d_{t-1})V^*(x_{t+1}, q_t)\Bigg]\Bigg\},$$

where i indicates one of four alternative models, a is one of four regulatory alternatives, and R is the current year harvest return. Implementation of this approach was conducted using the software MDPSolve (©Paul Fackler 2013). Differences from the traditional optimization approach using this software include:

- calculation of a passive AHM policy now appropriately averages model-specific values rather than model-specific states;
- a passive AHM policy is calculated for a discrete grid of model states rather than for a single, specified model state;
- some sources of uncertainty were fixed at their expectations (at least for now);
- the Closed-season constraint was imposed by assigning the Closed alternative a value of negative infinity when $N_{t-1} \geq 4.75$; and
- the Average Reward algorithm was used rather than Backwards Iteration; this is more appropriate for infinite time horizon, no discounting.

The adoption of new software per se did not lead to any significant differences in the optimal, passive adaptive management policy. Implementation of the preferred alternative of the SEIS, however, does appear to make the adaptive management policy much more liberal. This result is counter-intuitive (more uncertainty usually tends to make harvest policies more conservative) and several hypotheses have been advanced to explain the result:

H1: Distribution of population size - The predicted population size is assumed to be distributed log-normal (increasing variance means an increasing mean).

H2: The closed-season constraint - With more variance the policy becomes more knife edged (few intermediate regulations); more of the state space gets Liberal but more of the state space can't get Closed because of this constraint.

H3: Non-linear vital rate and/or utility functions - especially the population-utility function for mallards that incorporates a population goal. Add more variance to population predictions and the expected utility declines (because of the non-linear utility function). Could it be that the optimization is trying to make up for that by grabbing more harvest (value is the product of population-utility and harvest)? This would explain the more liberal policy and the greater difference in population size and goal with SEIS.

H4: Resilience - If there's a (greater) chance the pop will be higher than the mean, then capitalize on it by selecting Liberal. If Liberal is the "wrong" choice, the effects are short-lived and you can always correct next year. The idea is that as the prediction variance grows, you have less control over the population. If you have less control, you might as well go for the most harvest.

These hypotheses are currently being tested. The presentation concluded with several questions for the Working Group to ponder:

- Is the objective function appropriate in light of findings related to the SEIS and given the direction of the NAWMP?
- Are the regulatory alternatives appropriate given that the maximum rate is only 11% (mean for adult males) (and that there is virtually no distinction between Moderate and Liberal)? Are the alternatives consistent with what we are trying to achieve in harvest management?
- To what extent can we do a better job of modeling the system given the large-scale changes taking place?
- Will potential cut-backs in monitoring lead to less ability to "see" the system and act appropriately?
- Will changes in decision frequency be considered (e.g., every three years as in Canada)?

6.3 Practical considerations for scheduling a single regulations meeting (*Ken Richkus*)

Due to a longer than anticipated technical scoping process, the need to develop new optimization code in MATLAB, and outstanding work to be completed on a revised technical approach associated with the implementation of the SEIS preferred alternative, we now anticipate implementation of the SEIS starting with the 2016 regulations cycle. We discussed the following timeline/milestones for implementation:

- Dec 2013–Nov 2014 Remaining technical work completed and verified, adjustments made to harvest strategies and decision frameworks;
- Dec 2014 Draft report prepared and discussed at the HMWG meeting;
- Jan 2015 Final report delivered to Flyway Technical Sections and Councils for discussion at winter meetings;
- Feb 2015 Final report presented at the SRC meeting (published in the 2015 Preliminary Federal Register);
- Feb/Mar 2015 Discussion at winter Flyway Technical Meetings;

- Mar 2015 Discussion at Flyway Council Meetings, Council Recommendations to Implement or Modify;
- Jun 2015 SRC approves or recommends modifications;
- Jun/Jul 2015 Modifications completed; and
- Jul 2015 SRC approves for implementation for the 2016 regulations cycle.

In addition to the timeline for implementation, we also discussed a possible schedule for the single regulations meeting proposed under the SEIS for promulgation of annual regulations. We quickly acknowledged that timing of this meeting within the proposed Federal Regulations publication schedule is dependent on multiple factors outside the purview of the HMWG (e.g., full public comment periods under the Administrative Procedures Act, timing of state legislative sessions, timing of state commission meetings, etc.). Many of these factors are being considered through ongoing discussions among the Division of Migratory Bird Management (DMBM) staff and the National Flyway Council.

