Black Duck International Harvest Strategy

Proposal

The Black Duck International Management Group (hereafter Management Group) and their technical staff met in Ottawa, Canada, on February 20, 2008 to discuss and negotiate an international harvest strategy for black ducks.

The Management Group is composed of: Wayne MacCallum (Atlantic Flyway Council), Dave Risley (Mississippi Flyway Council), Rick Bennett (USFWS), Bob Blohm (USFWS), Basile van Havre (CWS), and Doug Bliss (CWS). Two provincial representatives could be added in the future.

Technical support staff present at the meeting: Paul Castelli (Atlantic Flyway Technical Section), Paul Padding (USFWS), Mark Koneff (USFWS), Keith McAloney (CWS), and Eric Reed (CWS).

The Management Group will be responsible for making harvest strategy decisions, whereas the existing Black Duck Adaptive Harvest Management Working Group will provide technical advice to the Management Group.

The need for an international harvest strategy:

The Management Group agreed that an international harvest strategy for black ducks is needed. Such a harvest strategy will ultimately be based on an Adaptive Harvest Management (AHM) approach based on breeding ground integrated survey data.

AHM models, based on breeding ground data, are being developed and it is expected that they will be completed by September 30, 2009. However, the harvest management objective and associated constraints of these AHM models must be clearly identified and ideally agreed-to between now and fall of 2008.

Because an AHM strategy, based on breeding ground data, is not expected to be available for the next 2-3 years, the Management Group agreed to develop an interim strategy for the period 2008-09 to 2010-11. The Management Group will review options for an AHM approach or an extension to an interim strategy in June 2010 or sooner if AHM models are available.

Interim strategy:

Goal

The overall goal of the interim strategy is to maintain the population at or above current levels, i.e., the 1998-2007 average of the entire composite survey area (700,300 black ducks). To achieve this goal, Canada and the US will independently determine appropriate regulations that are designed to achieve either no change in harvest or the change required to meet established criteria (see below).

Criteria for regulatory decisions

The Management Group agreed that breeding-ground survey data (from the entire composite survey area) would drive management actions. The 3-year moving average of the total survey area would be compared to the long-term (1998-2007) average (see Appendix for details of the calculations of the 3-year moving average and SE). The Management Group agreed that the decision criteria for regulatory changes would be a 15% difference between the 3-year moving average and the 1998-2007 long-term average. For every regulatory cycle there will be 2 possible tests to determine the appropriate regulatory action: a test for restriction and a test for liberalization. Tests are framed from the negative presumption perspective with a Type I error rate α of 0.10. Details of the tests are given in the appendix.

Change in harvest when regulatory changes are needed

When the decision criteria call for a regulatory change, the required proportional change in harvest will be of the same magnitude as the population-based threshold for determining if a regulatory change is warranted (i.e., 15% change in harvest). Harvest will be estimated from harvest survey data in Canada and the US.

Harvest neutral regulations

When no regulatory changes are required, harvest regulations set in each country will be expected to be harvest-neutral. That is, any harvest regulations changes would be expected to have no significant impact on realized harvest. A harvest-neutral proposal would be one in which the predicted country-specific total harvest of black ducks would fall within the 90% confidence interval of the mean 2002-2006 country-specific total harvest, after detrending (see Appendix for details). The 2002-2006 period was chosen to reflect the most recent levels of black duck harvest.

Allocation of harvest between Canada and the US

The goal of the strategy is to share the harvest equally between countries (50%), but, recognizing incomplete control of harvest through regulations, the strategy will allow realized harvest in either country to vary between 40 and 60%. Parity will be assessed from a running average of country-specific total harvest proportions for the same period length as the harvest-neutral regulations criteria (5 years). If the average proportion of harvest in a country exceeds 60%, the Management Group will make the decision regarding how to proceed. Country-specific harvest proportions will be calculated from harvest surveys using total black duck harvest.

