Northern Pintail AHM Revision: Possible Problem Statement, Objectives, and Alternatives

Notes from discussions of the Pacific Flyway Study Committee's
Northern Pintail AHM Working Group
September 25, 2018

Background-

PFC interest in pintail AHM revision since at least 2010, included in HMWG priority work since 2012, FWS too busy with limited staff and other priorities, and other flyways said they were not interested. Pacific Flyway provided leadership in past and is prepared to provide leadership in the revision and begin work now to increase efficiency of larger group when time permits. Here the PF developed a draft problem statement. This will be presented to the HMWG in Dec 2018. The statement may be revised based on input from other flyways and the service at this meeting. The Pacific flyway also wants to coordinate direction and work to be completed. The PF is prepared to continue working on a revised harvest strategy in 2019, but understands some funds from Service region 8 may be available to contract with USGS for support during the revision process. The below problem statement is only the beginning of a larger process to revise the harvest strategy and coordinate efforts with the other flyways and Service.

Problem Statement

Current strategy is unable to determine regulations appropriate to maximize sustainable hunting opportunity consistent with current demographics.

Perceived Problems

Biology

1) Substantial efforts are made to annually band northern pintails, yet these data are not currently being used to inform harvest management decisions.
2) Survival rates have not changed despite especially restrictive hunting regulations beginning in the 1980s. There is substantial uncertainty in the relationship between population, harvest, and mean annual survival rates.
3) Pintail abundance appears stable during May 1985–2017 averaging 2,793,562 birds (SE = 102,524). A 2-pintail daily bag limit has been authorized during 8 of the last 9 years (2009–2017) with a duck season length consistent with current liberal regulatory packages in each flyway, suggesting that regulations of at least 2-pintail daily bag limits with a full duck season length are sustainable given current population dynamics.
4) There is substantial uncertainty associated with the expected harvest and harvest rate of a 3-pintail daily bag limit (or greater bag limits)
   a) There has been only 1 year (1997) with a 3-pintail bag limit since 1966 (53 years)
   b) Bag limits of ≥4 birds occurred before 1988 (≥32 years ago) and were associated with season lengths that are inconsistent with each flyway's current suite of regulatory packages (≤14 days shorter than current liberal packages)

5) Direct harvest rate estimates are low (average 0.035, SE = 0.002 during 1985–2016 for adult males) compared to other large duck species and relative to mallards that currently average about 0.13 (range = 0.11–0.14, during about 1990–2017) for the three mallard stocks.

Demographic Models

6) The baseline model used in the pintail harvest strategy since 1997 lacks adequate power to either 1) predict pintail abundance, or 2) learn about the mechanisms for compensatory harvest mortality. For example; a predictive model where pintail abundance in year $t + 1$ is equal to year t carries greater model weight than the current additive model (0.504 vs. 0.496)
7) The compensatory model does not adequately capture the phenomena/hypothesis of interest by the management community, i.e., harvest is compensatory by various means (e.g., density dependent productivity, density dependent survival, and/or individual heterogeneity. Evaluation of the compensatory hypothesis in the current model is impossible based on:
    a) The compensatory model was added to the harvest strategy's additive model in 2007 to posit an alternative hypotheses about the effect of harvest on population dynamics; model credibility weights are updated annually based on the relative predictive performance of the two models; model weights favor the additive model (58%) and have not changed appreciably over time
    b) Under certain circumstances, the compensatory model predicts harvest has a greater negative impact on subsequent year's abundance than the additive harvest model. For example, predicted pintail abundance is greater with the additive model than the compensatory model 21 of 44 years (0.49) during 1974–2016 (this happens when post-harvest abundance is greater than 4,295,000)
    c) Thus, the current compensatory model can behave as both compensatory and super additive making evaluation of the compensatory harvest hypothesis impossible via changing relative model weights.
8) An alternative compensatory model (phenomenological) has been developed for consideration that posits some harvest is free relative to population abundance (possibly through density dependent reproduction and survival, and/or individual heterogeneity); relative to the current additive model, model weights favor this compensatory model (0.648 vs. 0.352) and would likely have significant implications for the optimal harvest policy/regulations
    a) The alternative compensatory model uses the existing additive model and discounts harvest depending on May abundance (BPOP) via regression model and is constrained such that harvest cannot be greater than observed. The harvest discount model is Discounted_harvest = B_0 + B_1(Observed_harvest) + B_2(Observed_BPOP) + B_3(Observed_BPOP^2), where B_0 is –1868126, B_1 is –0.73534, B_2 is 1.22998, and B_3 is-0.0000000865423
    b) Another alternative compensatory model considered simply discounts observed harvest by multiplying the observed harvest by 0.75431, and this model also carried more weight than the additive model (0.542 vs. 0.458), but had less weight than the regression-based compensatory model presented above.

