Imperial College
Conservation Science

MARINE TURTLE RESEARCH GROUP

Managing social-ecological systems under uncertainty: a multidisciplinary approach

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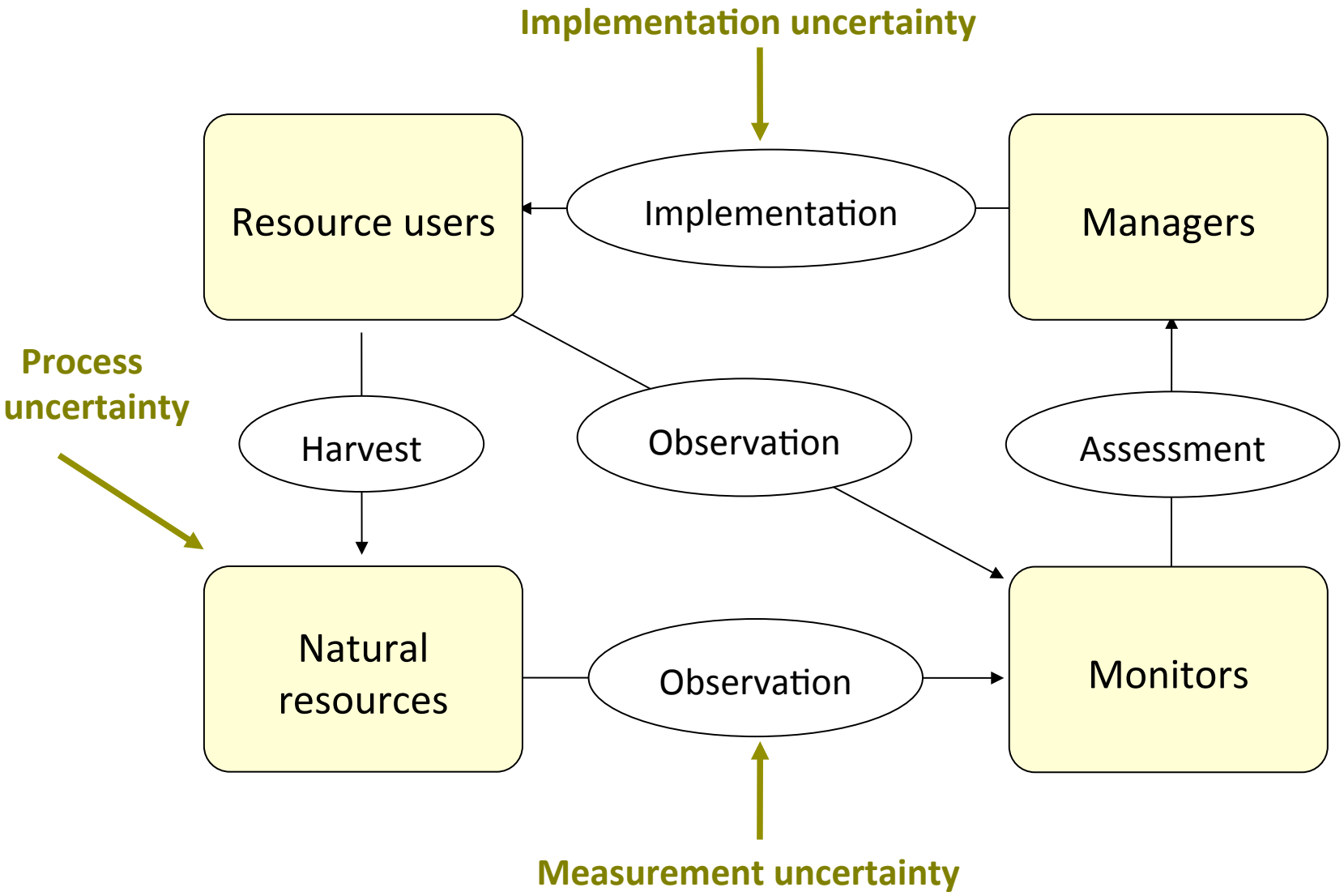
Uncertainty

cartoonsbyjosh.com



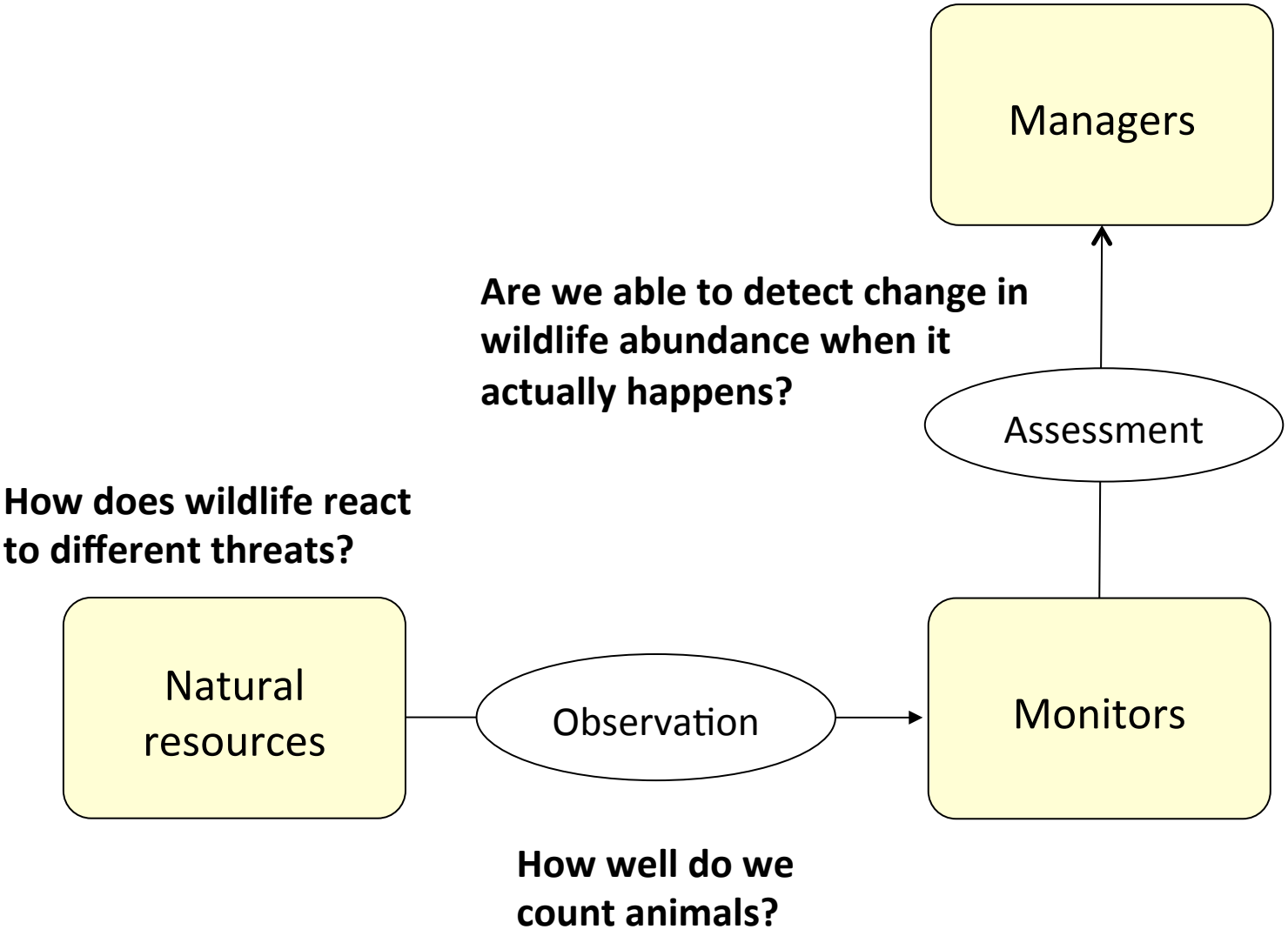
Milner-Gulland et al. (2010) ***Biology Letters***

