•presentation provides a summary of the annual AHM report

•**Disclaimer**: Nothing in this presentation represents an official position of the USFWS on the selection of the 2002 duck-hunting regulations. It is intended merely to support the established administrative process for promulgating regulations.

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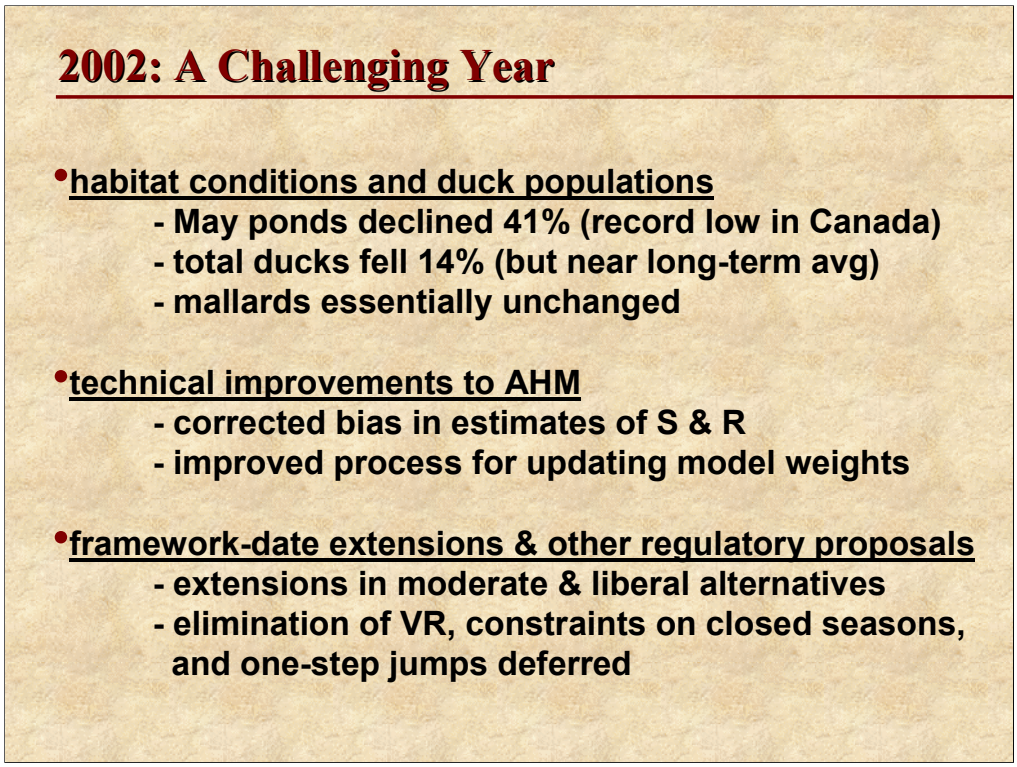
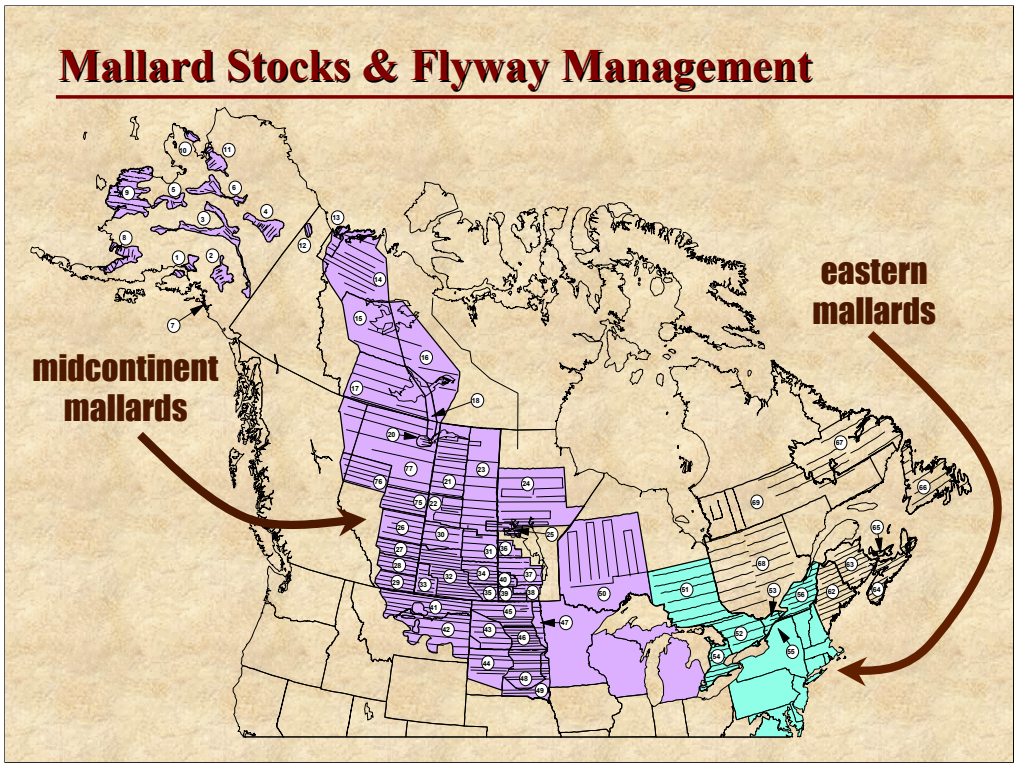


•Development of regulations that are scientifically sound and broadly supported is always a challenge. This year especially so.