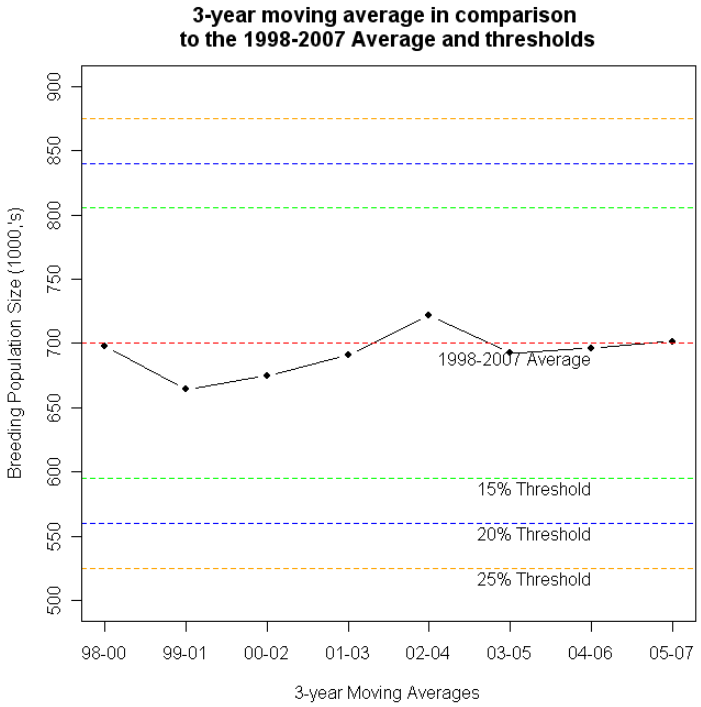
Monitoring programs needed for strategy implementation

Recognizing the importance of maintaining the long-term data sets that support the above harvest strategy, Canada and the US will maintain the following monitoring programs:

a. Harvest surveys (parts-collection and questionnaire)
b. Eastern Waterfowl Breeding Population Survey
c. Pre-season banding.

Appendix: Technical details associated with the development of test criteria, definition of harvest-neutral, and harvest parity

Nathan Zimpfer
April 28, 2008



The overall goal of this proposed strategy is to maintain the black duck population at or above the 1998-2007 mean black duck breeding population estimate over the entire composite eastern survey area (700,300 black ducks).

Canada and the US would independently determine the regulations to maintain current harvest levels (harvest-neutral) or otherwise meet harvest levels set by the decision criteria. If the decision criteria call for a regulatory change, then the proportional change in harvest called for will be same as the population-based threshold for determining if a regulatory change is warranted (e.g., a harvest reduction of 15% if the 3-year moving average fell below the 15% threshold). Harvest will be estimated from harvest survey data in Canada and the US. Harvest allocation among countries is expected to be shared equally (50%); however, recognizing incomplete control of harvest through regulations, harvest proportions in either country may vary between 40 and 60%. Parity will be assessed from country-specific harvest proportions, using a 5-year moving average of the harvest in each country. Should the average harvest proportion of either country exceed 60%, the Black Duck International Management Group will make the decision as to how to proceed.

Population-Based Decision Criteria

The metric for comparison to the 1998-2007 mean black duck breeding population estimate (entire composite eastern survey area) is the most recent 3-year moving average of the entire composite eastern survey area. Three-year moving averages and standard errors were calculated as:

$$\overline{N}_{3yr} = \left(\sum_{t-2}^{t} N_t \right) n^{-1}$$

$$se(\overline{N}_{3yr}) = \frac{\left\{ (n-1)^{-1} \left[\sum_{t-2}^{t} N_t^2 - \frac{\left(\sum_{t-2}^{t} N_t \right)^2}{n} \right] \right\}^{0.5}}{(n-1)^{0.5}}$$

The standard error calculation uses a bias correction of (n-1) for small sample sizes.

For every regulatory cycle there are 2 possible tests to determine the appropriate regulatory action, a test for restriction, and a test for liberalization. Tests are framed from the negative presumption perspective. The general format for the tests is:

$$\frac{N_{3yr} - N_{threshold}}{\sigma(N_{3yr})} < Z_{alpha}$$

where $\overline{N}_{3yr}$ is the current 3-year moving average and $\sigma(\overline{N}_{3yr})$ is the standard error of that estimate, and $N_{threshold}$ is the breeding population size that would trigger a management action. Z_{alpha} is the random normal variable from the standard normal distribution given a specified alpha level.

