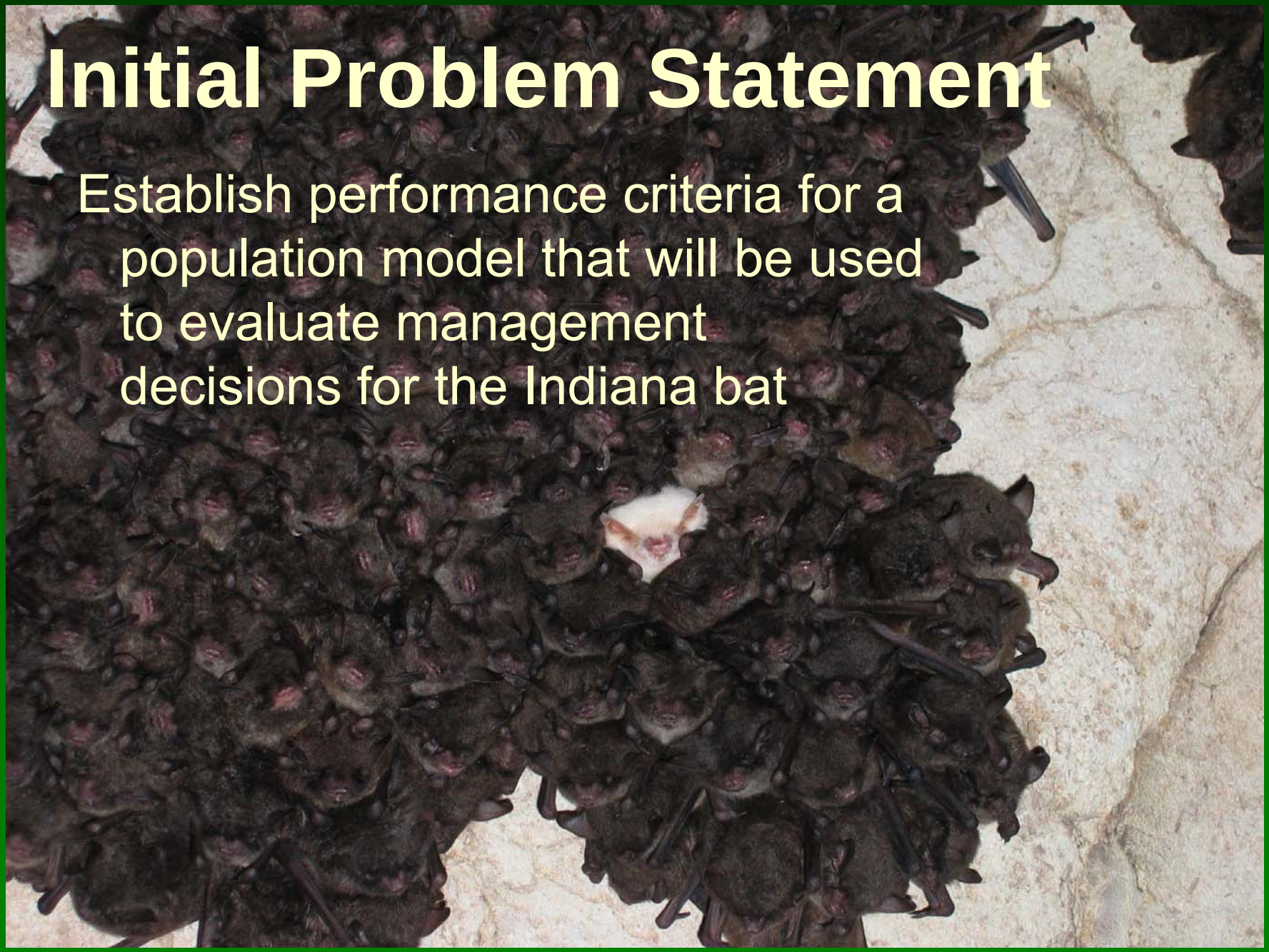
Indiana Bat Structured Decision Making Workshop
December 8-12, 2008

Initial Problem Statement

Establish performance criteria for a population model that will be used to evaluate management decisions for the Indiana bat



Indiana Bat (*Myotis sodalis*)

Status:

