

Statistical Power of the Alaska MAPS Data

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Statistical Power of the Alaska MAPS Data

MA_S, not MAPS...

Only addressed survival, not productivity

Outline for Today...

1. What do we want to detect
2. What pattern of decline
3. What species
4. Mechanics
5. Results for WIWA
6. Contrasts of 3 species
7. Current Power & Utility of AK MAPS
8. Possible improvements to Power
9. Prognosis for future MAPS style monitoring

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What Do We Want to Detect

Detection Goal



How much decline?

Over how long a time period?

Our Analyses

1) 50% decline over 20 years

2) 50% decline over 10 years

- greater rate of change,
but less data to detect change

What Pattern of Decline?

1) Progressively Declining Survival in 1 Population (Trend)



What Pattern of Decline?

1) Progressively Declining Survival in 1 Population (Trend)



2) Abrupt Change in Survival During Time Series for 1 Population



What Pattern of Decline?

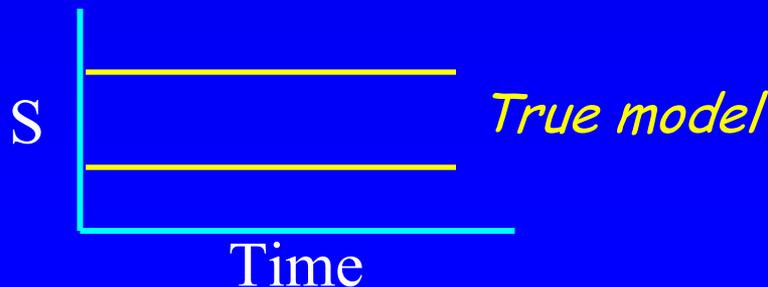
1) Progressively Declining Survival in 1 Population (Trend)



2) Abrupt Change in Survival During Time Series for 1 Population



3) Difference between 2 Populations



What Pattern of Decline?

1) Progressively Declining Survival in 1 Population (Trend)



2) Abrupt Change in Survival During Time Series for 1 Population



3) Difference between 2 Populations



What Species?

HETH



Survival=Phi=0.492
Recapture (M)=p=0.823
Recapture (F)=p=0.575

WIWA



Survival=Phi=0.397
Recapture (M)=p=0.633
Recapture (F)=p=0.295

FOSP



Survival=Phi=0.530
Recapture (M,F)=p=0.564

Transient = Bird never recaptured or only recaptured within 7 days of original banding

What Species?

HETH



Survival=Phi=0.492
Recapture (M)=p=0.823
Recapture (F)=p=0.575

N = 934

Tau = 0.38 (% transient)

WIWA



Survival=Phi=0.397
Recapture (M)=p=0.633
Recapture (F)=p=0.295

N = 3,231

Tau = 0.29 (% transient)

FOSP



Survival=Phi=0.530
Recapture (M,F)=p=0.564

N = 419

Tau = 0.36

Cookbook Mechanics of Power Analysis

Ingredients

$N_{\text{residents}}$

Parameter estimates (S, p) at time zero

True model (pattern)

Time horizon (temporal goal)

Beta = Type II error = prob. accepting null that's not true
= probability of concluding no decline in Survival,
when, in fact, there is a decline in Survival.

Power = $1 - \text{Beta} = 0.8$

Recipe

Generate simulated data, given above 4 ingredients

Fit true model and null model to these data

Examine relative model fits, given Beta

Main Entrée

Cookbook Mechanics of Power Analysis

Ingredients

$N_{\text{residents}}$

Parameter estimates (S, p) at time zero

True model (pattern)

Time horizon (temporal goal)

Beta = Type II error = prob. accepting null that's not true
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$$\text{Power} = 1 - \text{Beta} = 0.8$$