One factor which is under the control of DMBM's Branch of Population and Habitat Assessment (PHAB) is when annual population monitoring data and annual updates to decision frameworks can be made available to the Flyways to inform harvest management discussions. PHAB staff committed to having the the annual duck/goose Status Reports, AHM Report, and Harvest Management considerations document available in Sept each year. For example, these documents will be available in Sept 2015 to inform the 2016 regulations cycle. This should give the Service and the Flyway Councils maximum flexibility in scheduling a regulatory meeting around other non-technical factors. This assumes that we do not make any changes to our decision frameworks which would capture data on environmental conditions in early fall or winter. However, there are some brant and swan populations that use midwinter survey results to inform regulations. Results from the previous midwinter would still be available to develop regulations, or, if desired by the Service or the Flyways, we could wait until the current year midwinter survey if completed to develop recommendations (late January). Similarly, mid-continent white-fronted geese, Rocky Mountain Population of Sandhill cranes management plans are all based on fall surveys. We will need to continue discussing these different survey timeframes (and the desires of the Flyways and Service) when finalizing a regulatory schedule.

7 Triple-loop learning and AHM

7.1 Back to the future (*Fred Johnson*)

Fred Johnson presented the lessons learned from AHM and the opportunities for adapting current decision frameworks in the face of recent concerns about the harvest management community's limited capacity and the dwindling resources necessary to maintain AHM. After the HMWG discussed these ideas, a white paper (see appended: Adaptive Harvest Management: Lessons Learned and Prospects for the Future) was developed outlining the HMWG's position while offering suggestions about how to move forward to meet these current challenges.

8 Multi-stock harvest management

8.1 Status of the development of a wood duck harvest strategy (*Jim Kelley and Paul Padding*)

For many decades wood duck harvest management has been conservative in nature, with daily bag limits of only 2 birds in all Flyways except the Pacific Flyway. Much of this conservatism was based on perceived population declines observed in the early 1900s and also the lack of reliable population estimates and indicators

of status throughout the specie's range. A general consensus emerged that the wood duck population had increased from past declines, which led to recent interest in liberalizing wood duck harvest regulations. A Wood Duck Population Monitoring Initiative during the 1990s sought to evaluate and improve wood duck monitoring programs, with special emphasis on banding programs. Results of the Initiative indicated that available data did not support harvest management at the sub-population level. An assessment of wood duck harvest potential using the Potential Biological Removal approach indicated that an increase of bag limits from 2 to 3 birds likely could be supported (Garrettson 2007). As a result, daily bag limits were increased to 3 birds in 2008. In granting the bag limit increase, the Service Regulations Committee requested that the Flyway Councils work with the Service to develop a wood duck harvest strategy (73 FR 55607). Harvest rates have been monitored on an annual basis since the bag limit increase and Flyway Council Technical Sections have been working with DMBM staff to evaluate potential approaches to developing a harvest strategy. However, several key policy level issues remain un-resolved:

(1) Should observed kill rates be calculated on an annual basis, or on the basis of 2 or 3-year averages?

(2) Observed kill rates should be based on what cohort –adult males or adult females –northern birds or a Flyway-wide average?

(3) How should management objectives be set and expressed?

(4) What are the monitoring program and test criteria that should be used to guide regulations?

(5) What set of regulatory alternatives should be considered in the harvest strategy?

At least one Flyway Council has formally requested the Service to lead an effort to re-engage all Federal and State stakeholders in order to finalize a wood duck harvest strategy. We expect that discussions will resume during the 2014 regulations cycle.

8.2 Policy considerations for adjusting the teal harvest strategy (*Jim Dubovsky, Jim Kelley, and Paul Padding*)

The discussion began with a brief history of the process to this point. The Teal Harvest Potential Working Group completed a review in January 2013 indicating that additional harvest opportunity is available on teal species, primarily on blue-winged teal and to a lesser extent on green-winged teal. As guidance for moving forward, the Division of Migratory Bird Management (DMBM) in early 2013 drafted a document stating what it (DMBM) felt were appropriate means to craft regulations to take advantage of that opportunity, given the likelihood of success of various strategies and past policy decisions by the Service. Essentially, DMBM felt that the most appropriate path forward for production states was to pursue Special September Teal Seasons as currently offered to non-production states. Non-production states could also pursue additional opportunities through increases in bag limits or season lengths, but not on a state-by-state basis (i.e., state "options"). DMBM stated that due to past policy decisions by the Service, use of bonus teal seasons, expanded use of September Duck Seasons (i.e., those currently used in Iowa), and expansions of teal/wood duck seasons in Tennessee, Kentucky, and Florida should not be considered in the future.

The DMBM document and subsequent recommendation by the Division at the early season Service Regulations Committee (SRC) meeting generated much discussion between the Flyway Consultants and the SRC. The Flyways felt that by accepting the DMBM recommendation, the Service was already closing some doors that the Flyways wanted to pursue, and felt that such a decision was not in the spirit of a partnership between the Service and the Flyways. Ultimately, the Service did not accept entirely the recommendation by the DMBM, but also did not completely open the door for consideration of regulations that had been eliminated previously. Specifically, the Service stated:

> "If Flyway Councils wish to pursue these regulatory approaches to providing additional teal harvest opportunity, we request that they provide compelling information as to why such policies

and approaches should be reinstated (i.e., bonus teal) or expanded/modified (i.e., September duck seasons or September teal/wood duck seasons."

