Report to the Natural Resources Commission

Michigan Black Bears: Indices, Estimates & Models

Thursday 8 March 2012

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Charge:

- Present an overview of ways to monitor populations
- Present an assessment of the bear monitoring techniques currently being employed by the MDNR

What we do isn't rocket science.

It's harder than that.

We are always working with less information than we would like to have.

But, incomplete information is not the same as no information.

How do we monitor populations?

How do we monitor changes in population size?

Cost ↑	Census	Information ↑
	Estimate	
	Index	

Census

A complete count of the number of animals present.

The count is complete so there is no error and therefore no confidence intervals.

Rare for wildlife species – sometimes used for threatened and endangered species or large animals in well defined areas.

Cannot miscount or double count.

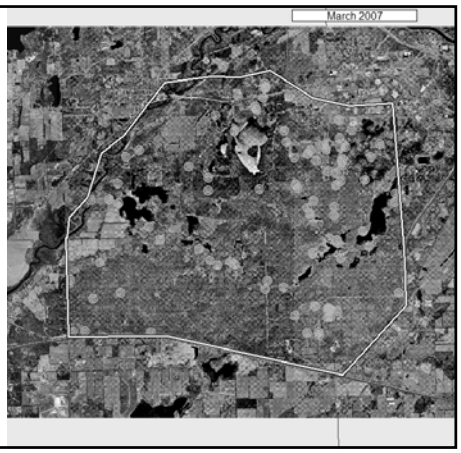
How do you know if you actually counted them all?

Usually time consuming and expensive.

Fort Custer Training Center

About 11 sq miles

87% detection



Estimate / Measure

A statistically/scientifically based determination of a parameter value – such as population size.

Based on a portion (sample) of the entire population.

Only by pure chance will the estimated value exactly match the parameter (the true value for the population).

An estimate has meaning on its own. It does not need to compared to something else.

Usually has a confidence interval associated with it.

Estimate/Measure

Estimating the size of the EUP bear population using mark – recapture based on tetracycline

Estimating the size of the LP bear population using mark – recapture based on genetics

Estimating annual survival rates from radio telemetry

Estimating the size of the WUP moose herd using a sightability model

Indices

Relative comparison

- Provide information about the relative change in a parameter.
- Have meaning only when compared to something else.
- Can tell us if the parameter went up, went down or stayed the same size
- But cannot tell us the magnitude of the change.
- Trend analysis -- can predict future index values, but mostly tells us what has happened.

Indices

Pheasant call counts

Pellet-group counts

Scent-post stations

Bears harvested per day of hunter effort

Deer seen per 30 minutes of spot lighting

What is the point of using an index vs. an estimate?

Problems
- Need at least 2 things for comparisons
- Often have no variance or CI
- Constant conditions required
- Index must reflect what you want it to reflect (not just behavior)

Benefits
- Easier to conduct – cheaper
- Estimate may be impossible to get

How do we predict changes in population size?

We use models

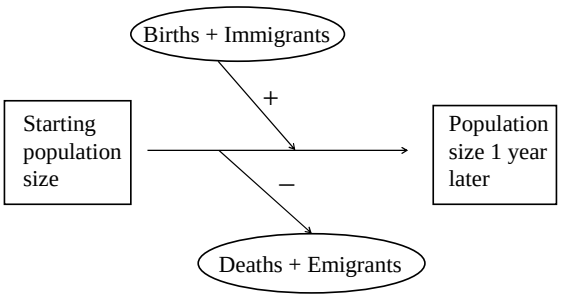
A mathematical representation of the demographic processes exhibited by a population

Or (in other words)

An attempt to look into the future & duplicate nature on the computer

Almost always based on an estimate.

A basic population projection model is pretty simple



Many factors impact how a population grows

Survival rate	Male:Female
Immigration rate	% of females breeding
Emigration rate	Age at first reproduction
Starting population size	Offspring:Female
Density	Sex ratio at birth
Weather	Random chance

Assessment of MDNR's bear monitoring program.