Study-area: Serengeti, Tanzania

I – Wildlife monitoring under uncertainty

Nuno A, Milner-Gulland EJ, Bunnefeld N. (in press) Detecting abundance trends under uncertainty: the influence of budget, observation error and environmental change. *Animal Conservation*

Nuno A, Bunnefeld N, Milner-Gulland EJ. (2013) Matching observations and reality: using simulation models to improve monitoring under uncertainty in the Serengeti. *Journal of Applied Ecology* 50(2): 488–498.


Managers
Are we able to detect change in wildlife abundance when it actually happens?
Assessment
How does wildlife react to different threats?
Natural resources
Observation
Monitors
How well do we count animals?

Questions

1. How do different monitoring budgets translate into data quality (accuracy and precision)?

2. How are different types of error affected by budgetary, observational and ecological conditions?

Types of error

-**Type I errors (α):** rejecting the null hypothesis when it is true

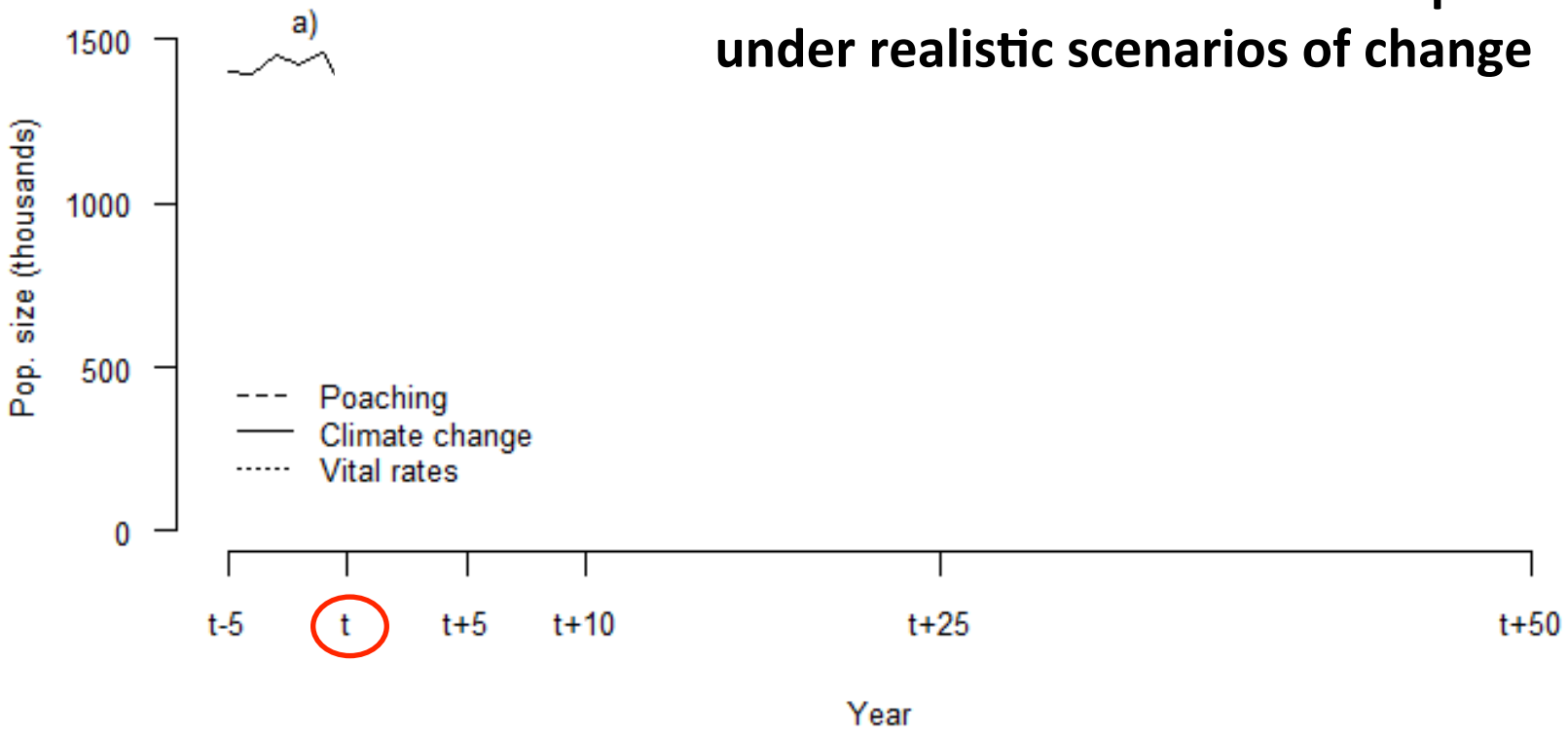
-**Type II errors (β):** failing to detect a difference that is present

- **Shape errors:** misclassifying a trend as linear when it is actually non-linear or vice-versa