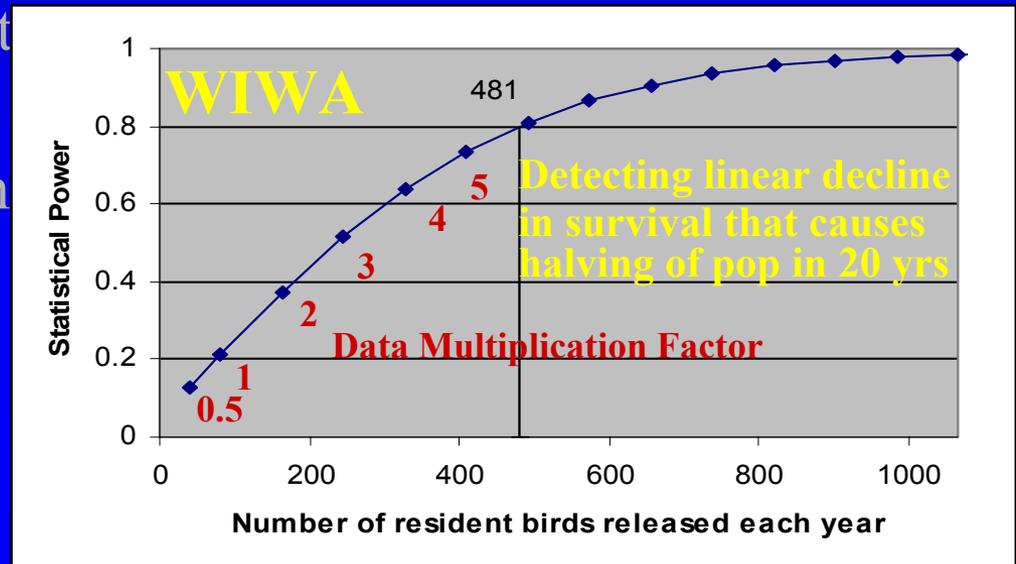
Recipe

Generate

Fit true

Examine

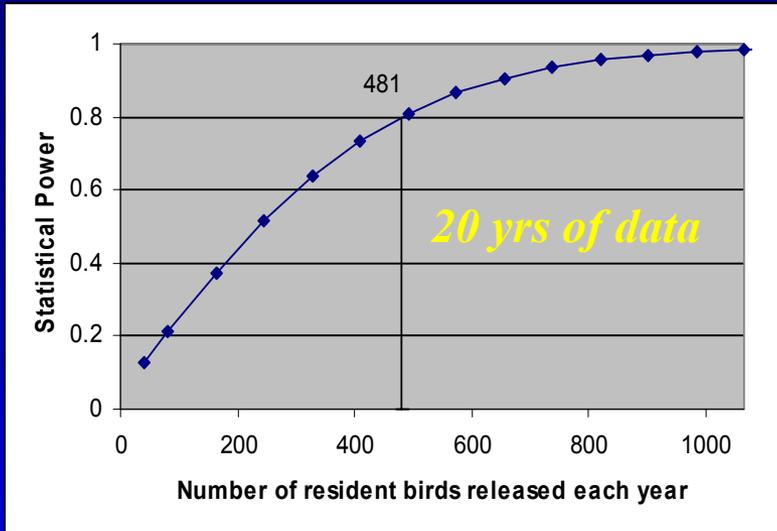
Main Entrée



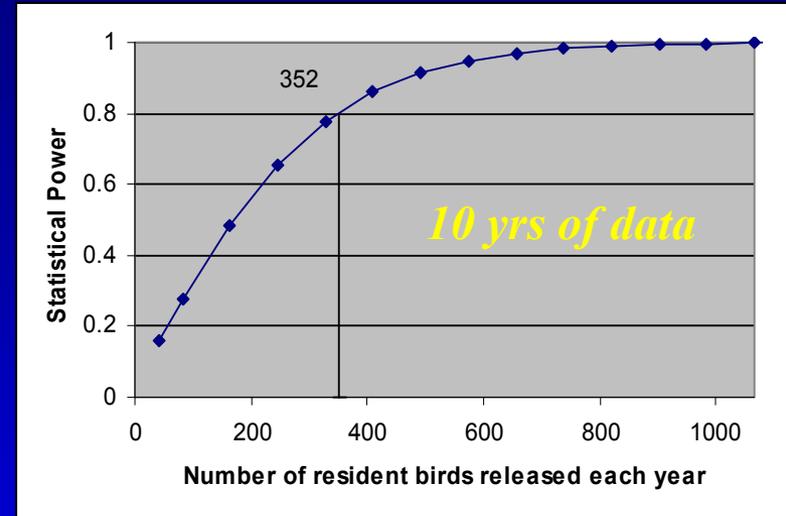
ents

More Results for WIWA

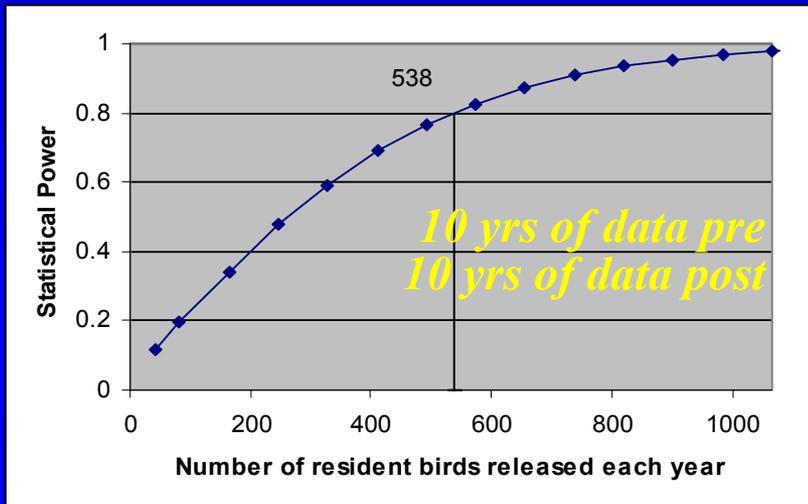
Linear Decline, 50% drop in 20yrs