- listed under the Endangered Species Preservation Act in 1967
- Currently listed as Endangered under the Endangered Species Act

Recovery Plan:

- 1983 w/revised plan due in 2009

4 Decision Contexts

A. Recovery Planning
B. Section 10(a)(1)(A) Permitting
C. Section 7 Consultation
D. Section 10(a)(1)(B) Incidental Take Permits/Habitat Conservation Plans

Need for a Demographic Model

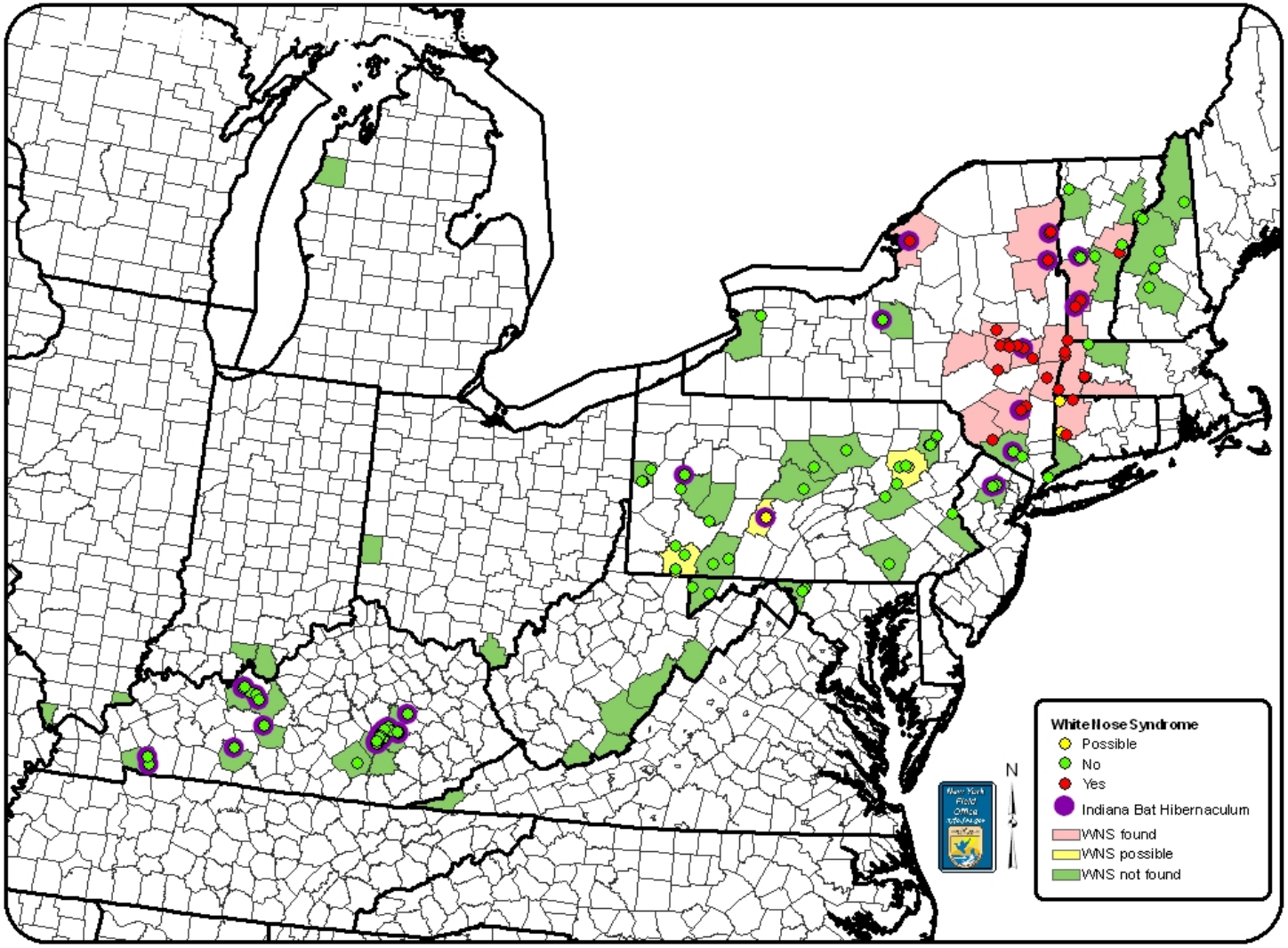
- Currently, no demographic model is available
- Lack of a model is an impediment to decision making
- We need the ability to predict the effects of proposed actions on size, persistence, and distribution of Indiana bat populations – in all decision contexts
- Emergence of WNS has increased the urgency of having a predictive model- and has provided funding

WNS

White-nose Syndrome

- first documented 2007
- unidentified agent causing large-scale mortality of bats in the Northeast
- spreading rapidly
- largest threat to bat conservation in the U.S.