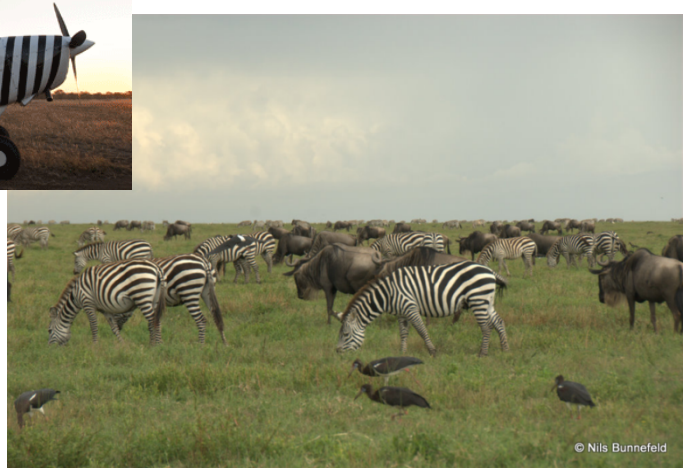
1. Operating biological model

Wildebeest

“True” abundance of different species under realistic scenarios of change



2. Observation model

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ARKive
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Types of factors

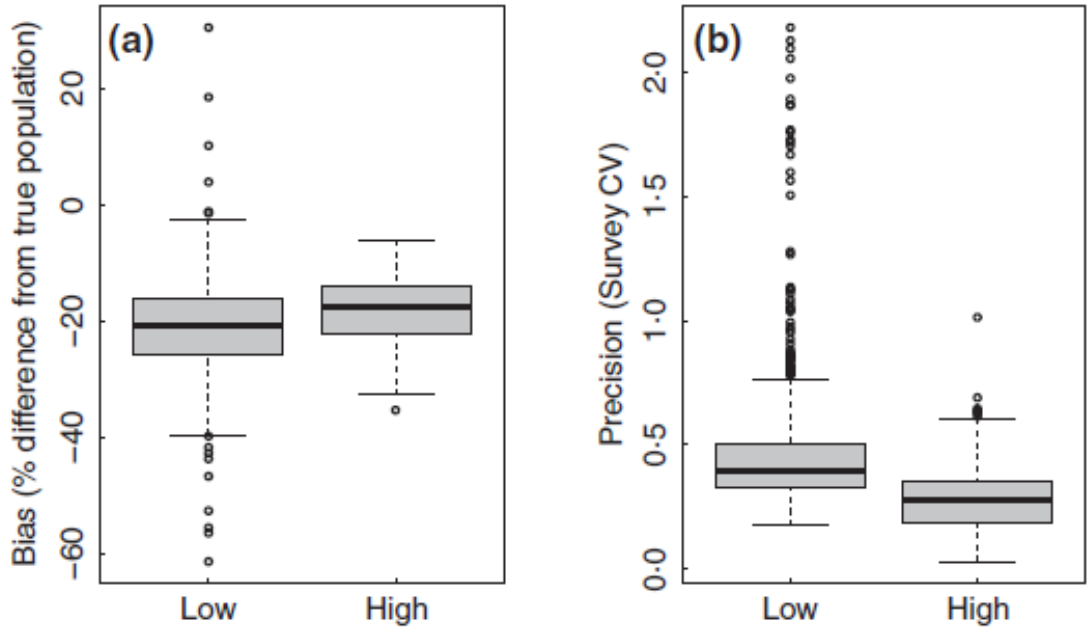
Wildebeest monitoring:

Population characteristics	Population size Proportion of juveniles (%) Aggregation Spatial autocorrelation
Sampling characteristics	Distance between transects (km) Time between photos (seconds)
Flight characteristics	Mean flight altitude (m) CV (coefficient of variation) error altitude Mean flight speed (km/sec) CV (coefficient of variation) error speed
Observer effects	Minimum error counting juveniles (%) Number of animals in a photo for which 50% juveniles are missed Mean error counting adults (%) CV (coefficient of variation) error counting adults

Results: monitoring wildebeest

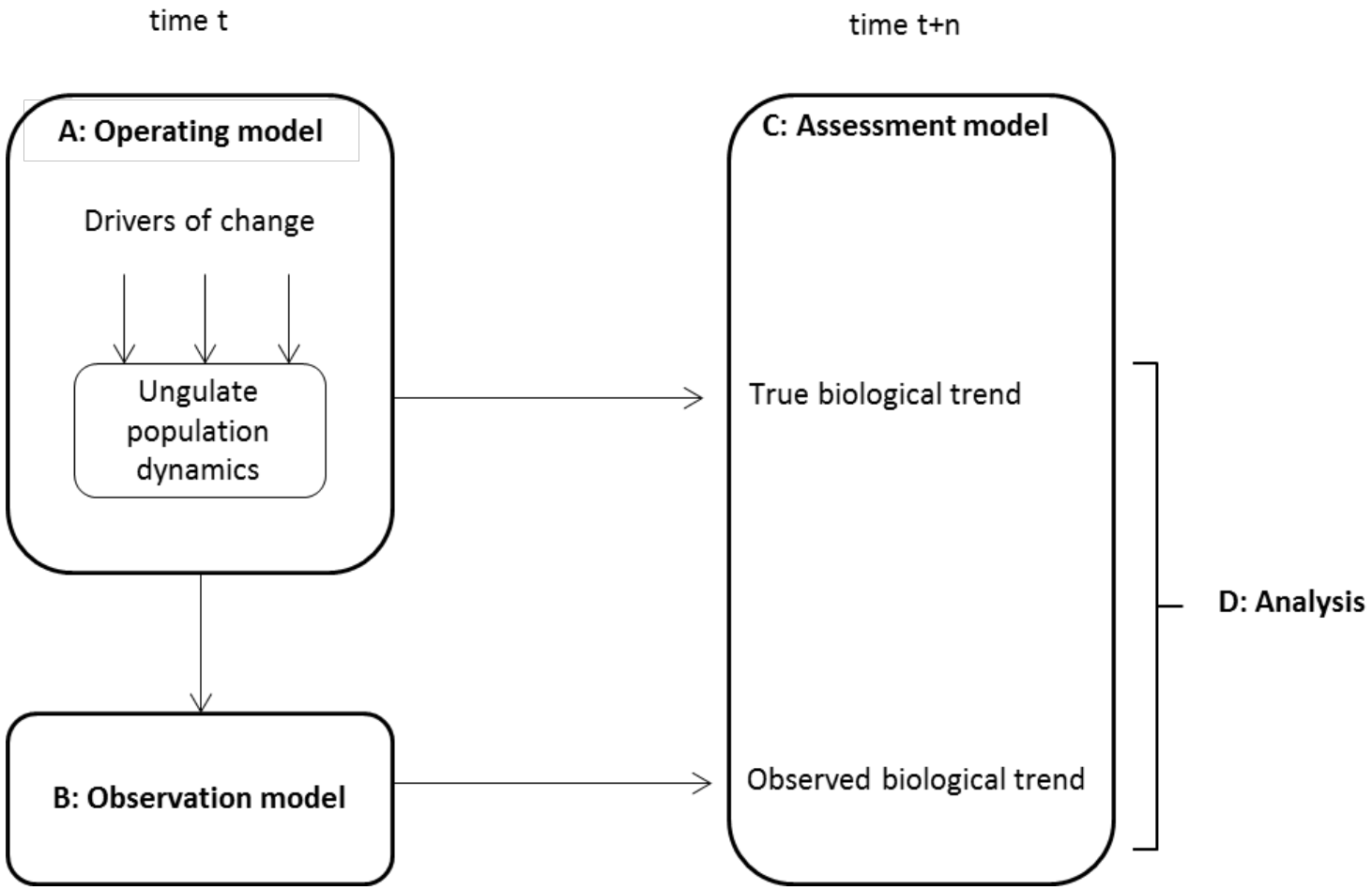
The likely effect of budget on data quality