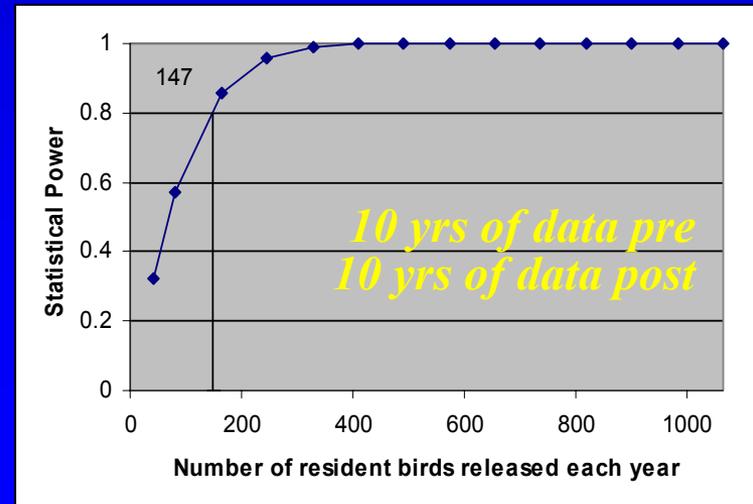
Linear Decline, 50% drop in 10 yrs



One time drop, 50% decline in 20 yrs

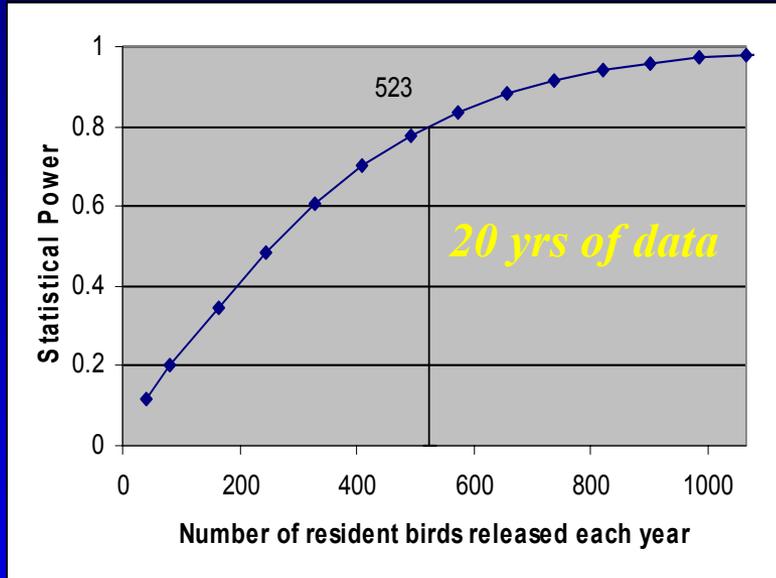


One time drop, 50% decline in 10 yrs

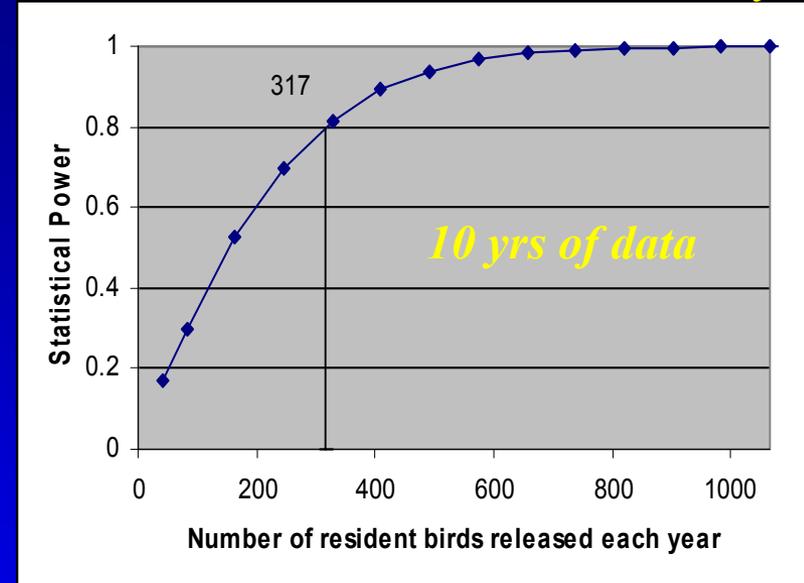


More Results for WIWA

Difference in S, 50% decline in 20 yrs