At this meeting, the DMBM representatives indicated that they could not divine exactly what would suffice to meet the criterion "compelling information" stated by the Service. However, for bonus teal, the group was informed that the regulation had been eliminated in the past for the following two reasons: (1) the small likelihood of assessing the impact of bonus teal regulations on teal and other species, and (2) concern about the take of other species during bonus teal periods. Therefore, the Flyways would need to sufficiently address those concerns in any response/evaluation they would submit to the Service. For expanded/modified September teal/wood duck seasons, the DMBM representatives stated that those regulations were eliminated from consideration more based on a judgement call by the Service (i.e., they did not want to see those seasons proliferate in scope), and therefore it is even harder to provide guidance to the Flyways on what would constitute "compelling information."

The ensuing discussion included statements by the Atlantic Flyway that their interpretation of "in lieu of" in the Federal Register (regarding September teal/wood duck seasons relative to teal seasons) meant that the two seasons were considered equal when those decisions were made. Since we have expanded teal seasons in recent years (i.e., increases in season length, bag limit, and inclusion of additional areas [Nebraska and several Atlantic Flyway states]), the state representatives stated that Flyways should be allowed to pursue modifications to those seasons. Discussion regarding possible regulatory alternatives for production states focused on the desire of the Central Flyway to implement bonus teal regulations instead of September teal seasons. Their reasons for doing so included: (1) potential negative impacts to banding programs in Central Flyway states, (2) a belief that an appropriate study could not be conducted in Central Flyway states due to the nature of hunting in those areas (e.g., open areas where hunting parties could not be covertly observed during spy blind work, hunters moving from pothole to pothole during a hunt to pursue birds), and (3) the likelihood that the experiment would fail due to the preponderance of "brown ducks," which hunters have difficulty discriminating among. The Central Flyway indicated a willingness to conduct an evaluation of bonus teal impacts, but the group did not begin discussions on how such an evaluation would be conducted. The HMWG then discussed a few potential sources of data for an evaluation, including banding data, an assessment of bag-size distributions from harvest data, and information from previous assessments of September teal season and bonus teal regulations.

Additionally, the state representatives voiced concerns about the need for evaluations when such a large additional harvest opportunity exists, such as with blue-winged teal. The HMWG discussed how issues such as risk tolerance might be incorporated into objective functions in the future to address this concern, but we did not explore any specific possibilities.

Finally, the Flyway Representatives reminded the participants that the Service also stipulated that additional harvest opportunities should be targeted at blue-winged teal and not the other teal species. Therefore, the Service likely would not consider additional regulations in the Flyways that would result in a substantial increase in the harvest of green-winged and/or cinnamon teal.

8.3 Evolution of Multi-stock Management Pursuit in the Atlantic Flyway (*Min Huang*)

The Atlantic Flyway provided a brief history of the double looping process for Eastern Mallard AHM and how the current move towards a multiple species decision framework has evolved. A thorough assessment of Eastern Mallard AHM, which was implemented in 2002, had not been conducted since implementation. Discussions at the 2010 Atlantic Flyway summer meeting led to a desire to conduct an assessment of the underlying models and a potential update of the parameters upon which the models are built. The double looping of Eastern Mallard AHM began in 2011. This was stimulated in part by the dramatic shift in harvest policy that occurred in 2010. In particular, we questioned whether maximizing long term harvest of eastern mallards was still our sole objective, as that was heavily influencing the harvest policy. Declining numbers of mallards breeding in eastern North America, especially in the northeastern U.S., also suggested that 60-day seasons may not be sustainable over the long term. In addition to assessing model performance and updating

model parameters, the Atlantic Flyway began a structured-decision making (SDM) process to help review the objectives and regulatory alternatives used in the current AHM framework and identify changes that could be implemented after the new SEIS on migratory game bird hunting is completed.

Prior to 2011 Eastern Mallard AHM relied upon 6 population models that represented alternative hypotheses concerning bias (i.e., bias in recruitment, bias in survival, or no bias) and the strength of density dependence (i.e., strong versus weak). Based on the assessment of eastern mallard AHM and poor performance of the initial models, the model set was revised in the winter of 2012 to inform the 2012-2013 hunting regulations. The revised set, which was developed by eliminating hypotheses concerning bias and adding hypotheses of additive versus compensatory mortality, consisted of the same 4 models used to inform mid-continent mallard AHM: Compensatory mortality and strong density dependence (ScRs), compensatory mortality and weak density dependence (ScRw), additive mortality and strong density dependence (SaRs), and additive mortality and weak density dependence (SaRw). A retrospective analysis of model performance for these 4 models from 2002-2011 indicated the strongest support for SaRw (weight = 0.425) followed by, ScRw (weight = 0.279), SaRs (weight = 0.182), and ScRs (weight = 0.114). Both the AF and USFWS approved the use of this new model set until the entire AHM protocol could be revised.

