Population Ecology and Conservation of the Snail Kite: an Update

Wiley Kitchens

Julien Martin

Chris Cattau

Andrea Bowling

Christa Zweig

Erik Powers

Brian Reichert

Kyle Pias

Zach Welch

Melissa DeSa

Sarah Haas

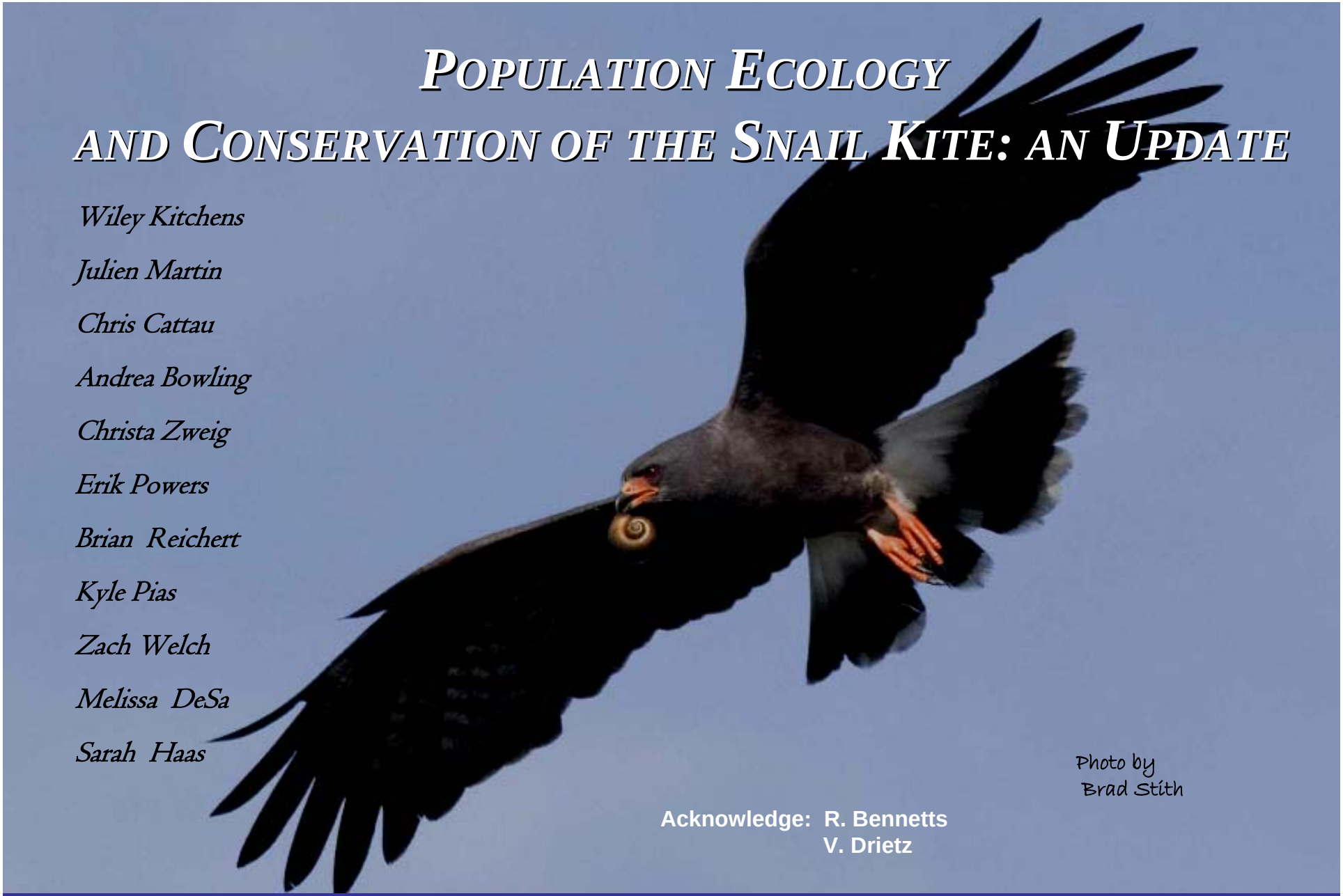


Photo by
Brad Stith

Acknowledge: R. Bennetts
V. Drietz

UNIVERSITY OF FLORIDA

USGS
science for a changing world

Kite Studies

- Julien Martin
  - Demography , population size,and viability studies
  - Movement and consequences on demography
  - Natal location influences movement and survival of the snail kite
  - Effects of drought and habitat degradation on the viability of the snail kite

- Chris Cattau
  - Effects of exotic vs. native snails on foraging behavior and energetics
  - Estimating juvenile survival for kites hatched throughout the KCOL
  - Exploring the multiple-competing hypotheses approach to kite population decline

- Andrea Bowling
  - Exploring monthly dispersal of juvenile snail kites with multistate models
  - Comparing pre- and post- population decline trends in juvenile movement