2007-08 Winter Survey Results

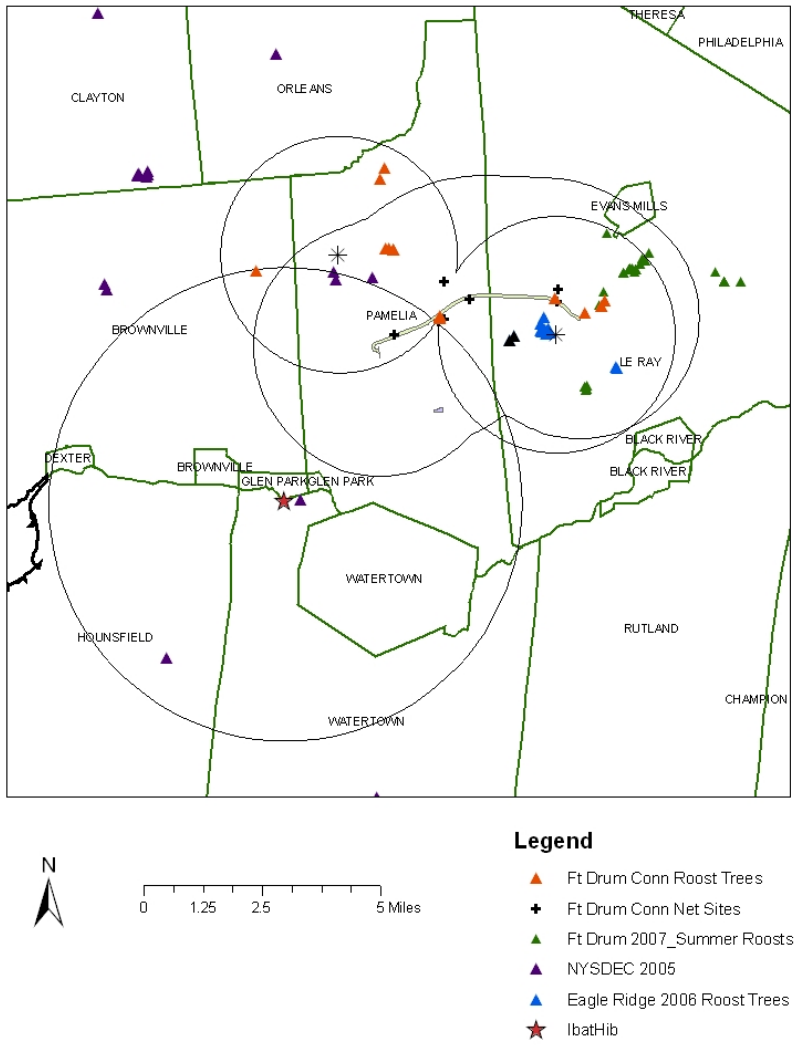


PrOACT Process

- Ran examples for 3 decision-making contexts through alternatives development
- Discovered our fundamental objectives are basically the same for ESA decisions
- Discovered we actually missed a fundamental objective for S7 consultations and don’t fully understand the best surrogates for our “maximizing conservation benefit” objective
- Carried 1 specific example decision through the entire PrOACT process

S7 Example

- New 4-lane highway
- Impacts to 3 maternity colonies
- Foraging habitat limited in the area
- Some stream/wetland impacts
- Some forest impacts
- Trees cut in winter
- Forest preservation
- Hedgerow plantings
- Pre- and post-construction mist-netting and radio-telemetry