Currently the AHM models only hypothesize density dependence operating on recruitment. Density dependence could very well be operating on survival in some form. Similar to what is hypothesized with black ducks, winter severity might be a factor influencing eastern mallards. However, despite much analysis, no definite co-variates can be found that adequately explain mallard dynamics. The Atlantic Flyway sees this as the final effort to develop meaningful alternate hypotheses and model sets. In the absence of the development of a meaningful alternate model set, we feel that this gives us the impetus to potentially abandon an eastern mallard based strategy and place a concerted effort on the development of multi-stock management.

The SDM exercise to re-examine the management objectives for eastern mallard harvest management led to the following "fundamental objectives" for the Atlantic Flyway as a whole:

- Maintain an eastern mallard population that provides long-term sustainable uses;
- Provide eastern mallard hunting opportunity in accordance with hunter desires; and
- Accommodate harvest management objectives for other duck stocks.

Results of this objective-setting process clearly indicated that some states were dissatisfied with the current Eastern Mallard AHM process because it does not account for the status of, and opportunities for harvest of, other duck stocks in the flyway. While this was not a surprise, the importance that many states placed on considering multiple stocks had never been quantified.

In light of all that came out of the Eastern Mallard AHM double looping process, the Atlantic Flyway recommended that no additional effort be invested in refinement of the current Eastern Mallard AHM approach, and that work be directed instead to explore development of a multiple-stock approach. The Flyway recognizes that Eastern Mallard AHM was an important step forward for duck harvest management in the Atlantic Flyway, as it allowed us to become uncoupled from decision-making based solely on the status of mid-continent duck stocks. A multi-stock approach is the logical and necessary evolution of harvest management in the flyway, but we will continue to use and evaluate Eastern Mallard AHM for the next several years until an alternative multi-stock approach is developed for consideration.

The discussion by the HMWG led to a number of issues for the Atlantic Flyway and HMWG to begin working on above and beyond the objective setting and initial model building that the Flyway had already conducted:

(1) Look at correlation of mallard BPOP to other species;

(2) Need to solicit and develop possible regulatory alternatives;

(3) Develop list of competing hypotheses;

(4) Measureable attributes for means objectives; and

(5) Incorporation of risk tolerance into framework (see #2 above).

9 Resurrecting AHM Communications Team and Future Challenges (*Dave Case*)

The AHM Communications Strategy has not been formally updated since 2006 and the HMWG Communications Team has only met sporadically since 2006. However, the importance of communications is as great as ever. The HMWG agreed that the Communications Team should be resurrected and the Communications Strategy updated.

The following will serve on the HMWG Communications Team:

Min Huang (Atlantic Flyway)
Adam Phelps (Mississippi Flyway)
Mike Johnson (Central Flyway)
Jeff Knetter (Pacific Flyway)
Ken Richkus (USFWS)
Jim Kelley (USFWS)
Alicia King (USFWS)
Dave Case (DJ Case - if funding is available)

The HMWG discussed communications issues and challenges:

- The relationship of the HMWG to the NAWMP Revision of Public Engagement Team needs to be considered...these need to connected.
- AHM Review.
  - This review needs to have a communications effort associated with it.
  - This will be an effort of the HMWG conducted through the flyway councils.
  - Why are we going through this double-looping process? Need to answer that.
  - Already broad agreement from Flyways for this process. In fact, welcomed because of the concerns expressed in this meeting.
  - Can we rename? AHM Review...we've learned some things, the world has changed...should we make changes/adjustments to AHM.
- Multi-species Management.
  - This is internal for now.
  - Could be viewed as a subset of AHM Review.
  - It is being explored in Atlantic Flyway...stay tuned.
  - Hunters..."aren't we already doing that?" Need to define it.
- System Change
  - Sooner or later we are going to hit a dry cycle, or other environmental shock and we are not prepared to deal with that communications wise.
  - An example is shock of habitat loss in prairie potholes.
  - Disconnect now between hunters and opportunity (e.g., Vrtiska et al. 2013).
  - Degree to which there is knowledge and engagement by decision-makers within agencies.

  - Hunting constituency still very influential and critically so.

- Changing agency cultures and availability of resources for traditional waterfowl management. Good and bad, resulting from:

  - High waterfowl populations for many years-no crisis, no administrative pain;
  - Overall push for smaller government...sequestration;
  - NAWMP Revision-focus on broadening the audience (people); and
  - Changing face of the USFWS.