- Brian Reichert
  - Wetland-specific survival rates and environmental correlates
  - Modeling the effects of aging (senescence) and radio-transmitters on snail kite survival

- Sara Haas
  - Genetic divergence among Snail Kite subspecies:

- Lara Drizd
  - Monitoring habitat quality within critical wetland units throughout range of the snail kite

Everglades Studies

- Christa Zweig
  - Characterizing relationship between hydrology and vegetative community composition in WCA 3A
  - Developing predictive artificial neural network models
  - Documenting changes in critical kite habitat in 3A and hydrologic correlates
  - Succession/state and transition models for 3A for management support decisions
  - Remote sensing techniques to differentiate slough and wet prairie communities in satellite data

- Althea Hotaling
  - Estimating transition between slough and wet prairies using multistate models
  - Testing influence of *wet and dry season, wet and dry years, and topography* on the conversion of these two important communities for snail kites and apple snails

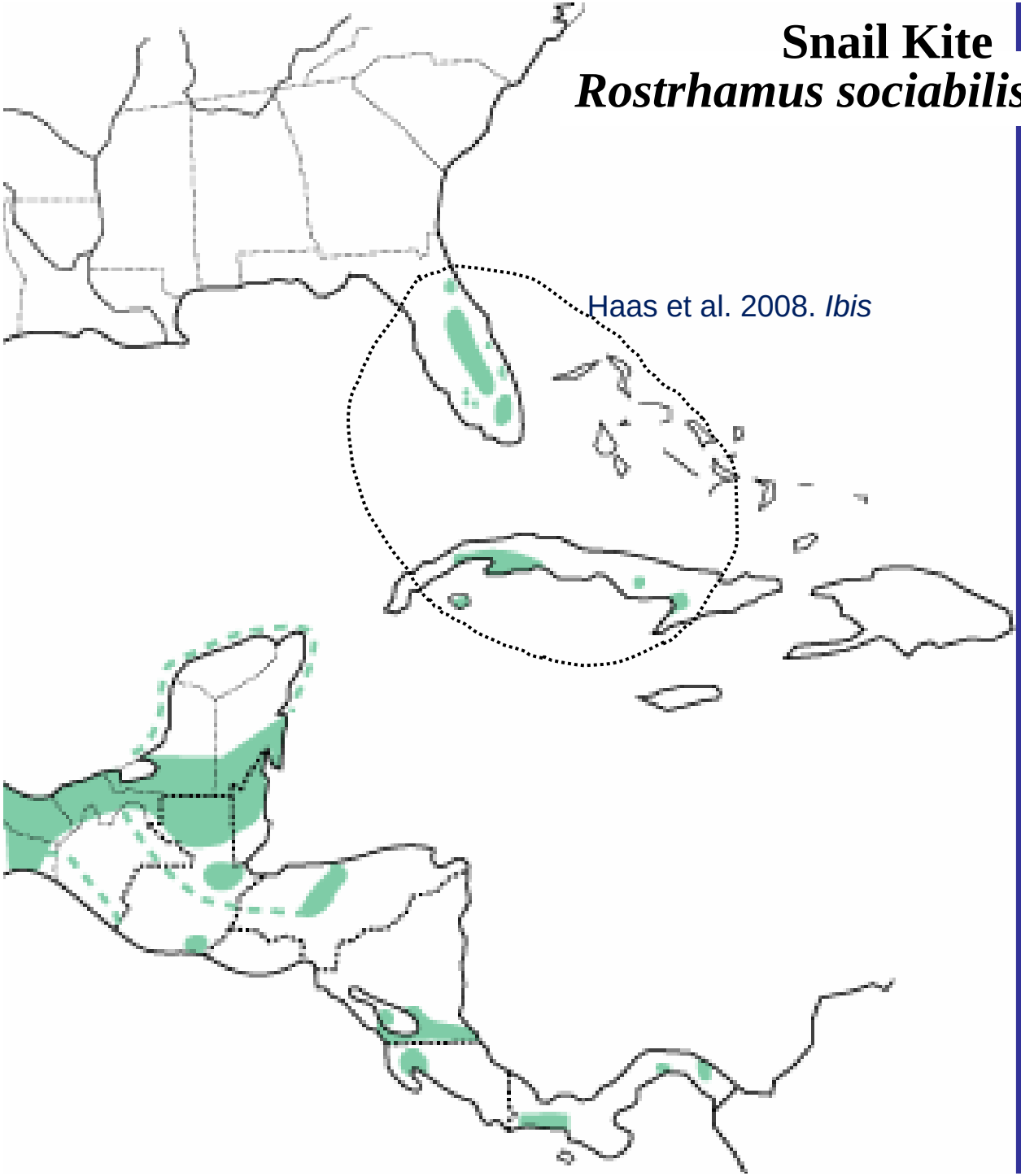
Outline

- Mandatory natural history /background info
- Demography and movement
- Kites are in trouble (big trouble): demographic evidence
- Water levels during the Fall (Sept-Jan) too high for too long
  ->Habitat conversion->degradation->Demo
- Water levels during Spring-Summer too low for too long
  -> Period 1998 to 2006
  -> Reduction in Survival, Reproduction, Recruitment
- PVA indicates short timeline for restoration (even DCOMP)