"Observed" abundance of different species under realistic scenarios of change



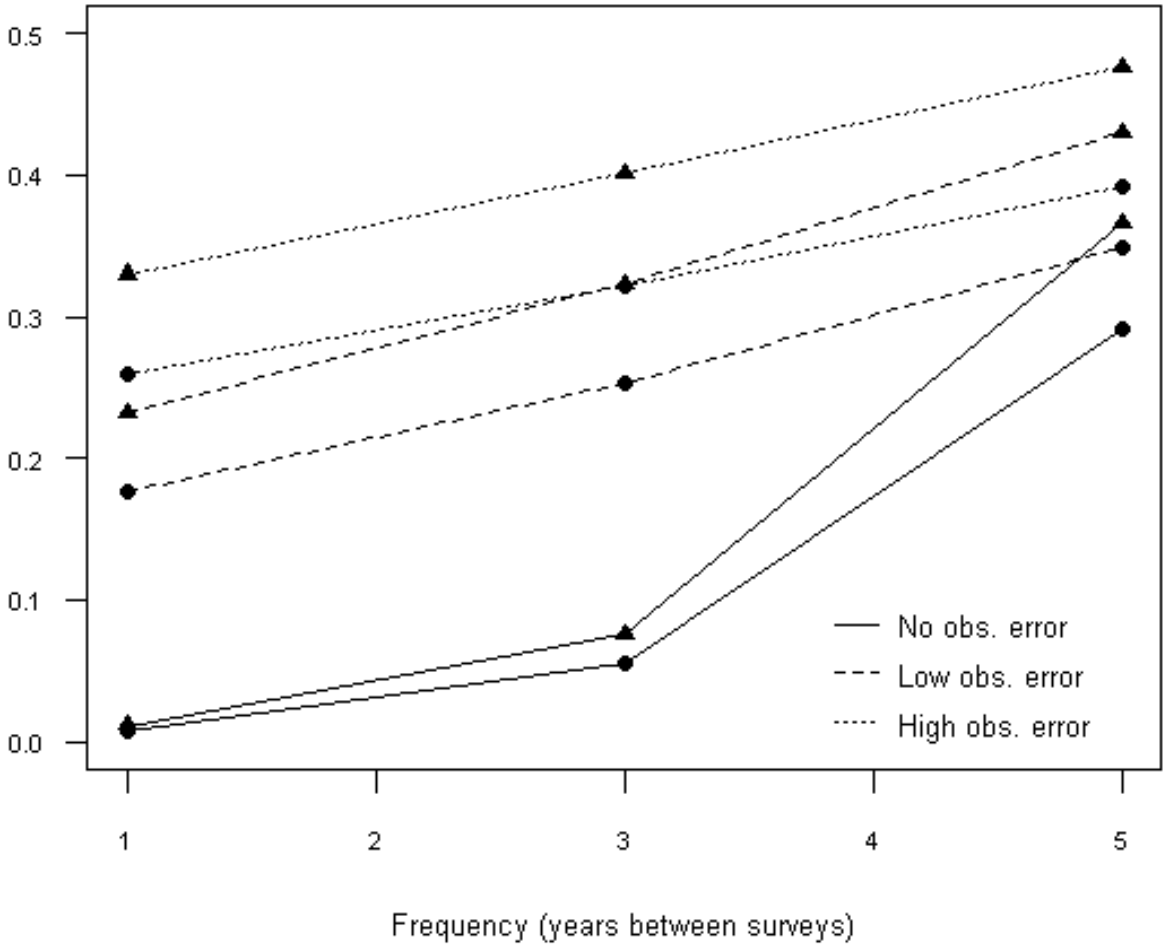
Nuno, Bunnefeld & Milner-Gulland (2013) ***Journal of Applied Ecology***