•After an unprecedented run of good water years in the prairies & parklands, things are drying up. Periodic drought, though it may lead to short-term declines in duck numbers, is a characteristic feature of the Prairie Pothole Region and is necessary for the long-term productivity of prairie wetlands. The effects of this year's drought on duck populations has not yet been felt, however, and total ducks remain near their long-term average.

•The mallard population models used in AHM are subject to constant scrutiny by parties both internal and external to the AHM process. This year, some important revisions have been made. Most notably, corrections for an apparent positive bias in estimates of survival and reproductive rates, and more comprehensive procedures for updating model weights using comparisons of observed and predicted population sizes.

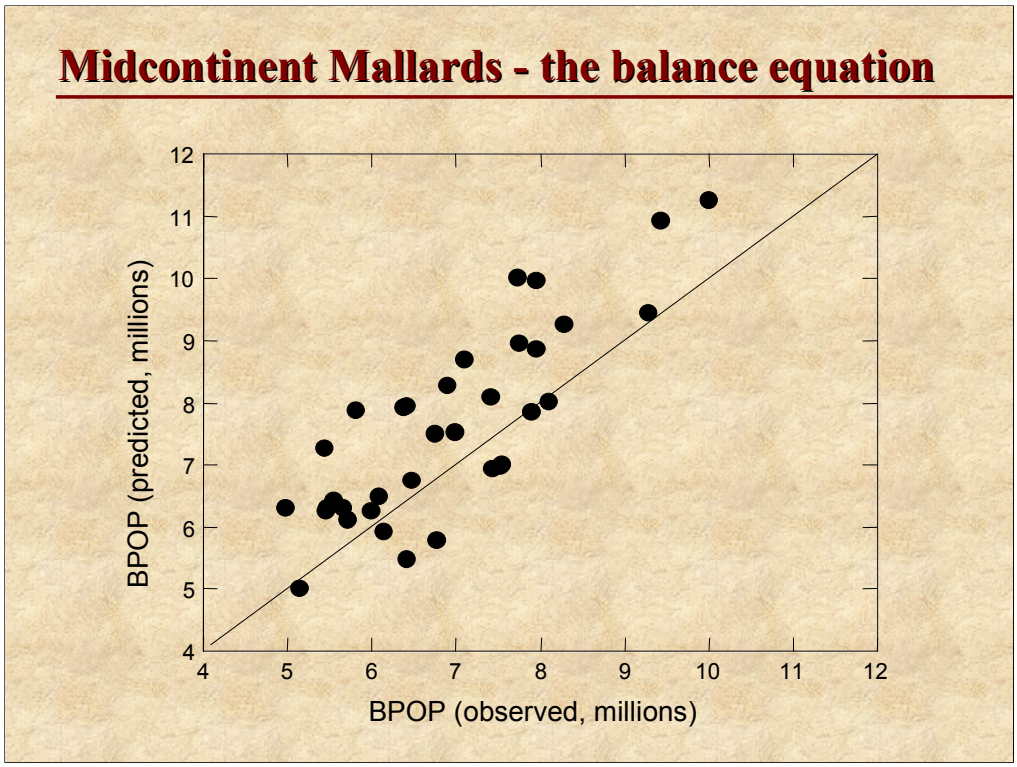
•The USFWS and Flyway Councils proposed a number of significant changes to the set of regulatory alternatives. Decisions about these proposals were especially difficult because they primarily involve social trade-offs (e.g., additional hunting opportunity early and late in the season may be accompanied by fewer liberal seasons over the long term).



•Breeding mallards are distributed widely across North America and there are undoubtedly geographic differences in optimal levels of sport harvest. The challenge is to vary hunting regulations among Flyways in a manner that recognizes each Flyway's unique breeding-ground derivation of mallards.

•Currently, 2 stocks of mallards are recognized for the purposes of AHM. The USFWS continues to use a constrained approach, in which the regulatory strategy for the Atlantic Flyway is based solely on the status of eastern mallards. The strategy for the western 3 Flyways continues to be based on the status of midcontinent mallards. This approach to managing multiple mallard stocks remains provisional until its implications are better understood.

•Efforts are on-going to identify a western mallard stock, and to assemble the monitoring & assessment tools necessary to manage these mallards within a AHM framework.



•All models of population dynamics used in AHM share a common structure, called a balance equation. The balance equation is basically an accounting tool that allows prediction of population size, given population size (N) and survival (S) and reproductive (R) rates during the previous year. In theory, measures of N, S, & R should perfectly predict subsequent population size. In fact they do not, as this graph depicts.

•First, the majority of the points lie above the diagonal line, suggesting an overall positive bias in measures of S & R (assuming the population survey is unbiased - a reasonable assumption). Second, the points do not lie exactly in line, indicative of variation in population size that is not accounted for in measures of S & R.

•These concerns motivated the AHM Working Group to conduct a comprehensive review of the midcontinent mallard models and procedure for updating model weights.