The Communications Team subsequently met on the evening of December 5. The scope and approach to updating the Communications Strategy was discussed and the following points were agreed to:

- The SEIS and resulting changes to the regulatory process and timing are important to communicate. However, given the regulatory nature of the SEIS, the USFWS will clearly need to take the lead on that component on of the Strategy, but with review and input from the HMWG.

- Jim Kelley, Alicia King and Ken Richkus will develop a first draft of the SEIS component of the updated Communications Strategy. A draft of the Communications Strategy with key issues identified for flyway review will completed and distributed by June 2014 to allow full review by flyway technical committees and councils.

- What is the Problem/Issue we are trying to address through communications plan?

  - Turnover in technical representatives and flyway councils (and throughout FWS for that matter)...a whole new crew.
  - Need to be prepared to deal with potential counterintuitive nature of regulations...or just big changes.
  - Widening gap in expertise...internally.
  - SEIS...various changes such as single meeting.
  - This is not a "build it and you are done" enterprise, especially if you add doubling looping and improvement to the system.
  - JVs really want to be engaged (could be an outcome of the Joint technical group that will be meeting).
  - Need to maintain monitoring systems to support this.
  - Relevancy of waterfowl manager...evidence is declining rank of council members. Need to increase relevance of harvest management in agencies. Need to engage our constituents.
  - Been good times in waterfowl management...in some cases "too good."
  - Economic impact of hunting/waterfowl hunting.

- The following actions should be considered in the Communications Strategy:

  - Promote the communications tools (videos, etc.) on flyways.us website.
  - Conducts some AHM Workshops at flyway tech/council meetings.
  - Hold some HMWG/AHM webinars.

10 UPDATING HMWG PRIORITY ACTIONS AND WORK PLAN

The Working Group reviewed progress on the 2014 priority action items and opened up a discussion to identify the highest priority technical work for 2015. 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 2013) was identified as the highest priority for technical work in 2015 (Table 3). 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 2014 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.

10.1 2014–2015 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 2014 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 2014 decision results (i.e., practice round comparison);

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

(3) An update describing a multi-stock harvest management framework for the Atlantic Flyway;

(4) An evaluation of the harvest management implications of NAWMP implementation;

(5) An update describing research developing adjustments to mid-continent mallard AHM in response to climate change; and

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

10.2 2014 HMWG Meeting

The 2014 HMWG meeting will be hosted by the Mississippi Flyway in Bloomington, Indiana and is scheduled from 1–5 December 2014.

Table 3 – Harvest management decision frameworks, technical issues, project leads, deadlines, and action items identified at the 2013 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 Final SEIS.

Decision Framework	Issue	Leads	Deadline	Priority
National				
Mallard stocks	Optimization, model weight updating, etc...	Johnson, Boomer, Zimmerman	12/2014	High
Pintail	See mallards	Sanders, Runge	12/2014	High
Scaup	See mallards	Boomer, PHAB	12/2014	High
Canvasback	Adjust harvest strategy	PHAB	12/2014	High
Teal	Adjust triggers for special teal seasons	Fleming and Teal group	12/2014	High
Shared				
MCP Cranes	Adjust management plans	CF Tech Comm and MN	12/2014	High
RMP Cranes	Adjust management plans	CF and PF	12/2014	High
Black duck	See mallards	Devers, PHAB, and CWS	9/2014	High
Pacific Flyway				
Cacklers, Dusky, Aleutian, Wrangel Island, PF Brant, BT Pigeons, PF WFG	Adjust management plans	PF Tech Comm	12/2014	High
Central Flyway				
Hi-Line	Adjust management plans	CF Tech Comm	12/2014	High
Mississippi Flyway				
EPP, MVP, SJBP	Adjust management plans	MF Tech Comm	12/2014	High
Atlantic Flyway				
AP, NAP	Adjust management plans	AF Tech Comm	12/2014	High

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Harvest Management Working Group
2013 Meeting Agenda
Boise, Idaho

Monday (December 2) ***Travel Day***

[1700] State Technical Representatives meeting (Vrtiska)

Tuesday (December 3) ***Welcome, Reports from Partners, New Business***

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

[0830] Flyway reports/perspectives

- Atlantic, Mississippi, Central, Pacific (State Technical Representatives)
- USFWS (Flyway Representatives)
- CWS (Flyway Representatives?)
- Communicating HMWG priorities (Kelley)
- USFWS Budgeting and Monitoring Priorities (Richkus)

[1000] **Break**

[1015] Old and New Business

- Updating 2014 Eastern mallard model weights (Zimmerman and Boomer)
- Black duck AHM (Devers)
- New Business...