Objectives

- Maximize conservation benefit (fundamental)
- Avoid JAM (constraint)
  - Potential metrics for first 2 objectives
    - Probability of extinction [P(x)] by RU, rangewide
    - Change in P(x) compared to baseline
    - Change in time to recovery (what is recovery?)
    - Probability of recovery as a function of time
- Fulfill action agency mission (constraint)
- Minimize impact of take (fundamental)
- Achieve recovery criteria (e.g., protect 80% of important winter sites) (means)
- Minimize adverse effects (means)

Alternatives

- No action
- Proposed action
- Action with conservation measure A
- Action with conservation measure B
- Action with conservation measure C

Consequences

	Δ rec	Min p(x)	Δ p(x)	apprec. ↓ in S/R	AA mission	Take impact	Protect Imp. Hib
No Action				Policy			
Action as proposed	Parametric Model					Colony-level back of envelope modeling	
Action with CM A							
Action with CM B							
Action with CM C							

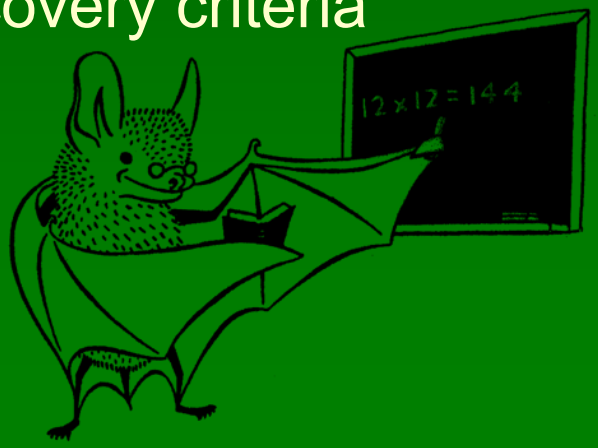
Parametric Model

- Recovery Unit level
- Capable of addressing uncertainty
  - range of parameters (lots of demographic data gaps)
- Capable of incorporating catastrophic events (like WNS)
- Spatial structure- track some hibernacula separately