Midcontinent Mallards - model revisions

Revisions…

- **correction for +11% bias in estimated growth rates**
- **updating procedure includes all sources of prediction error**
- **survival hypotheses re-parameterized to better reflect uncertainty about survival rates in absence of harvest**
- **alternative hypotheses of reproduction equally supported by data**
- **annual precipitation was dropper as a predictor of pond changes**

•The most notable revisions are:

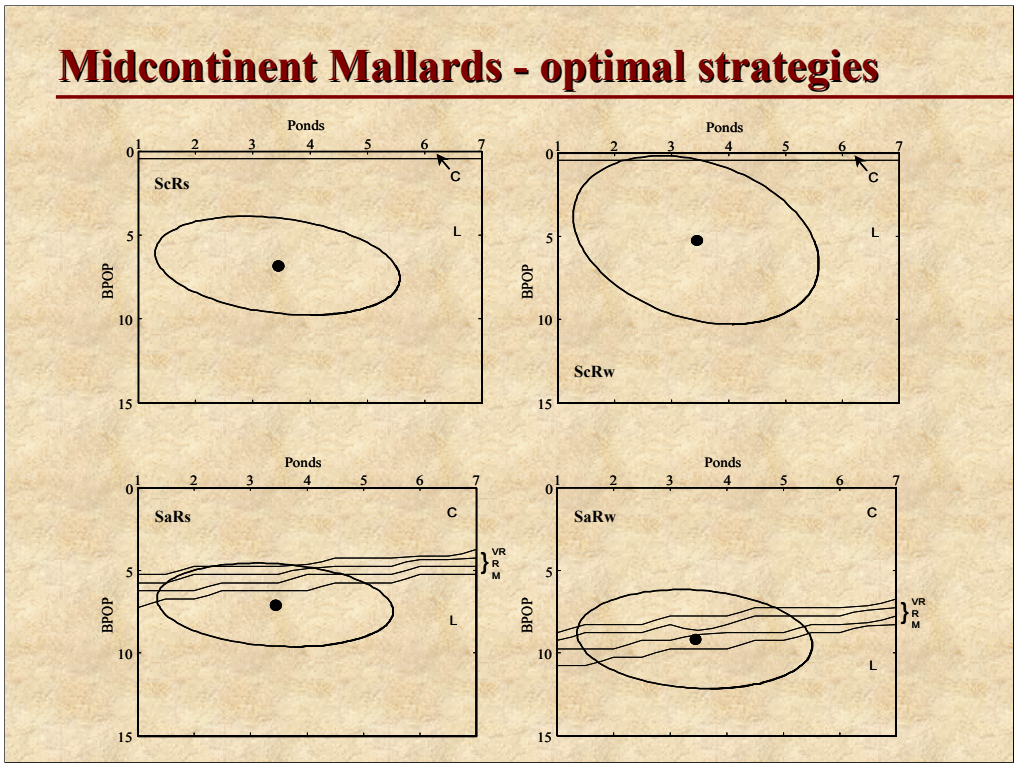
•An empirical correction for the +11% bias in growth rates. The source & cause of the bias remains unknown, but S & R data-collection programs are being carefully scrutinized.

•The procedure for updating model weights now accounts for sources of prediction error common to all the alternative models. This will make model weights change less from year to year, and help ensure they more accurately reflect evidence in support of the alternative hypotheses of population dynamics.

•The 2 sub-models that predict survival rate as a function of kill rate have been modified to reflect a key source of uncertainty, which is the survival rate in the absence of hunting.

•The 2 sub-models of reproduction are now both equally supported by historic data. This was not the case with the original models, in which the alternatives were selected on theoretical, rather than empirical, grounds.

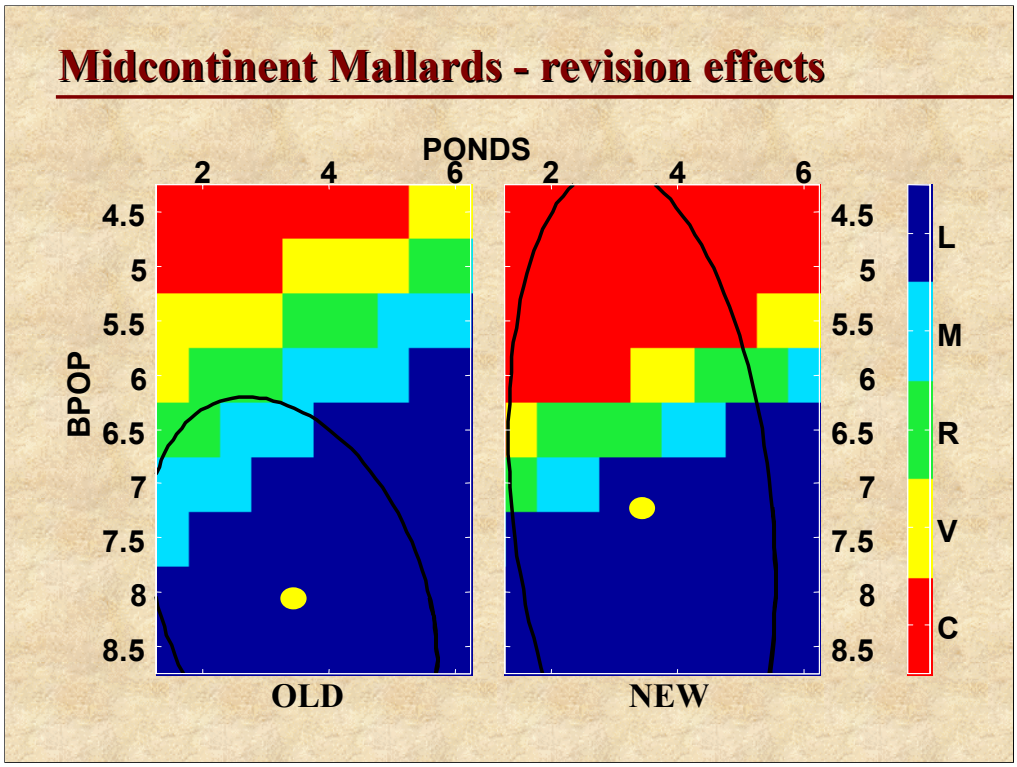
•Annual precipitation was dropped as a predictor of changes in pond numbers, and its contribution to the variance of ponds is included with all other sources of random error. This was done for purposes of model simplification, and should have a minimal effect on regulatory strategies.