Difference in S, 50% decline in 10 yrs



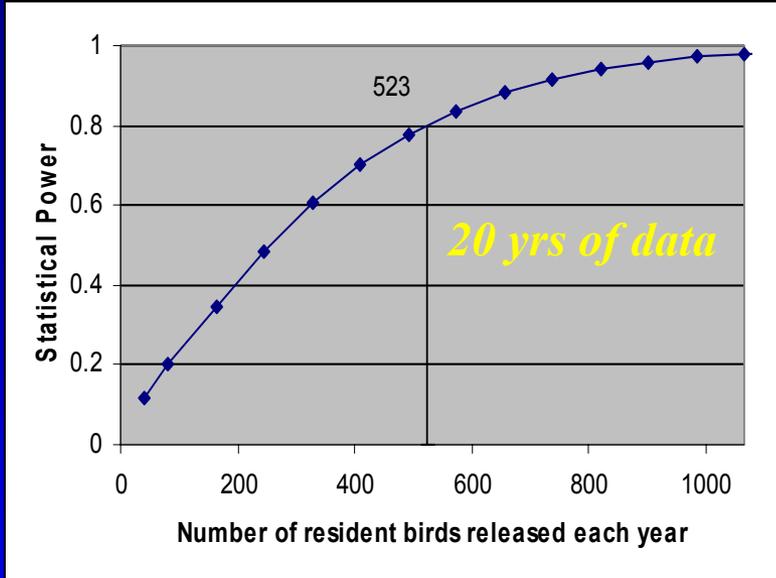
Overall, poor power to detect changes in survival we deemed important
(needed 1.5 to 4.3 times the amount of data we have...)

But, significant survival differences were detected for WIWA !!