[1200] **Lunch**

[1300] NAWMP Revision and IIC

- IIC Workplan (Humburg)
- Human Dimensions Working Group (Case)
- National Science Support Team (Devers)
- Group Discussion: Considerations for a Joint Technical Committee Meeting (Richkus)

[1500] **Break**

[1515] Progress Reports

- Northern pintail integrated modeling (Osnas)
- Model development to suport adaptive responses to climate change (Zhao)
- Nebraska harvest data evaluation (Vrtiska)
- Sea duck harvest potential assessment (Dwyer)

[1700] **Adjourn**

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

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

[0815] Revisiting the harvest management decision problem (Boomer)

[0900] An alternative approach to informing decision in the absence of an observed state (Johnson)

[1000] **Break**

[1015] Practical considerations for scheduling single regulations meeting (Richkus)

[1030] Group Discussion: SEIS implementation planning

- HMWG recommendation for meeting date
- Sequence of steps for implementation
- Communication issues: objectives, target audiences, key messages, key actions

[1200] **Lunch**

[1300] Back to the future (Johnson)

[1400] Facilitated discussion: Triple-loop learning and AHM (Case)

[1500] **Break**

[1530] Group discussion: Charting a course of increasing resilience in waterfowl management (Case)

[1700] Adjourn

Thursday (December 29) ***Multi-stock harvest management and 2015 Planning***

[0800] Recap and Discussion (Case)

[0830] Group discussion: wood duck harvest management (Kelley and Padding)

[0900] Group discussion: policy considerations for adjusting teal harvest strategies (Flyway Representatives)

[0930] Group discussion: multi-stock harvest management

- Atlantic Flyway update (Huang)
- Implications for AHM double-looping

[1000] **Break**

[1015] Resurrecting AHM Communications Team and future challenges

- SEIS
- Double-looping
- System change

[1500] **Break**

[1515] Meeting summary (Case)

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

[1600] Adjourn

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

[0800 – 1200] Mid-continent mallard AHM double-looping (Mississippi and Central Flyways, USFWS)

2015 Harvest Management Working Group Priorities

Priority rankings and project leads identified for the technical work proposed at the 2013 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 3. 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, 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 (*HDWG, Flyway Councils, FWS, NAWMP Interim Integration Committee, Joint Technical Committee, others...*)

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 (*Seaduck Joint Venture, HMWG*)
- Two-tier licensing system evaluation (*Central Flyway, HMWG*)

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

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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
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
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
Fred Johnson	USGS	U.S. Geological Survey
Other Participants		
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Erik Osnas	Post Doctoral Researcher	U.S. Geological Survey
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Figure 1 – The participants of the 2013 Harvest Management Working Group meeting met in Boise, Idaho.

Adaptive Harvest Management:
Lessons Learned and Prospects for the Future

Prepared by the Harvest Management Working Group

23 December 2013

The adaptive management of waterfowl harvests in the United States has endured as an institution for almost 20 years. The U.S Fish and Wildlife Service adopted a framework for adaptive harvest management (AHM) in 1995 after a controversial regulatory experiment, an unpopular Supplemental Environmental Impact Statement (U.S. Department of the Interior 1988), and a period of restrictive hunting regulations had severely eroded the collegiality important to collective decision-making. Today, AHM remains one of the few large-scale, successful examples of adaptive resource management. Much has been learned about the harvest potential of waterfowl populations, the ability of managers to regulate harvest, and the monitoring and assessment programs needed to support an adaptive process of decision making. In the long run, however, perhaps one of AHM's greatest contributions will be in its capacity to compel managers to periodically reexamine their purposes and rules of operation. Referred to as double- and triple-loop learning (Figure 1), this critical self-examination is usually precipitated by a recognition that current operating premises and protocols are inadequate to address emerging ecological or sociological problems in management. An awareness of these problems develops because performance expectations are not being met, because the beliefs underlying those expectations change, or because initial expectations were unrealistic. This type of social learning is difficult because institutions have to acknowledge deficiencies in their processes and policies and because the search for solutions usually causes conflict. This is where the waterfowl management enterprise now finds itself. The key challenge facing harvest management is whether AHM as an institution can be adaptive, and whether the knowledge and experience gained in the application of AHM can be reflected in higher-level policy decisions.

Although AHM has improved our understanding about the potential of some waterfowl populations to support harvest, most of the key lessons learned concern the process itself. These lessons include:

(1) The establishment of harvest-management goals and objectives presents significant challenges to the waterfowl management community.

- Waterfowl biologists seem more comfortable with assessing potential ecological impacts, rather than crafting management objectives (and measurable attributes) that reflect social values.
- Maximum sustainable harvest is not necessarily a good measure of hunter satisfaction.
- Liberal regulations, even for long periods of time, won't necessarily sustain hunter numbers.
- The lack of understanding about what satisfies and motivates waterfowl hunters makes it difficult to specify social objectives and relevant metrics, as well as how regulatory alternatives should be crafted to achieve that satisfaction.

(2) There are limits to our ability to regulate harvests.