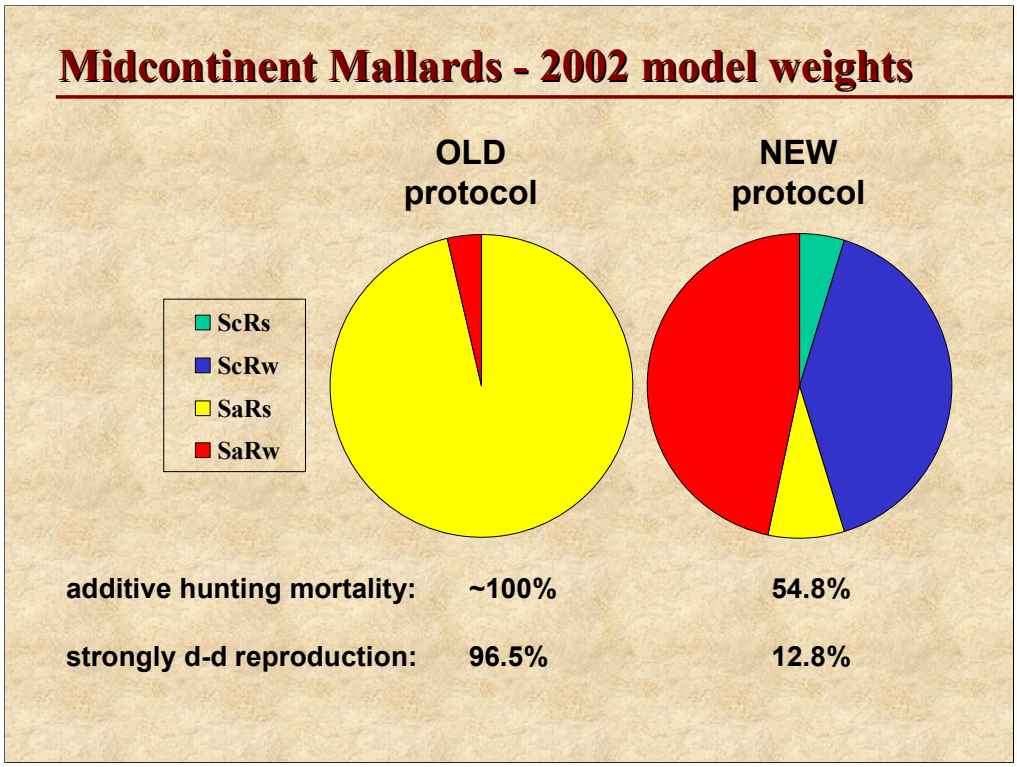
•Optimal regulatory strategies for each of the revised models (Sa = additive mortality, Sc = compensatory mortality, Rs = strongly density-dependent reproduction, and Rw = weakly density-dependent reproduction) were derived based on the current harvest-management objective and on the 2001 regulatory alternatives (without framework-date extensions). The dot in the center of each graph represents the average population size and pond numbers expected over the long term, and the ellipse represents conditions expected in 95% of all years.

•Under the models with compensatory hunting (top), the optimal strategy is to have liberal regulations all the time because at harvest rates achieved under the liberal alternative, harvest has no effect on population size. Under strong d-d reproduction, the population fluctuates within relatively narrow bounds.

•The models with additive mortality (bottom) lead to more conservative regulatory strategies because hunting regulations can have a pronounced effect on population size and, thus, on the ability to maintain the population above the NAWMP goal.



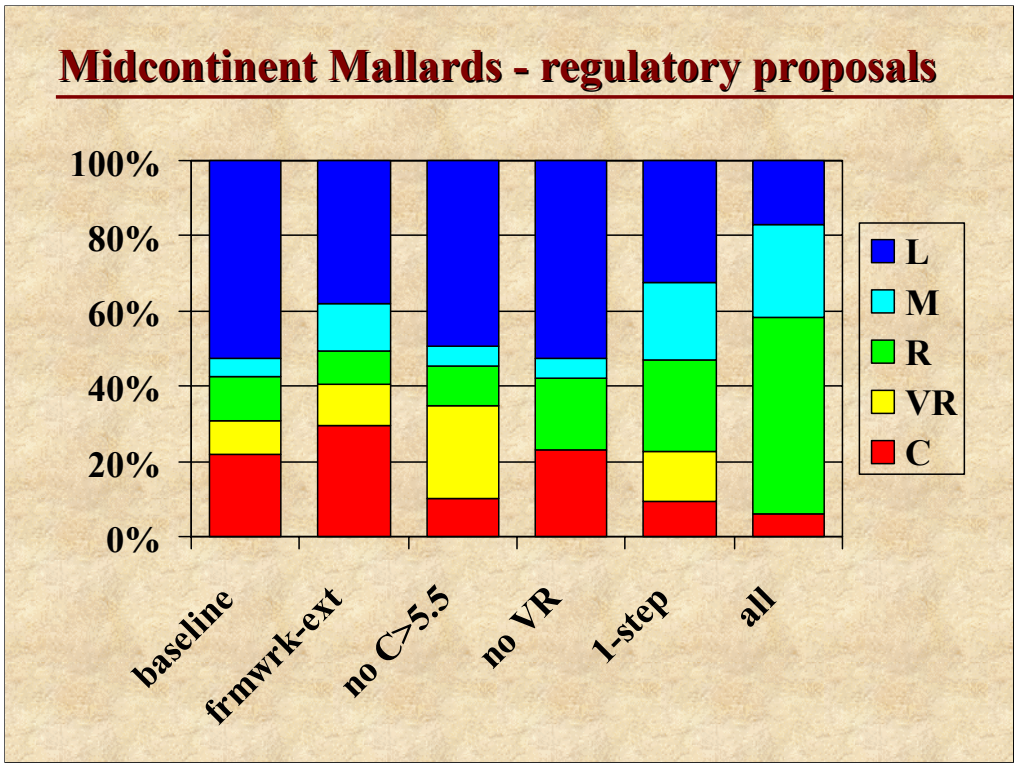
•Based on model weights and regulatory alternatives in 2001 (which vary little from those recently updated for 2002), the revisions lead to a more conservative regulatory strategy overall. And the prediction ellipse now more accurately reflects the expected variation in population sizes. The new models also lead to a more knife-edge strategy, meaning the large changes in regulations can be precipitated by small changes in population size and pond numbers.