The test for restrictions would be:

H_0: $\overline{N}_{3yr} <$ threshold for restriction

H_a: $\overline{N}_{3yr} \geq$ threshold for restriction

where the burden of proof is placed on the more liberal (in this case, no change) regulatory scenario. Maintaining current regulations (or harvest-neutral alternatives) would require sufficient evidence to reject H_0. A similar test would be framed for liberalization, again, with the burden of proof on the more liberal regulatory prescription.

For example, given a population change threshold of 15%, and a Type I error rate of 0.05, the test for restriction is:

H_0: $\overline{N}_{3yr} < 595{,}255$

H_a: $\overline{N}_{3yr} \geq 595{,}255$

If $\frac{\overline{N}_{3yr} - 595{,}255}{\sigma(\overline{N}_{3yr})} > 1.644$ then one would reject H_0 and conclude that restrictions are not warranted. The test is identical for other alpha levels except Z_{alpha} would equal 1.28, 1.03, and 0.84 for alpha levels of 0.10, 0.15, and 0.20 respectively.

The test for liberalization at the 15% population change threshold is:

H_0: $\overline{N}_{3yr} \leq 805{,}345$

H_a: $\overline{N}_{3yr} > 805{,}345$

If $\frac{\overline{N}_{3yr} - 805{,}345}{\sigma(\overline{N}_{3yr})} > 1.644$ then one would fail to reject H_0 and conclude that liberalization is not warranted.

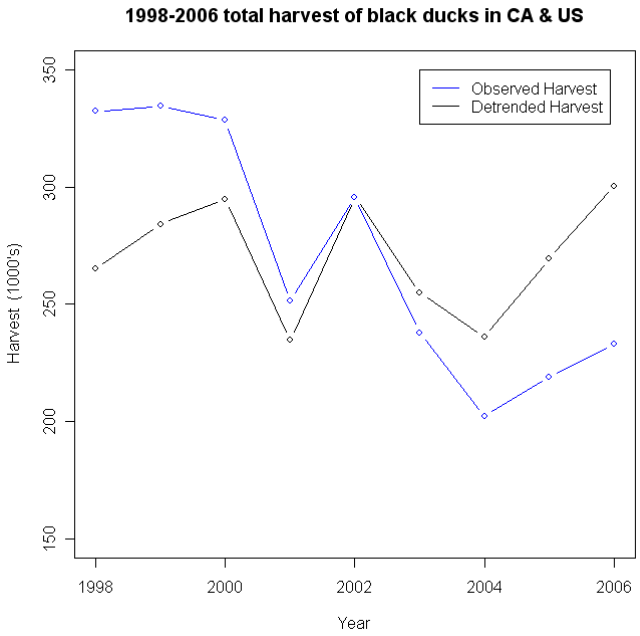
Harvest Assessment – Defining "Harvest-Neutral" and a Retrospective Look at Parity

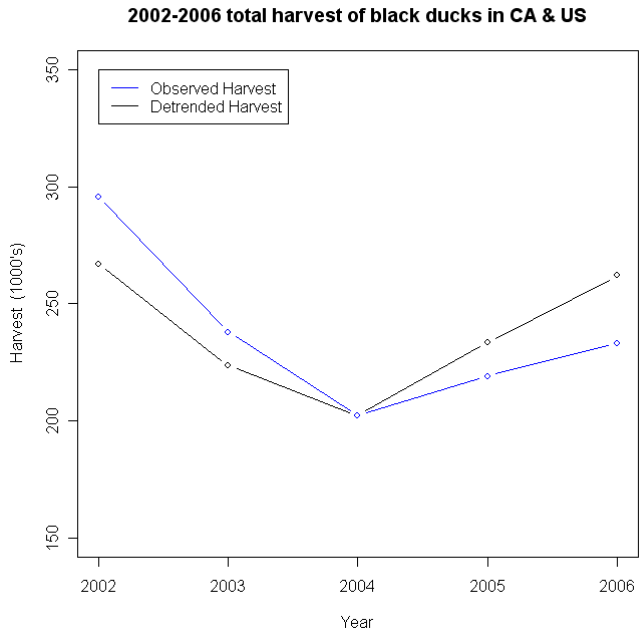
Harvest data were examined on a country-specific basis and on a total basis for the 1998-2006 period, and for only the last 5-year period (2002-2006). In an effort to develop an understanding of the true variation in harvest, I looked at total and country-specific harvests on the observed scale, and after detrending the data. Essentially, detrending is the examination of residual variation in the data after controlling for, in this case, some unknown random time