3. Assessment model & Analysis



Results

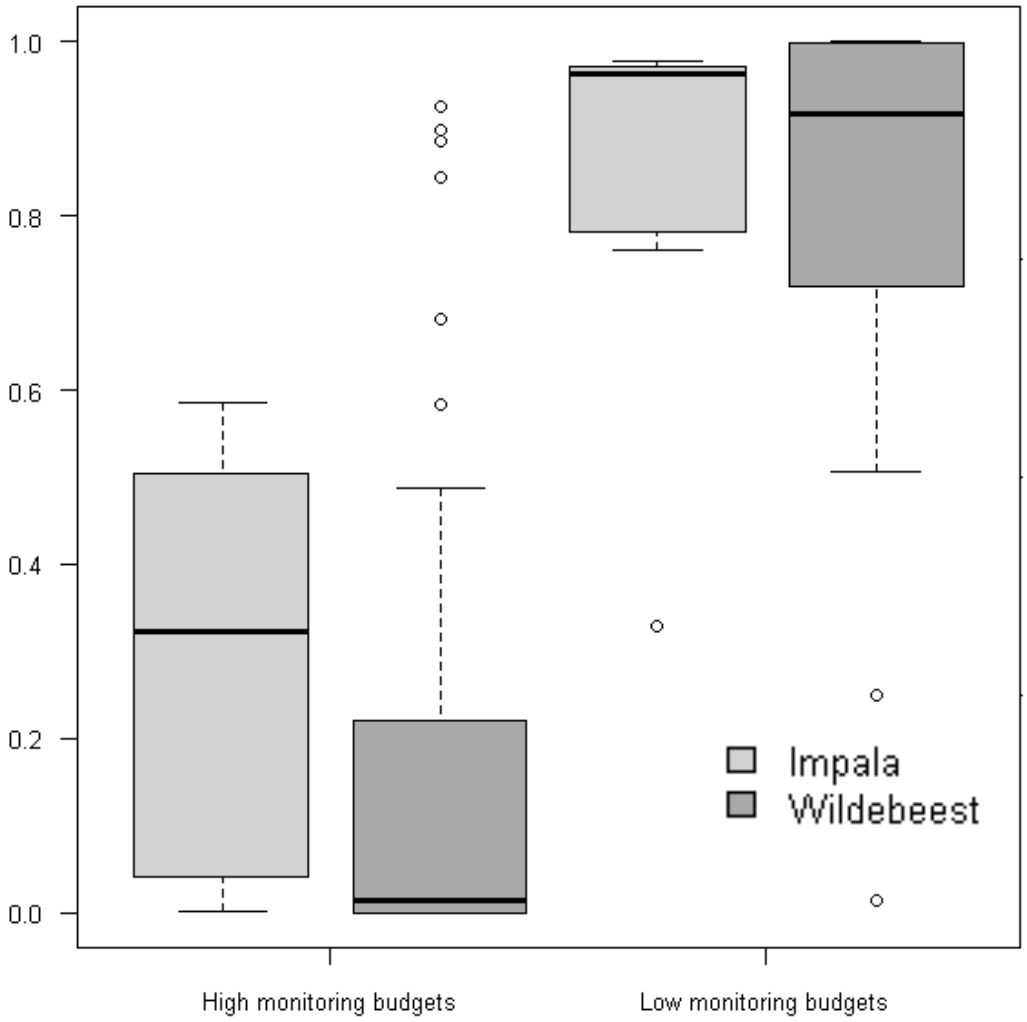
Type II error



▲Impala
● Wildebeest

Results

Type II error



Key messages

- To make robust management decisions, we should account for multiple types and sources of uncertainty

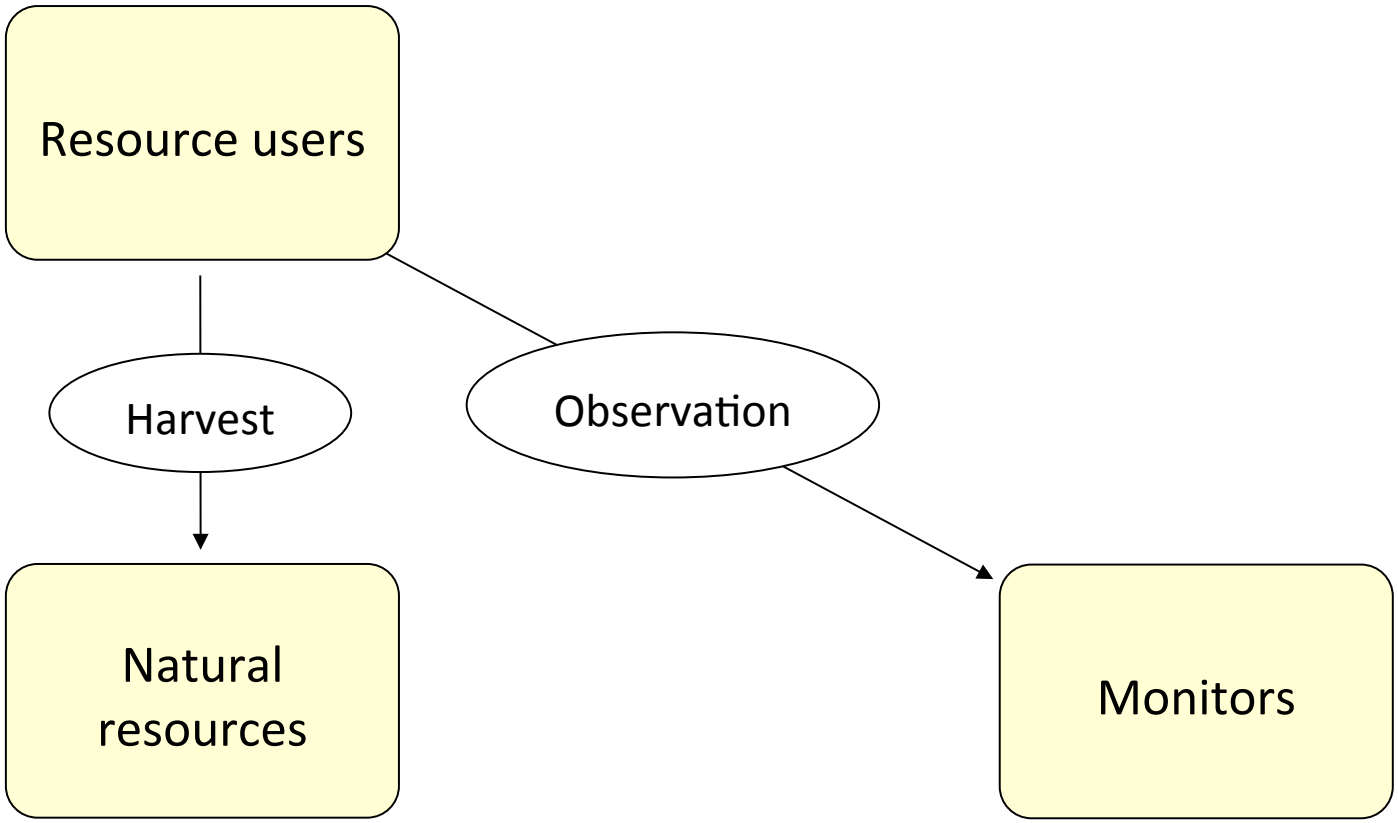
- Need to integrate ecological modelling, threat scenarios and costs into decision-theoretic approaches to NRM and conservation

- Our uncertainty mitigation efforts must be focused on the kinds of information which are most valuable

II – Assessing "sensitive" resource use

Nuno A, St John F. (in press) How to ask sensitive questions in conservation: A review of specialised questioning techniques. *Biological Conservation*.

Nuno A, Bunnefeld N, Naiman L, Milner-Gulland EJ. (2013) A novel approach to assessing the prevalence and drivers of illegal bushmeat hunting in the Serengeti. *Conservation Biology,* 27(6): 1355-1365.