•The revisions also have produced different conclusions about the best predictive models. Under the new protocol, model weights suggest much less evidence for the additive hypothesis and for strongly-density dependent reproduction than had been the case under the old protocol.

•Under the old protocol, the model that accumulated the most weight (SaRs) was the one that best compensated for the positive bias in projected growth rates. This self-regulating mechanism helped ensure that regulations in the past were commensurate with with resource status, even in the face of an unrecognized bias. Moreover, we have confirmed that even if the bias correction had been made in 1995, we would still have had liberal regulations every year because population size & pond numbers were so high.

•The old model weights also demonstrate why models sometimes can make accurate predictions for reasons having little to do with the biological hypotheses expressed therein.



•Using the revised protocol, the AHM Working Group examined the various regulatory proposals that were made.

•"Baseline" in this graph represents the expected frequency of regulations under the 2001 model weights.

•Framework-date extensions are expected to reduce the frequency of liberal, and increase the frequency of more restrictive, seasons.

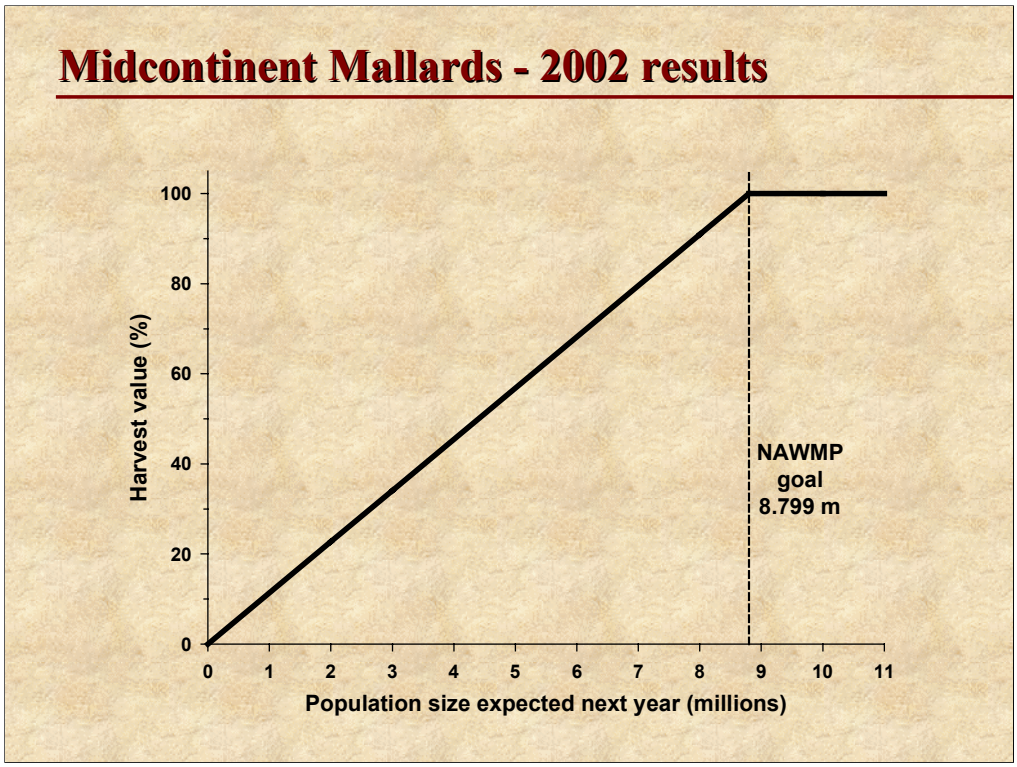
•A constraint on closed seasons above population levels where we've had open seasons in the past (i.e., 5.5 million mallards in traditional area + Lake States) has little effect on expected population size and harvests, but does successfully reduce the risk of closed seasons.

•Elimination of the very restrictive alternative basically results in restrictive seasons for conditions that otherwise would call for very restrictive.

•The "1-step" constraint reflects a desire to move no more than one regulatory alternative between successive years. This constraint dampens the variability in regulations, and effectively increases the frequency of mid-level regulations. It also reduces the frequency of both closed and liberal seasons.

•Implementation of all the proposals would be expected to result in moderate or restrictive regulations in most years.