effect. Note that detrending the data has an effect only on the variance. Also note that all statistics are in thousands of black ducks.

Total Harvest

Using the entire time series of data the mean continental harvest of black ducks is 270.603 (SE = 17.492). Detrending the time series reduces the SE to 8.974. The mean continental harvest of black ducks over the last 5 years has been 237.694 (SE = 15.791). Detrending results in a reduced SE of 13.938. The reduction in variance that results from detrending is dependent upon how well a linear random effect fits the time series. The better the model fit (i.e., higher R^2) the larger the reduction in variance. In this case the linear model with a single random effect had a better fit to the entire time series than to the time series truncated to the last 5 years, given the greater difference between the variance in the observed and detrended data. In this analysis detrending usually results in a larger decrease in the variance when the entire time series is used.

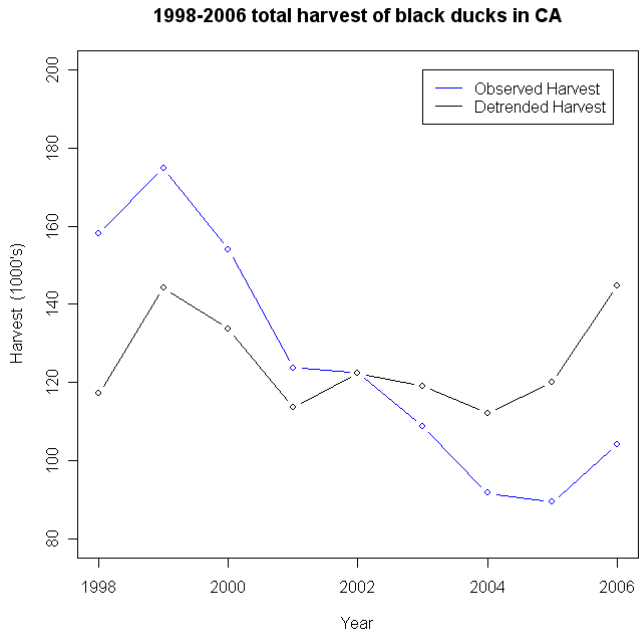


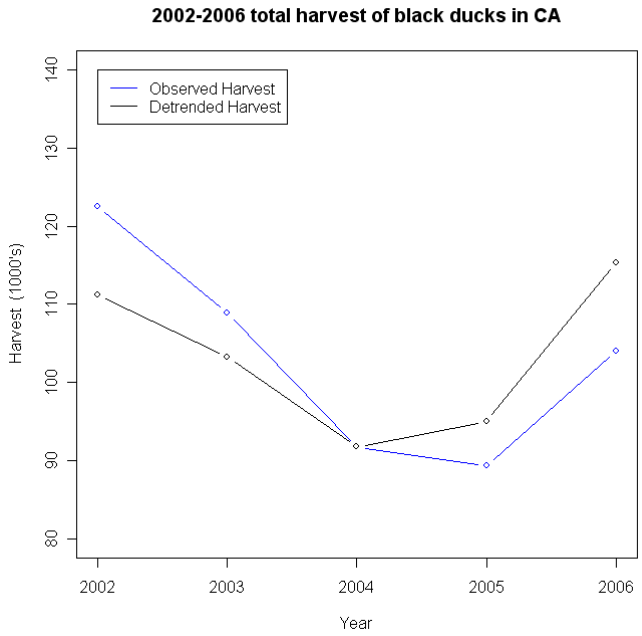


Canadian Harvest

The estimated mean total harvest for black duck provinces in Canada (Ontario and East) for the entire 9-year dataset is 125.256 (SE = 10.209). After detrending the SE is reduced to 4.477, a 56% reduction.