AHM Learning

9) The method of learning in the current AHM protocol is relative credibility (weights) of 2 competing models and, considering identified model deficiencies/limitations, this learning is of little value in regard to improving protocol performance over time (identifying the model, or balance of models, that is the best overall predictor of changes in population abundance).
    a) A single model with greatest predictive ability would likely provide better harvest strategy performance than the existing two competing models.
10) The current AHM protocol is of little value in regard to purposeful learning about the phenomena or mechanism of compensatory harvest mortality, effects of harvest regulations on demographics, and appropriate regulations and harvest rate to achieve MSY given the model deficiencies/limitations and the limited alternative regulatory packages.
11) Important demographic parameters are not updated annually or on a regular basis. For example, predicted harvest associated with each regulatory alternative is outdated using data from 2003 and earlier (15 or more years old); harvest rates and survival rates are not calculated or considered in the harvest strategy; and implications of harvest on subsequent biological year productivity, survival, and abundance are not directly estimated and updated.

Objectives

12) Flyway councils are not in agreement about relative importance of competing means objectives, regulatory alternatives, and a tradeoff assessment to select among options
13) AHM performance statistics (expected frequency of regulatory packages) have not been realized for the northern pintail AHM protocol (expected closed 16.6%, 1-bird bag 24.8%, and 2-bird bag 58.5%; observed 2010–2018 [n = 9] closed 0%, 1-bird bag 11%, 2-bird bag 89%), or for any other stock, some with over 20 years of implementation experience, yet these statistics were used to drive the decision for an optimization objective function, regulatory alternatives, and closed season constraint
14) The objective function of MSY in the optimization process implies this is the harvest management objective. The policy is actually constrained by the regulatory alternatives (closed or 1 or 2 bird daily bag), models of population dynamics, associated credibility weights and season closure constraint.

AHM in General

15) Current AHM protocols are too complex and demanding on resources (staff time) to process annually, review and revise, and produce annual assessment reports in a timely fashion for distribution and digestion by the management community prior to desired Flyway Council meeting schedules
16) Optimization software currently used by the U.S. Fish and Wildlife Service (Service) is not readily available to the management community to repeat or check assessments or explore alternative options

17) The optimization process used by the Service includes a complex calculation/routine to account for the additional uncertainty associated with establishing hunting regulations 1 year in advance of the regulation-year data, this routine is not understood by most managers or the public, and resulted in communication and credibility challenges as some resultant policies have been counter intuitive to observed current year data

Human Dimensions and Public Communication

18) An increasing number of vocal and politically active waterfowl hunters have expressed dissatisfaction with a 1-bird bag limit after the recent 8 years with a 2-bird bag limit because the necessity for this is not clear (see below) and is suspected to have negative implications for hunter recruitment, retention, reactivation, and satisfaction along with motivation for wetland conservation
19) An increasing number of vocal and politically active waterfowl hunters have expressed concern that a 3-pintail bag limit (or higher) is not an option under the current harvest strategy, as it was under earlier harvest strategies, regardless of pintail abundance.
20) There is a substantial public communication and credibility challenge in setting annually varying (supposedly optimal) hunting regulations in advance of current year abundance and other information when regulations are counter intuitive and inconsistent with earlier strategies and experience when setting regulations with current year data
    a) This has played out for pintail regulations where, for example, a 1-bird bag limit was established for year $t + 1$ and year t data indicated an increase in abundance to levels where at least a 2-bird bag limit would have been appropriate based on previous experience
    b) In another case a 2-bird bag limit was authorized when the same data would have resulted in a 1-bird bag limit under the earlier strategy that used current data, and the population increased in the subsequent year suggesting a 1-bird bag limit was not necessary if it would have been implemented per the earlier strategy (albeit sample size is limited to 1 and there is variance around any system response)
    c) This challenge could become especially acute with substantial public outcry when it involves general duck seasons

Harvest Management Objectives (1997–present)

Fundamental

- Conserve pintail population indefinitely
- Provide harvest opportunity
- Minimize regulatory burden on the public
- Encourage hunter participation
- Provide for other non-consumptive uses

Means

- 6% annual population growth rate (1997–2009)
- Minimize frequency of closed seasons (1997–present)
- Eliminate partial seasons (2010–present)
- Maximize frequency of liberal seasons (1997–present)
- Minimize large changes in regulations (2010–present
- Maintain harvest distribution among flyways at historic levels (PF = 0.55, CF and MF = 0.20 each, and AF = 0.05) (1997–2009). Closed season not considered when the observed breeding population is above 1.5 (1997–2009) or 1.75 (2010–present) million birds

Possible Revised Harvest Management Objectives

Fundamental

- Conserve pintail population in perpetuity
- Actively explore the greatest pintail bag limit during the full duck season that are sustainable and can be maintained during most years
- Minimize hunting regulation burden (annual variation and complexity)
- Maximize understanding of resultant hunting regulations

Means:

- Ensure that harvest rate is about or less than ½ R max
- Actively explore alternative bag limits (including at least 3-bird bag with current season length options) and resultant demographics
- Identify appropriate regulations to maximize long-term hunting opportunity (MSY) consistent with recent past population abundance and dynamics
- Stabilize regulations for a period of at least 3–5 years based on population status during the previous 5–10-year period
- Maintain equal bag limits across flyways when the regular duck season regulatory package is liberal
- Closed season not considered when the observed breeding population is above 1.75 million birds
- Avoid closed seasons

Harvest Strategy Revision Considerations

The objective is to:

1) Develop a harvest strategy that has peer-reviewed acceptance by flyways, easy to understand, process, and communicate.