MDNR manages black bear using a variety of methods

- Demographic data are obtained through mandatory check of all harvested bears
- Population size estimates are generated using mark-recapture methods using tetracycline- laced bait in the UP & hair snares in the NLP
- Data on success rates, hunter attitudes, etc. are obtained from hunter surveys
- Population projection models are used to track changes in population size between MRRC estimates
- Movement patterns are monitored using radio telemetry (currently only a few small studies underway)
- Population size is tracked using bait stations (currently generally restricted to Drummond Island)

How I went about it

MDNR Wildlife Division provided

- WUP, EUP NLP harvest, survey & MRRC data files
- Wildlife division reports
- Power Point presentations
- *Michigan Black Bear Management Plan* (6/2009)
- *A Review of Bear Management in Michigan* (10/2008)
- *Recommendations for Bear Management in Michigan* (12/2008)
  - MI Bear Consultation Team

I had access to all the publicly available on-line material

I contacted the following Wildlife Division personnel when I had specific questions about methodologies or when I needed additional materials:

Adam Bump Dwayne Etter Sarah Mayhew Brian Frawley

How I went about it

I examined the methodologies for basic statistical soundness –

- Was there a sufficient sample size?
- Was the sample collected in a manner that would in all likelihood yield a representative sample?
- Were the proper analytical techniques used?
- Were the conclusions consistent with the results of the statistical analyses?

In general I did not check the math.

I did not do a detailed analysis of the MDNR's bear model.

I reviewed the model's inputs, assumptions, logic, formatting & outputs.

I did not do any sensitivity analyses or simulation analyses

Truth in advertising statement:

I consulted with the MDNR on the mark-recapture population size estimation program using tetracycline in the UP

I helped develop, with MSU colleagues and MDNR personnel, the mark-recapture population size estimation program using hair snares in the NLP

Sarah Mayhew, the Wildlife Division's biometrician, received her MS degree under my direction

Adam Bump took my Population Analysis and Management Class

Findings:

Overall –

The methods used by the MDNR to gather data on black bear in MI are sound and appropriate

As are the analyses

Data are gathered from multiple sources

Given the financial and personnel constraints the MRRC estimates are being generated on a reasonable schedule

Findings

MDNR Black Bear Model –

The structure of the model follows accepted modeling practices

Model appears to reasonably reflect the ecology of MI bears

Model is appropriately stratified by WUP, EUP and LP

Model inputs appear to be based on the best available data

Model is appropriately updated with the most recent population size estimate

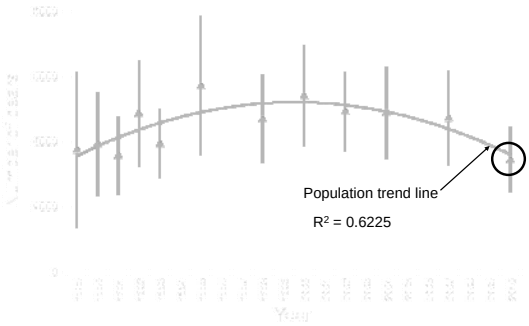
Since it is deterministic, the model projects for an appropriately short period of time

The MDNR's black bear model appears to be sound.

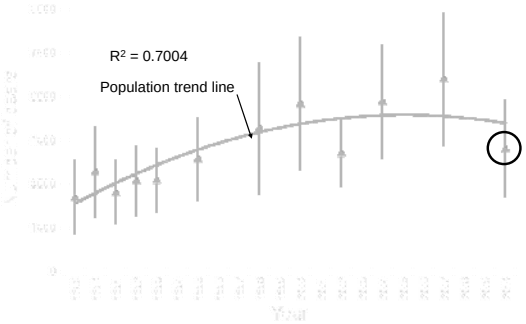
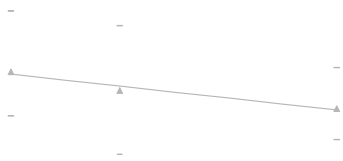
There is no reason to believe that the model predictions are biased.

A thorough analysis of the model and other data gathered on MI black bears needs to be weighed against the cost of such a study.

Yearling and adult bear tetracycline capture-mark-recapture estimates (95% CI) for the Western Upper Peninsula, 1989-2010



Yearling and adult bear tetracycline capture-mark-recapture estimates (95% CI) for the Eastern Upper Peninsula, 1989-2010



Genetic Capture-Mark-Recapture Estimates and 95% CI for the NLP