When considering only the last 5 years, the mean harvest estimate is 103.310 (SE = 6.025). After detrending the SE is reduced to 5.216, a 13% reduction.

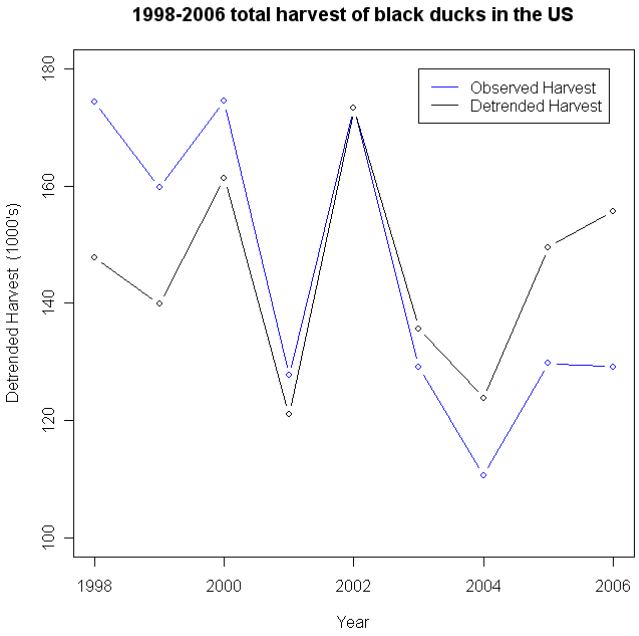


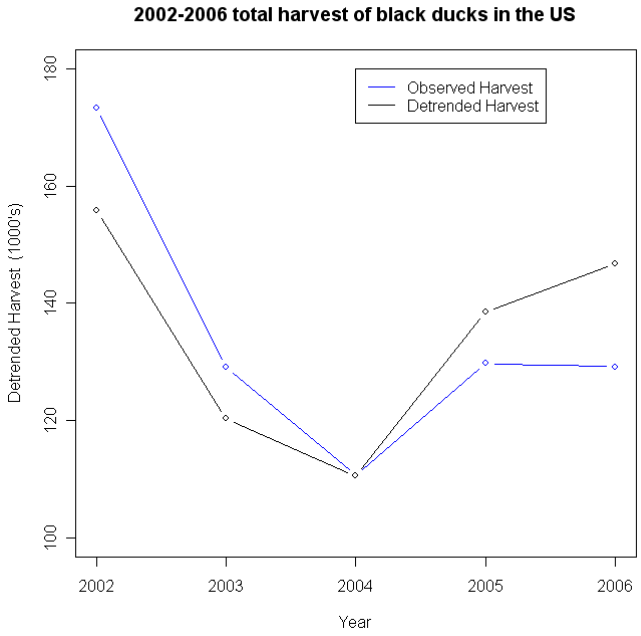


US Harvest

For the purpose of this analysis, the estimated harvest in 1998 uses MQS data and HIP data thereafter. It is assumed that the estimated harvest from the 2 surveys was not different. The mean annual harvest in the US Atlantic and Mississippi Flyways on the observed scale is 145.347 (SE= 8.303), over the 1998-2006 period. The detrended estimate of SE is 6.094, or a reduction of 26%.

If one believes that only the last 5 years are reflective of the harvest of black ducks then the mean harvest estimate is 134.384 (SE = 10.384). After detrending the SE is reduced to 9.625.





Harvest-Neutral Regulations Changes

A harvest-neutral proposal is one in which the predicted country-specific total harvest of black ducks falls within the detrended 90% confidence interval of the mean 5-year (2002-2006) country-specific total harvest. Thus, regulations changes in the US that are predicted to result in an annual US black duck harvest of 125,040-143,728 birds would be considered harvest-neutral changes, as would Canadian regulations changes that are expected to result in an annual harvest of 96,445-110,173 black ducks in Canada.

Mean total harvests for each country over the 2002-2006 period, and the associated 90% confidence intervals after detrending.