2) Achieves the fundamental harvest management objectives and learn about regulatory effects on demographic parameters (harvest rate [and/or harvest] and subsequent survival, production, and population size) through an adaptive resource management framework

Focus could be on regulatory effects on harvest rate relative to ½ R max (PBR approach) and production and survival rates, but also consider population size so as to build in adequate safeguards in case harvest, production, and survival rates are too imprecise to effectively detect meaningful change in these parameters with regulatory changes.

Note: details of a proposed strategy are to be developed in cooperation with the Pacific Flyway Study Committee, Council, other flyway technical committees and councils, and the Harvest Management Working Group. This will involve much work and substantial review of what worked and what failed during earlier stabilized regulations and prescriptive/derived harvest strategies, and what has been learned from past regulations and observed population dynamics.

Management Approach

There is little information to evaluate potential for 3-bird bag limits or implications for population demographics. Since about 1988, the harvest management community adopted a conservative regulation/harvest strategy philosophy (1- or 2-bird bag limits) with little risk to the population and little reward in regard to hunting opportunity. After over 30 years, the population has not recovered despite improving wetland conditions and restorations efforts. We still don't know much about effects of harvest on population demographics. It may now be time to take more risk with regard to reducing or limiting population recovery with more reward for hunting opportunity. There is some uncertainty about how best to probe the system for this kind of learning and to limit risk fulfilling trust responsibilities and maintaining credibility with the public.

There are at least 2 alternative approaches depending on the fundamental objectives, for example, "provide hunting opportunity" or "maximize hunting opportunity." For the former, stabilized regulations at full season length and 2-pintail daily bag limit may be appropriate with little apparent risk. For the later, this implies a need to investigate regulations that allow achievement of MSY. There are several alternatives for learning about appropriate regulations for MSY.

Strategy Alternatives (with assumed risk-benefit: low, medium, high)

1. Updated current AHM protocol model parameters (status quo), low
2. Step out of AHM for a short stint with stabilized (3 to 5-year) regulations
   a. Stabilized regulations with 2-bird bag limit unless extreme conditions reached for 1 or closed seasons (to be determined), low
   b. Stabilized regulations with 3-bird bag limit unless extreme conditions reached for 1–2 or closed seasons (to be determined), high
3. Revise current AHM protocol via parameter updates and compensatory model replacement

a. Include at least 3-bird bag option and passive learning, low
b. Include at least 3-bird bag option and active learning, high

4. Develop new adaptive framework with option for at least 3-bird bag limit, medium

The decision about what alternative to pursue and constraints/criteria may be as much a social-political decision as it is biological.

What We Know about Demographics Relative to Regulations

Here is what we can say about relevant (107 day season) regulations and associated demographics after 33 years (1985–2017) of experience:

Attribute	Mean	SE	N	Min	Max
BPOPo (observed)	2,793,562	102,524	33	1,789,710	4,428,650
1-bird authorized	2,875,102	127,158	10	268,140	2,827,785
2-bird authorized	3,356,502	182,517	8	327,138	3,368,212
3-bird authorized	3,557,991	NA	1	380,705	3,017,240
BPOPc (corrected)	3,599,463	88,713	33	2,708,095	4,428,650
1-bird authorized	2,838,870	156,748	10	3,009,726	4,350,839
2-bird authorized	4,048,702	87,293	8	3,678,949	4,428,650
3-bird authorized	3,810,881	NA	1	3,810,881	3,810,881
Continental PF harvest	222,435	13,919	32	116,304	383,660
1-bird authorized	210,648	15,269	9	140,984	276,897
2-bird authorized	286,075	23,606	8	221,448	383,660
3-bird authorized	338,312	NA	1	338,312	338,312
Direct US harvest rate	0.035	0.002	26	0.015	0.051
1-bird authorized	0.036	0.002	5	0.031	0.040
2-bird authorized	0.044	0.002	8	0.034	0.051
3-bird authorized	NA	NA	0	NA	NA
BPOPo 1-year change	11,679	102,542	32	–1,506,284	920,092
1-bird authorized	34,380,	248,413	9	–1,506,284	825,895
2-bird authorized	–41,966	195,632	8	–955,567	920,092
3-bird authorized	–1,037,342	NA	1	–1,037,342	–1,037,342
BPOPc 1-year change	27,326	84,190	32	–1,642,744	836,434
1-bird authorized	16,714	244,165	9	–1,642,744	836,434
2-bird authorized	45,249	112,056	8	–365,520	531,751
3-bird authorized	–585,990	NA	1	–583,990	–583,990
Mean annual survival rate					
1-bird authorized					
2-bird authorized					
3-bird authorized					
Mean annual production					
1-bird authorized					
2-bird authorized					
3-bird authorized					