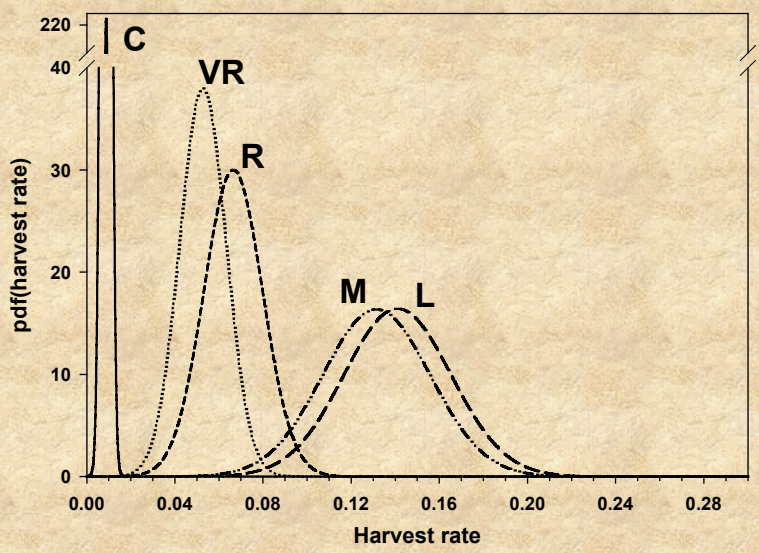
•Only framework-date extensions have been implemented for the 2002 season.



•Before discussing the AHM results for 2002, it is important to remember that the current management objective includes the NAWMP goal. The idea is to maximize harvest, but to devalue the value of that harvest opportunity whenever regulatory decisions are expected to produce a population size next year below the goal.

•The NAWMP goal in the objective has been revised to reflect the goal in the 1998 Update of the NAWMP.

Midcontinent Mallards - harvest rates



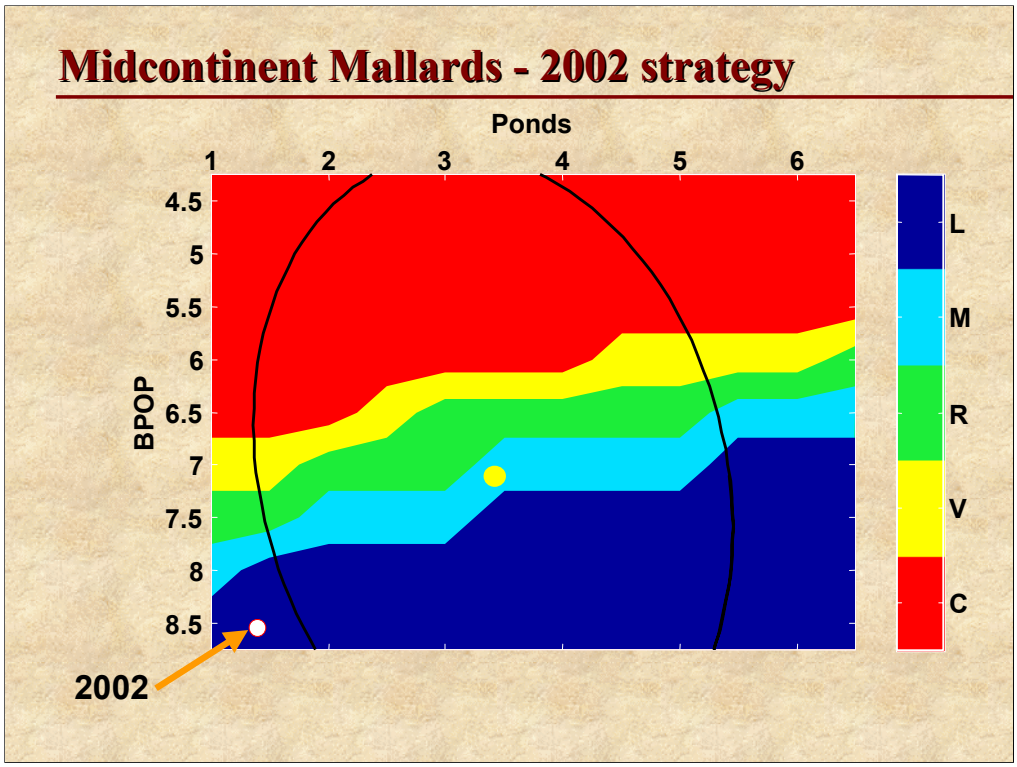
•These are the distributions of expected harvest rates under the 2002 regulatory alternatives in the 3 western Flyways.

•Note that the moderate and liberal alternatives account for a projected increase of 0.02 associated with framework-date extensions. These projections will be revised based on estimates of harvest rate available after the implementation of the extensions.

•Harvest rates under the liberal alternative also were updated to reflect harvest rates observed during the 1998-2001 seasons, based on the results of a small-scale reward banding program.

•Harvest rates under the closed-season alternative reflect those expected if Canada did not also close their season. This is a conservative measure because there currently is no procedure for coordination of regulations between the U.S. and Canada.

•Finally, note how in effect there is really only 3 basic levels of harvest pressure. Small differences in expected harvest rates among some alternatives are in large part responsible for the knife-edge nature of the regulatory strategy.



•The optimal strategy for 2002 in the 3 western Flyways was derived using the 2002 regulatory alternatives, the current management objective, and the revised set of population models. Assuming that model weights were constant, and that future regulations followed this strategy, we would expect the population size to average about 7.1 million (yellow dot). However, we expect considerable variation in population size and pond numbers (ellipse).

•Note that prescriptions for closed seasons represent resource conditions that are insufficient to support one of the open-season alternatives, given the current management objective. Closed seasons under all of these conditions are not necessarily required for long-term resource protection, and merely reflect the constraints of the NAWMP goal and current regulatory alternatives.