- Regulatory alternatives are social constructs with only some biological and legal constraints, and we seem to struggle with a consistent and systematic approach to their development.
- Large differences in regulations can result in small differences in harvest rate, and this can lead to so-called knife-edged strategies (i.e., those in which a large regulation change can accompany only a small change in resource status); conversely, large changes in harvest can occur with little or no change in regulations.
- We face severe constraints on our ability to direct harvest pressure at specific stocks of birds.
- Our ability to regulate harvests only within limits (partial controllability) imposes significant constraints on short-term performance and learning.

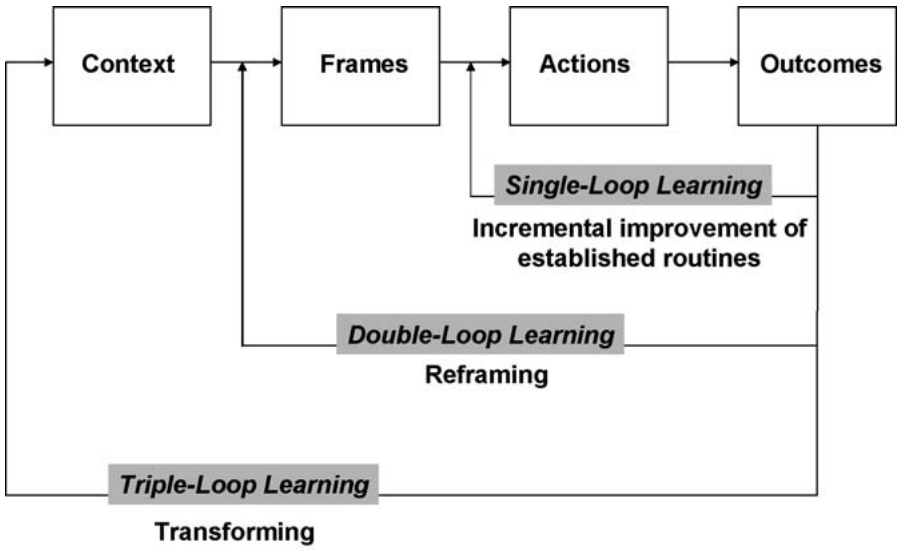

Figure 1 – Three types of learning in management institutions. The updating of model weights and harvest policies in AHM is characteristic of single-loop learning. Single-loop learning involves asking "Are we doing things right?" given specified objectives, alternatives, models, and monitoring programs. Double-loop learning involves the revision of management objectives, regulatory alternatives, or predictive models within the context of an established process. Double-loop learning involves asking "Are we doing the right things?" - in other words, are the specifications for single-loop learning correct? Triple-loop learning involves a consideration of fundamental transformation of the management framework, including institutional arrangements and processes (e.g., the integration of harvest and habitat management). Figure reproduced from Pahl-Wostl (2009).

(3) There are significant difficulties associated with accounting for sources of variation in harvest potential.

- Harvest potential varies over space, time, and organizational/functional (e.g., species) scales.
- Our ability to capitalize on it is severely constrained by limits on monitoring and assessment capacity, as well as traditional regulatory tools available to managers.
- In an ideal world, we would define the appropriate scales of management based on the largest net benefit in terms of population and harvest objectives; in reality, we are likely constrained to coarse-scale management by the resources available (Figure 2).

Despite a growing acceptance of these lessons, the harvest management community has found it difficult to incorporate them into the institutional structure and functioning of the AHM process. Moreover, the Working Group has identified a number of emerging concerns about the inability of the AHM process to cope with changing institutional conditions:

- The recent Supplemental Environmental Impact Statement (U.S. Department of the Interior 2013) will fundamentally affect the way we make decisions, and may well have unanticipated effects on management programs and institutions.
- Harvest and habitat management need to be integrated (or at least not working at cross purposes) as described in the most recent revision of the North American Waterfowl Management Plan (U.S. Department of the Interior, Environment Canada, and Environment and Natural Resources Mexico 2012). Moreover, the Working Group believes that formal incorporation of human dimensions into an integrated waterfowl management decision framework may be premature at this time because of the difficulty of articulating quantifiable, measurable objectives, and the technical challenges of developing modeling frameworks to support the formal consideration of these objectives.
- We are losing the traditional base of support, as well as strong leadership, for waterfowl management.