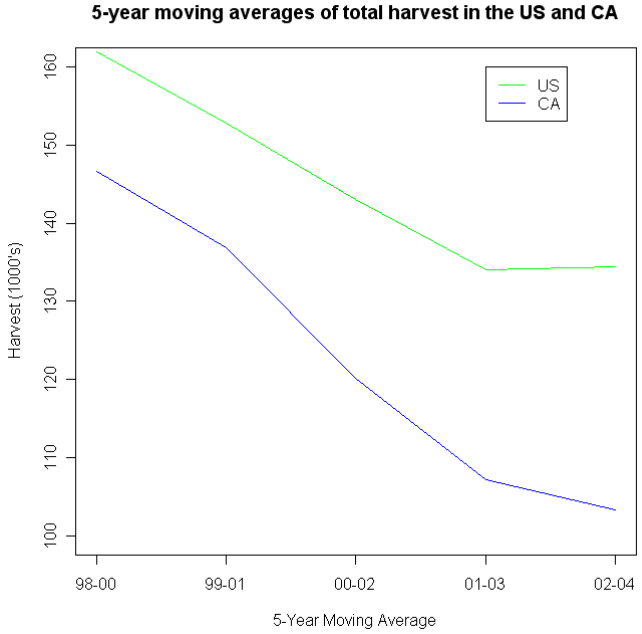
Country	2002-2006 mean	90% CI
United States	134.384	(125.040, 143.728)
Canada	103.310	(96.445, 110.173)

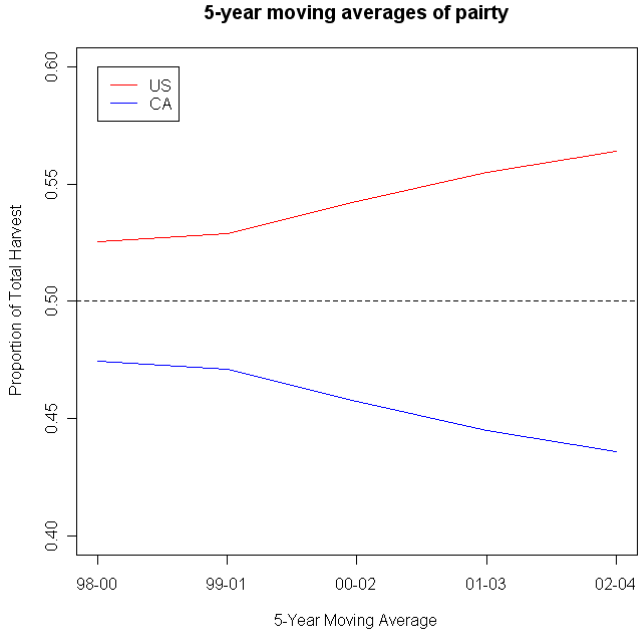
Parity and Harvest Moving Averages

I calculated country-specific 5-year moving averages of the observed harvest data. US moving averages are in green, and Canada averages are in blue. Note the changes in slopes between the US and Canada over time.

The second graph shows proportion of total 5-year average harvest taken by each country. Currently, we fall within the parity rule of 60:40.

5-year period	US proportion	CA proportion
98-02	0.5253	0.4747
99-03	0.5289	0.4711
00-04	0.5428	0.4572
01-05	0.5549	0.4450
02-06	0.5642	0.4358





Historical Performance of the Proposed Strategy

What would previous regulatory decisions have been for a harvest strategy based on a mean breeding population size of 700,300, a population change threshold for regulatory change of 15%, and an alpha level = 0.10? Since the strategy is based on 3-year moving averages, the first year in which a decision could be made is 2000. Using 2000 as an example year:

1. Thresholds for regulatory restrictions based on average ($\overline{N}_{3yr}$) and standard deviation ($\sigma(\overline{N}_{3yr})$) of $\overline{N}$ from years *t*, *t-1*,and *t*-2, and on a Type I error rate $\alpha = 0.10$ are