•Based on a population size of 8.5 million mallards (traditional surveys + Lake States) and 1.44 million ponds in Canada, the prescribed regulatory choice for the Pacific, Central, and Mississippi Flyways is the liberal alternative.

Eastern Mallards - revisions

Revisions…

- **allowance for possible +16% bias in estimated growth rates**
- **implemented updating procedure for model weights**
- **eliminated use of BBS for indexing population size and predicting R = *f*(bpop)**
- **incorporated alternative hypotheses of reproduction**

•With respect to eastern mallards and the Atlantic Flyway, the AHM Working Group also made some important revisions.

•S & R estimates also appear biased for eastern mallards, although the historic evidence is less conclusive than that for midcontinent mallards. Therefore, we have included both models that correct for and do not correct for the bias to determine which performs better over time.

•For the first time, we have implemented a procedure for empirically updating model weights; in the past, all alternative models were weighted equally.

•We have eliminated the use of the Breeding Bird Survey because of an apparent bias in this index in years in which the northeastern states experience high precipitation. The BBS had been used initially because it provided a longer historical record of population sizes than the current federal and state surveys in eastern Canada and the northeastern U.S.

•We have also incorporated competing hypotheses of strongly and weakly density-dependent reproduction that are equally supported by the historic data. This was deemed necessary because the strength of density dependence in reproduction plays a key role in determining optimal regulatory strategies.

Eastern Mallards - optimal strategies

	Model					
BPOP	BnRw	BnRs	BsRw	BsRs	BrRw	BrRs
0.1	C	C	C	C	C	C
0.2	C	L	C	L	C	VR
0.3	C	L	C	L	C	L
0.4	C	L	C	L	C	L
0.5	C	L	C	L	C	L
0.6	C	L	C	L	C	L
0.7	C	L	C	L	C	L
0.8	C	L	C	L	C	L
0.9	C	L	C	L	C	L
1.0	C	L	VR	L	C	L
1.1	C	L	M	L	VR	L
1.2	R	L	L	L	R	L
1.3	M	L	L	L	L	L
1.4	L	L	L	L	L	L
1.5	L	L	L	L	L	L

•The final model set now includes 6 models:
Bn = no bias correction, Bs = survival rates bias-corrected, Br = reproductive rates bias-corrected
Rw = weakly density-dependent reproduction, Rs = strongly density-dependent

•Based on the 2001 regulatory alternatives, there is variation in variation among models in optimal strategies for population sizes <1.4 million. The models with weakly density-dependent reproduction are much more conservative than those with strong density-dependence.

•All strategies are knife-edged, due to small differences in harvest rates among the regulatory alternatives.

Eastern Mallards - model weights

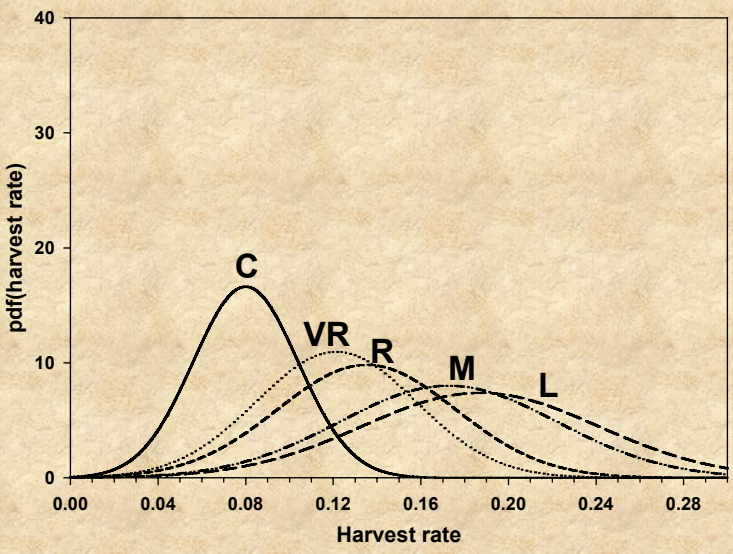
	Model					
Year	BnRw	BnRs	BsRw	BsRs	BrRw	BrRs
1996	0.1667	0.1667	0.1667	0.1667	0.1667	0.1667
1997	0.0565	0.1100	0.2053	0.2129	0.1996	0.2157
1998	0.0775	0.1515	0.1855	0.1897	0.1913	0.2045
1999	0.1257	0.2489	0.1552	0.1344	0.1732	0.1627
2000	0.0297	0.1066	0.2042	0.2068	0.2153	0.2374
2001	0.0553	0.1932	0.1270	0.2303	0.1408	0.2533
2002	0.0585	0.2062	0.1223	0.2190	0.1416	0.2524

•Model weights were calculated based on a comparison of observed and predicted population sizes, assuming equal model weight in 1996 (the last year data was used to develop most model components), and assuming accurate predictions of realized harvest rates.

•The model best predicting observed population size has varied among years; accordingly, there is no single model that is clearly favored over the others at the end of the time frame.

•However, we note that the two models with no bias correction performed poorly compared to the models with a bias correction.

Eastern Mallards - harvest rates



•These are the distributions of expected harvest rates under the 2002 regulatory alternatives.

•Note that the moderate and liberal alternatives account for a projected increase of 0.01 associated with framework-date extensions. These projections will be revised based on estimates of harvest rate available after the implementation of the extensions.