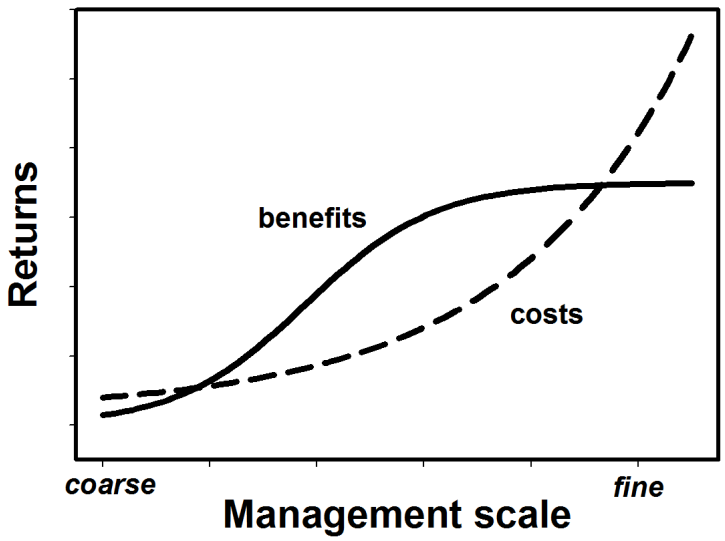

Figure 2 – Conceptual representation of how management returns (benefits and costs) are expected to change with the scale or resolution of management. The management scale, from coarse to fine, moves from simple, relatively wide regulations (such as large geographic scales or few species distinctions), to relatively complex regulations that attempt to target harvests for multiple species, populations, and geographic areas. Fine scale management also involves more expensive monitoring and assessment processes.

- Resources available for waterfowl management are shrinking and it will be difficult to maintain even the status quo in terms of monitoring and assessment programs.
- The gap between technical and practical expertise has grown and practitioners feel increasingly alienated from the process.
- The Harvest Management Working Group feels that it has become too focused on the annual process, and have largely lost the capacity to innovate and adapt to changing environmental and institutional conditions.

An inability (or unwillingness) to reach consensus seems to once again be affecting the decision-making process, raising the question of whether it is time to re-evaluate the AHM process as currently conducted. In particular, the HMWG believes that the AHM approach is on an unsustainable path in terms of the cost and complexity of maintaining current harvest protocols and developing new ones, especially in light of the changes articulated above. The HMWG also believes that the process has become overly cumbersome and rigid, and that it lacks the adaptive capacity to cope with changing ecological and institutional environments. This is not really surprising, given that ecosystems and human institutions routinely go through cycles of efficiency, crisis, and renewal. As harvest managers contemplate the ways AHM might be re-invented to address these concerns, the HMWG suggests several key questions be considered:

(1) How do we expand the discussion to address the integration of population, habitat, and hunting objectives? Are objectives about maximizing or about satisficing (i.e., would objectives or regulatory alternatives that were intended to achieve satisfactory levels of performance in most years lead to a simpler, more flexible process)?

(2) In dealing with uncertainty, are adaptive or robust approaches more appropriate? Robust approaches are intended to produce an acceptable level of performance regardless of key uncertainties, and are generally less demanding of monitoring and assessment resources. However, they are not expected to perform as well as adaptive approaches over the long term, especially if uncertainty is high.

(3) At what spatial, temporal, and organizational scales do we wish (or are we able) to manage harvests? Might a formal multi-species approach (rather than mallard-centric) at the Flyway level alleviate some of the concerns of harvest managers?

(4) How do we engage the waterfowl management community to ensure monitoring capabilities are maintained at sufficient levels for existing and future AHM protocols?

Finally, the Working Group urges the management community to more explicitly consider its risk tolerance. Generally, objectives in AHM have been cast as risk-neutral, in that the perceived value of management increases proportionally with some metric of performance (e.g., harvest; Figure 3). How might the attitude toward risk vary depending on the various metrics of performance (e.g., population size, harvest, hunter participation), as well as the life history of the species, the level of interest among hunters, the ability to regulate harvest, and the degree of uncertainty? Understanding managers' risk tolerance is reflected in many (all?) elements of the decision-making process, including specification of the objectives, the regulatory alternatives, the models of population dynamics, and the approach to optimization (e.g., robust vs. adaptive). Fortunately, the role of risk tolerance is well-established in decision analysis (principally in business; less so in conservation) and, over the next year, the Working Group intends to explore its application in AHM, and to communicate these concepts to the Flyway Councils and Fish and Wildlife Service.

In conclusion, we would like the harvest-management community to consider that it may be time to ask what we wish AHM to look like in the future. There is nothing in the SEIS that precludes this discussion, aside from the timing of the annual regulatory decision. The Working Group is anxious to engage both federal and state partners in this endeavor, recognizing that any new direction will require a sense of ownership on the part of all partners. The management community is urged to think creatively, while being cognizant of the lessons of the past.

Figure 3 – Example of a manager's attitude toward risk. A risk-averse harvest manager is willing to forego large harvests so long as some acceptable level of harvest is maintained. On the other hand, the risk-seeking manager is more accepting of low harvests as long as there is a chance of the occasional high harvest.

LITERATURE CITED

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This white paper was developed by Harvest Management Working Group members who acknowledge that the views and opinions expressed herein do not necessarily reflect endorsement or agreement by HMWG member institutions or agencies.