Resource users
Harvest
Observation
Natural resources
Monitors

Illegal bushmeat hunting

Illegal hunting in the Serengeti

How many?
8 to 57% hhs

Who poaches?
Ethnic group
Household size
Household migration
Household employment
Season
Hunting as source of cash

District
Distance from village to protected areas
Access to alternative sources of protein and/or income

Examples

"715 individuals were asked if they were involved in hunting. Many [84%] chose not to answer" (Campbell et al. 2001)

"deep reluctance among the respondents to talk about bushmeat hunting" (Nyahongo et al. 2009)

"collected data needs to be treated cautiously, because we may have been lacking important information due to fear from respondents" (Mfunda & Røskaft 2010)

How to estimate illegal resource use?

- Law-enforcement records
- Indirect observation
- Forensics
- Direct observation
- Self-reporting
- Direct questioning
- RRT
- Modelling

Gavin et al. (2010) *Cons. Bio.*

Specialized questioning techniques

- nominative technique
- randomized response technique
- crosswise, triangular, diagonal and hidden sensitivity models
- bean method
- grouped answer method
- surveys with negative questions

Nuno & St John (in press) ***Biological Conservation***

Unmatched-count technique

Treatment

Card 1

Livestock herding 

Farming 

Trading 

Hunting 

Teaching 

Control

Card 2

Livestock herding 

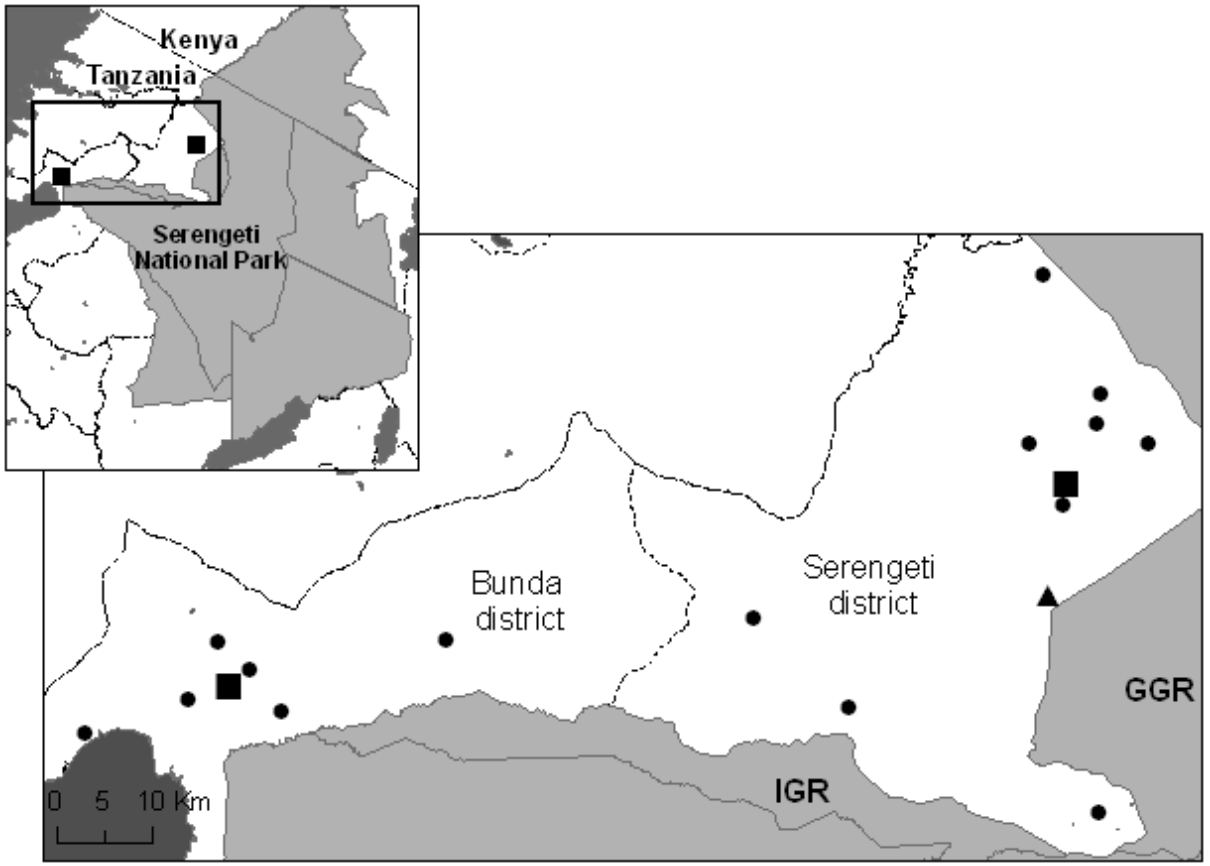
Farming 

Trading 

Teaching 

Dalton et al. (1994) *Person. Psychol.*

Main data collection



15 villages, Western Serengeti
1192 household interviews

Questionnaires

A. Individual characteristics

B. Household characteristics

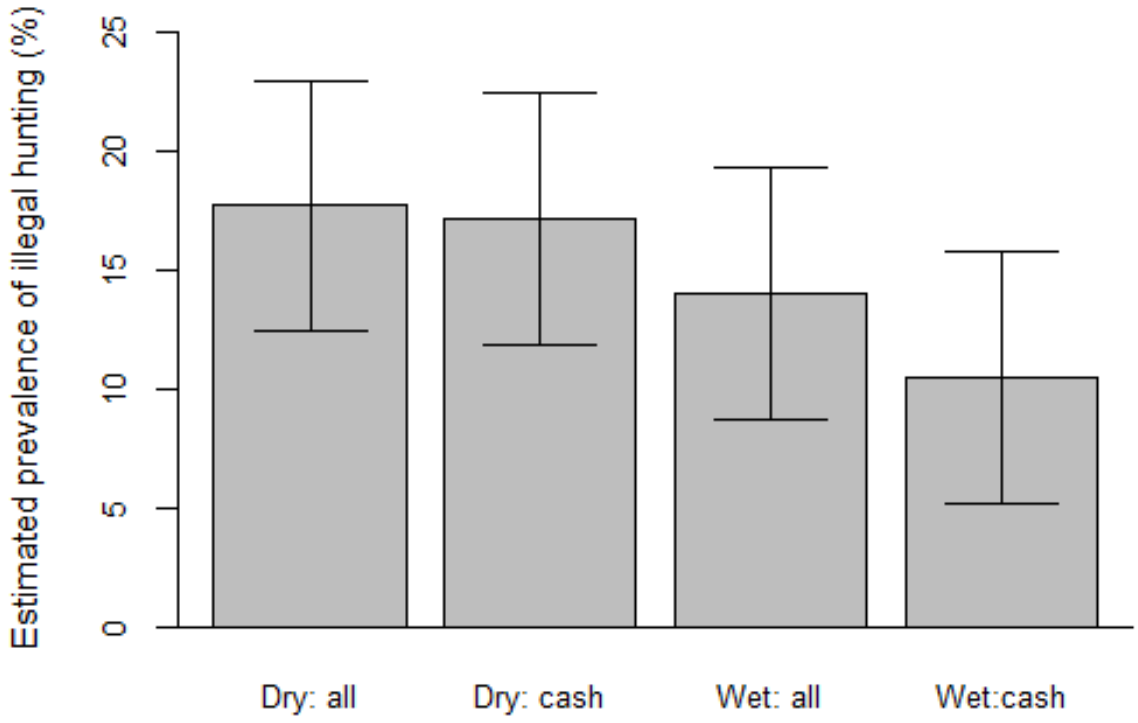
C. Household participation in hunting

D. Opinion about survey technique

Results I

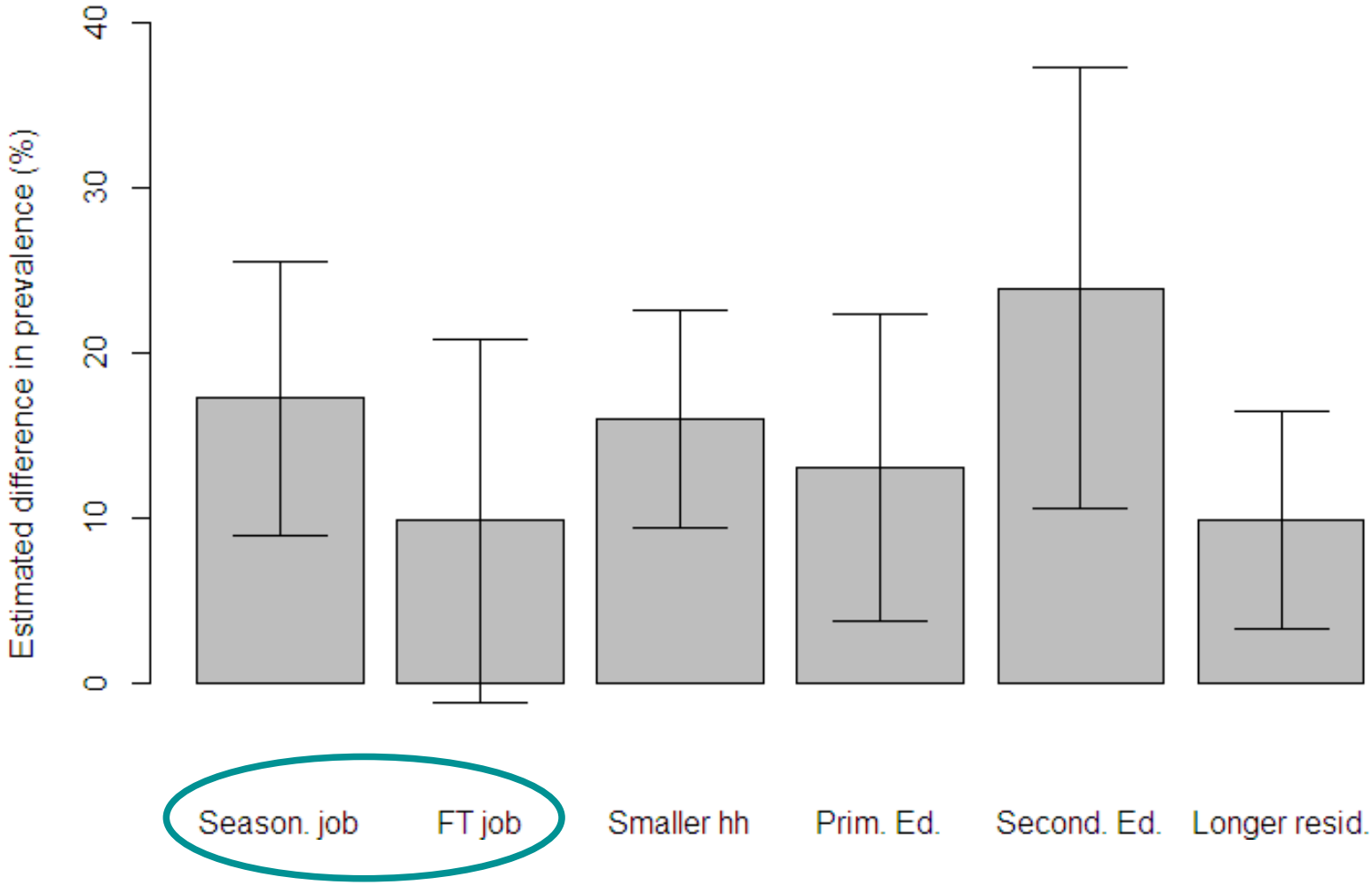
Non-response rate: <3%

Estimated hunting households (%):



Results II

Model coefficients (± S.E.):