•Harvest rates under the closed-season alternative reflect those expected if Canada did not also close their season. This is a conservative measure because there currently is no procedure for coordination of regulations between the U.S. and Canada. The mean harvest rate associated with the closed season is high compared to that for midcontinent mallards because of the large proportion of eastern mallard harvest that occurs in Canada.

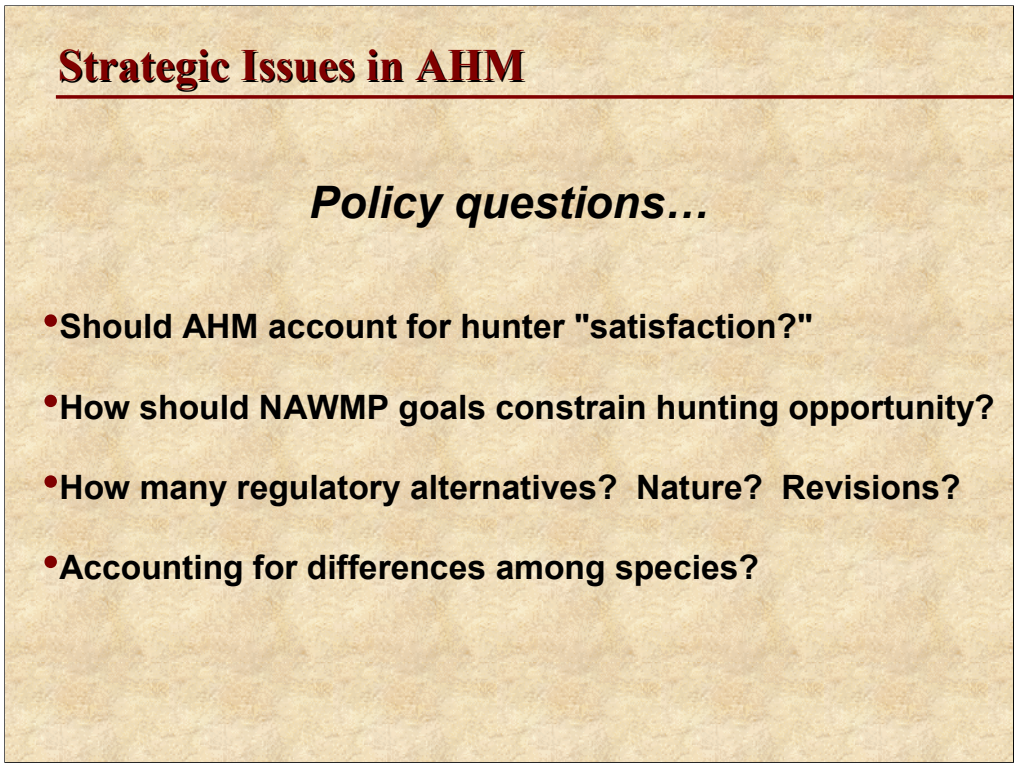
•Finally, note the large degree of overlap in these distributions - this is primarily responsible for the knife-edged nature of the regulatory strategies.

Eastern Mallards - optimal strategies

BPOP	OLD	NEW
<200k	C	C
225k	C	VR
250k	C	R
275k	C	M
300-500k	C	L
500k	R	L
>500	L	L

•This slide depicts a comparison of the optimal strategy under the old set of models (equally weighted) and the new set (based on 2002 model weights). The strategies differ only for population sizes $\leq$500 thousand. The population size has varied from 856 thousand to 1.1 million over the period of record (1990-2002).

•Based on a population size of 1.0 million this year, the prescribed regulation for the Atlantic Flyway in the 2002 season is the liberal alternative.



•The AHM Working Group has begun a strategic discussion about future development and application of AHM. This discussion was motivated in part by the special session on AHM that was held at the 2000 North American Wildlife and Natural Resources Conference. That session offered a retrospective on the development of AHM, and described a number of policy issues affecting future progress. Relevant questions that need to be addressed include:

•Whether AHM should account explicitly for hunter satisfaction and, if so, how would it be measured and monitored? The Wildlife Management Institute has received federal aid to explore this issue and will work closely with the AHM Working Group to help frame the issue.

•NAWMP goals are not needed for the purposes of resource protection because it is implicit in an objective to maximize long-term cumulative harvest. However, there may be other rationale for including NAWMP (or other population) goals. The difficulty is to agree to the extent to which hunting opportunity should be constrained by these goals.

•There continues to be some dissatisfaction with the current regulatory alternatives and a comprehensive review is needed. What should these alternatives look like and how often should they be re-visited?

•Perhaps the greatest challenge will be extending the AHM framework to account explicitly for species other than mallards (more about this in the next slide).

•The USFWS has decided to convene a task force of recognized federal and state leaders in waterfowl management to help address these questions. The task force will need to work closely with the AHM Working Group for technical support. The USFWS Director will announce appointments to the task force at a later date, probably this fall.

•Perhaps the most difficult scale issues facing AHM is the issue of multi-species management. The problem is characterized by the following features:

•Variation in harvest potential among species

•Many species are exposed to a common hunting season (at least in terms of framework dates and season length)

•Little is know about the population dynamics of most species when compared to mallards

•Difficult decisions are necessary about the relative value of different species in the hunter's bag and about how to meet legal obligations to protect all species exposed to a common hunting season

•The USFWS is asking the AHM Working Group to make substantive progress in addressing this issue prior to next year's hunting season

For More Information

AHM website at:
http://migratorybirds.fws.gov

•The website contains background information, annual AHM reports, reports for the AHM Working Group, and relevant news releases and Federal Register documents.