   H_o: $\overline{N}_{1998-2008} < 595.25$
   H_a: $\overline{N}_{1998-2008} \geq 595.25$

   $$\frac{\overline{N}_{1998-2008} - lth}{\sigma(\overline{N}_{1998-2008})} > 1.282 \qquad \frac{697.9 - 595.25}{27.9178} > 1.282 \qquad 3.677 > 1.282,$$

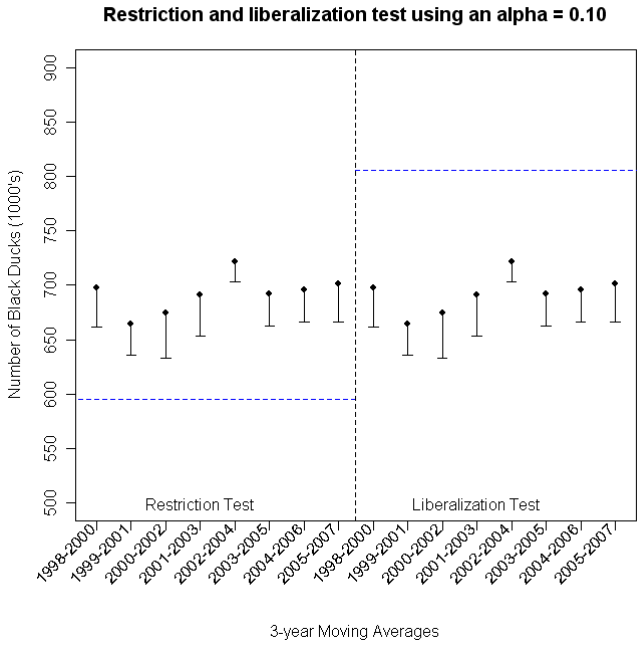
   where *lth* is, in this case, the threshold value for restriction (15% lower than the mean 1998-2007 survey area estimate). The conclusion is to *reject the null hypothesis*; the 3-year moving average is greater than the lower 15% threshold of 595.25, and restrictions are not warranted.

2. Thresholds for regulatory liberalizations based on average ($\overline{N}_{3yr}$) and standard deviation ($\sigma(\overline{N}_{3yr})$) of $\overline{N}$ from years *t, t-1,* and *t*-2, and on a Type I error rate $\alpha = 0.10$ are

   H_o: $\overline{N}_{1998-2008} \leq 805.35$
   H_a: $\overline{N}_{1998-2008} > 805.35$

   $$\frac{\overline{N}_{1998-2008} - lth}{\sigma(\overline{N}_{1998-2008})} > 1.282 \qquad \frac{697.9 - 805.35}{27.9178} > 1.282 \qquad -3.849 > 1.282,$$

   where *lth* is, in this case, the threshold value for liberalization (15% lower than the mean 1998-2007 survey area estimate). The conclusion is to *fail to reject the null hypothesis*; the 3-year moving average is less than the upper 15% threshold of 805.35, and liberalization should not be considered.



Testing if restrictions were warranted over the 2000-2007 period. If the test statistic is less than 1.282 then restrictions were necessary.

Decision year	3-year moving average bpop estimate (1000's)	3-year SE	Test statistic	Outcome of testing if restrictions necessary
2000	697.900	27.918	3.6769	No Change
2001	664.033	21.759	3.1611	No Change
2002	674.933	32.634	2.4417	No Change
2003	691.000	29.159	3.2838	No Change
2004	721.867	14.286	8.8632	No Change
2005	692.533	23.015	4.2270	No Change
2006	696.233	23.403	4.3150	No Change
2007	701.500	27.618	3.8472	No Change

Testing if liberalizations were possible over the 2000-2007 period. If the test statistic is greater than 1.282 then liberalizations were possible.

Decision year	3-year moving average bpop estimate (1000's)	3-year SE	Test statistic	Outcome of testing if liberalizations possible
2000	697.900	27.918	-3.8488	No Change
2001	664.033	21.759	-6.4945	No Change
2002	674.933	32.634	-3.9963	No Change
2003	691.000	29.159	-3.9217	No Change
2004	721.867	14.286	-5.8438	No Change
2005	692.533	23.015	-4.9019	No Change
2006	696.233	23.403	-4.6626	No Change
2007	701.500	27.618	-3.7603	No Change