Conclusions I

- poaching remains widespread in the Serengeti

- households hunt both for food and cash all year round

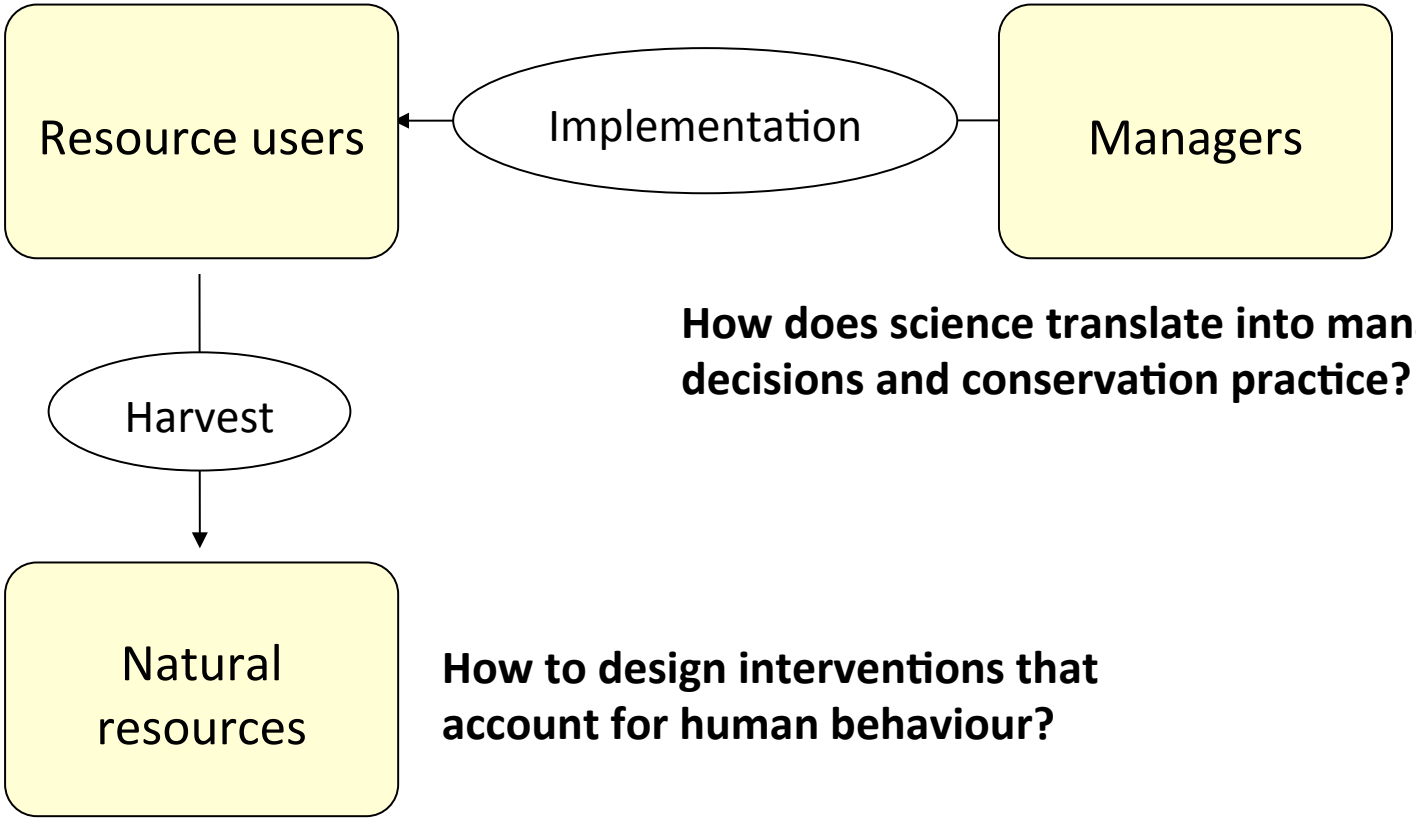
- current alternative sources of income may not be sufficiently attractive to compete with the opportunities provided by hunting

Conclusions II

A new tool for the conservationists' kit?

- Potential for wider application
- Sample size requirements
- Disentangle survey processes from actual effects of interest

III– Conservation implementation under uncertainty



How does science translate into management decisions and conservation practice?

How to design interventions that account for human behaviour?


STOP SEA TURTLE FARMING
stopseaturtlefarm.org
WSPA


Schooner's
sautéed turtle served with onions,
US$14.95
Boathouse Burger
onions, pickles, lettuce &
US$10.95

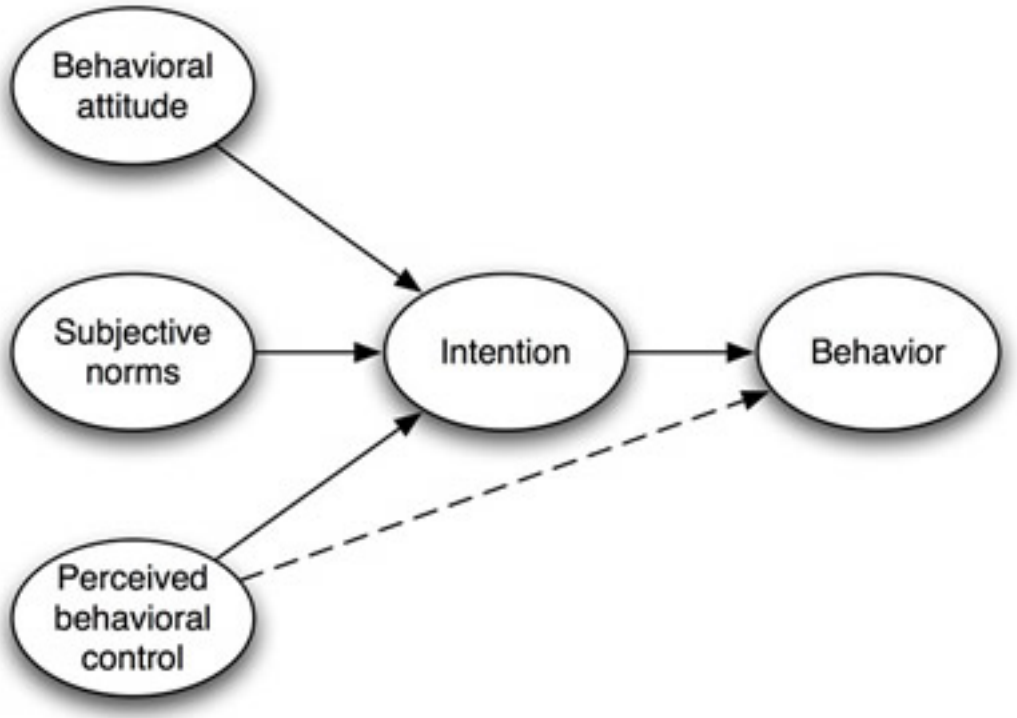

CAYMAN TURTLE FARM
ISLAND WILDLIFE ENCOUNTER

Some questions

- How to manage conflict over natural resource management and conservation?
- How to “predict” resource user behaviour in face of changing conditions?

Knowledge of wildlife rules & environmental awareness

Economics



Values towards wildlife

Interviews & socio-economic surveys

- 25 “stakeholders” (such as retired seamen)
- 561 households
- 174 high school students
- 117 cruise ship tourists
- 87 stay-over tourists
- 10 restaurant managers (ongoing)

Other areas of research

- Combining (and comparing) social and ecological information into integrated modelling frameworks for decision support

- Social monitoring & linking (and predicting) ecological outcomes with robust “social indicators” (e.g. social networks, behaviour, attitudes?)

- Actual (and perceived) value of information for decision-making

Acknowledgements & Questions

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