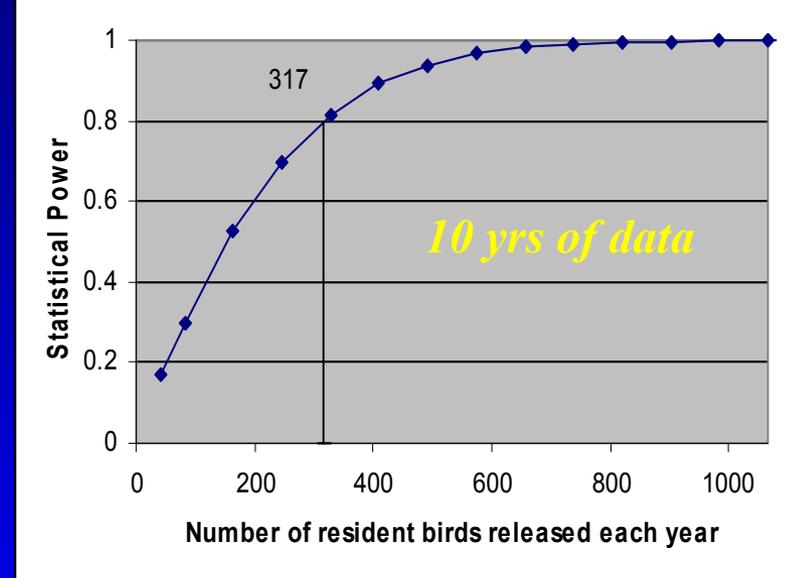
Why?? Bigger survival differences were realized than we simulated.

More Results for WIWA

Difference in S, 50% drop in 20 yrs

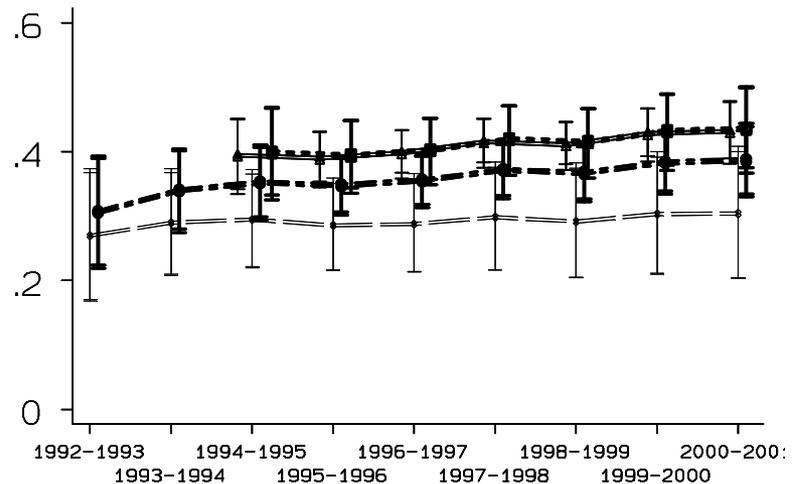


Difference in S, 50% drop in 10 yrs



16.9% difference in S

$\sim 0.386 / 0.289 = 33\%$ difference in S



Contrast the 3 Species

Multiples of Data Sets

50% Decline in 10 Years
Linear Decline One-time Drop

#residents/yr % transients

82

29



WIWA

4.3

1.5

34

38



HETH

5.7

2.3

11

36



FOSP

24.2

8.4

Utility of MAPS in Alaska (w/ current statistical power)

Pros

1. Important contribution to continental database
2. Can detect large changes for some common birds

Cons

1. Cannot detect smaller, but biologically important, changes for most species

Possible Design Amendments to Increase Power

Increase N, p, and/or #Years

1. More Years?? No, contrary to monitoring goals
2. Add more Stations? Unlikely; More total \$ and effort
(increases only N)
3. Sampling changes within a station
(increases both N and p; some “transients” become “residents”)
 - a. Increase # net days
 - b. Increase # net hours/day
 - c. Increase # nets (net density)
 - d. Increase size of station
 - e. Color banding/Resighting

Prognosis for future MAPS style monitoring

The Choices (...undoubtedly, there are others)

- 1. Discontinue MAPS stations.**
Lose "process" information to explain "patterns"
- 2. Maintain MAPS stations with same sampling effort.**
Still lacking ability to detect many changes in "reasonable" time frame
- 3. Maintain MAPS stations with increased sampling effort.**
Ideal; but is there the will and the money.
- 4. Incorporate into other studies**
Efficient and practical; but will it be sustainable enough to be useful.