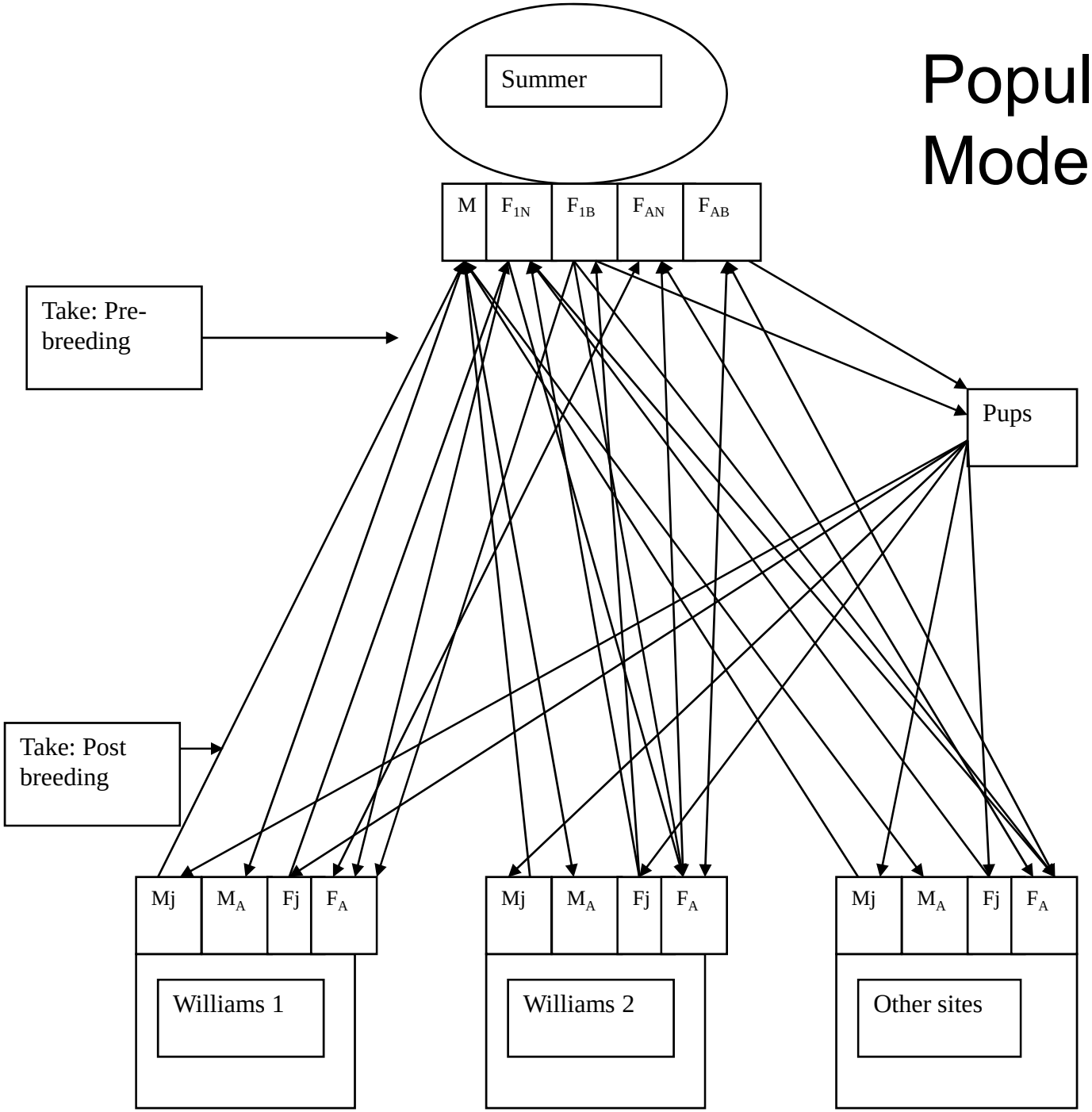
Parametric Model

- Input variables
  - Connection between colony-level changes (+/-) (field biologist calculations) to the recovery unit parametric model
  - Multipliers of parameters (reproduction or survival) or specific amounts of take
- Output variables
  - P(ext) by RU, P(ext) rangewide, P(rec) over time, Δ P(ext), Δ time to recovery, recovery criteria
- Parameters
  - Age and gender specific

  reproduction and survival



Population Model Structure



Tradeoffs

	Δ rec (yr)	Min p(x)	Δ p(x)	apprec. ↓ in S/R	AA mission	Take impact	Protect Imp. Hib
No Action	0	0.27	0	No	No	0	No
Action as proposed	4.5	0.3	0.03	Yes	Yes	50	No
Action with CM A	3.5	0.29	0.02	Yes	Yes	15	No
Action with CM B	0	0.25	-0.02	No	Yes	30	No
Action with CM C	0	0.27	0	No	No	15	No

Tradeoffs

	Δ rec (yr)	Min p(x)	Δ p(x)	apprec. ↓ in S/R	AA mission	Take impact	Protect Imp. Hib
No Action	0	0.27	0	No	No	0	No
Action as proposed	4.5	0.3	0.03	Yes	Yes	50	No
Action with CM A	3.5	0.29	0.02	Yes	Yes	15	No
Action with CM B	0	0.25	-0.02	No	Yes	30	No
Action with CM C	0	0.27	0	No	Yes	15	No

Tradeoffs

	Δ rec (yr)	Min p(x)	Δ p(x)	apprec. ↓ in S/R	AA mission	Take impact	Protect Imp. Hib
No Action	0	0.27	0	No	No	0	No
Action as proposed	4.5	0.3	0.03	Yes	Yes	50	No
Action with CM A	3.5	0.29	0.02	Yes	Yes	15	No
Action with CM B	0	0.25	-0.02	No	Yes	30	No
Action with CM C	0	0.27	0	No	Yes	15	No

But remember……

- Our current problem is that we want to build a model
- What will it look like?
- RFP/SOW
  - Providing a lot of details to modeler (unusual)
    - Input and output variables, structure, parameters
    - Stages of development
  - Other considerations
    - user-friendly
      - training component and user guide
      - format
      - ability to update

Next Steps

- Draft report from workshop
- Develop strategy for outreach/inreach and get model buy-in
- Draft an RFP or SOW
- Issue RFP, select modeling team, and issue contract
- Model development
- Companion FWS guidance development

SDM Haiku

Decisions structured.
Assumptions clearly explained.
Rest easy tonight.

-RAN 12.11.08