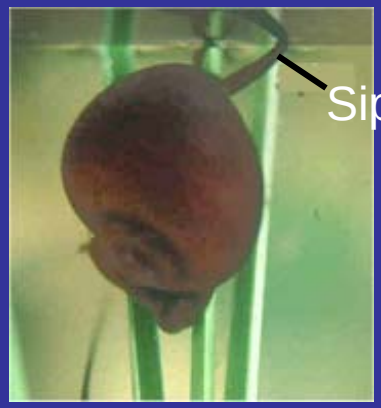
Background and Natural History Summary

Distribution of the Snail Kite (*Rostrhamus sociabilis)* in North, Central and South America

Snail Kite
Rostrhamus sociabilis plumbeus



Snail kite in Florida
Sentinel/Indicator ?



Food specialist

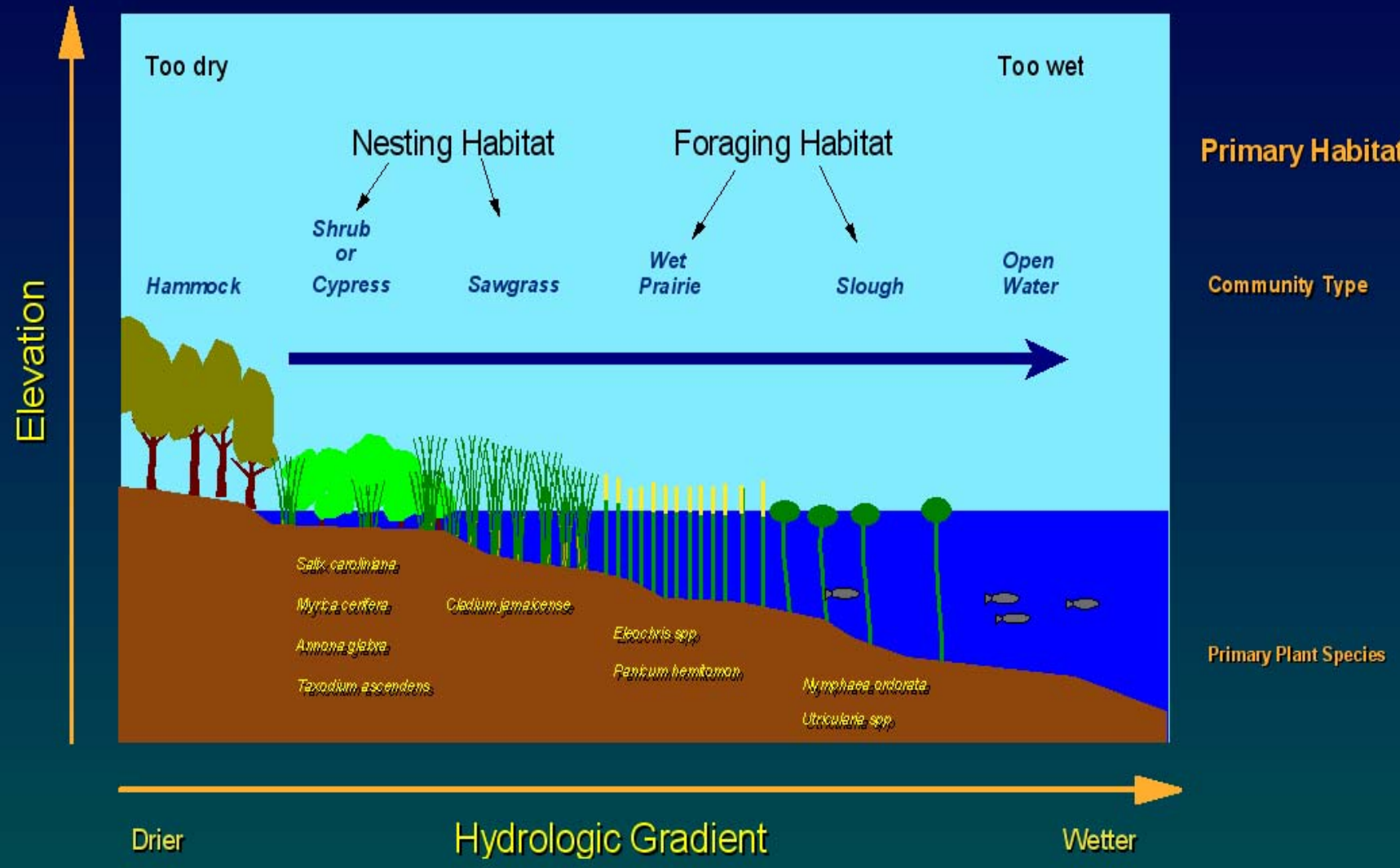
Wetland dependent

Closed population

Endangered species

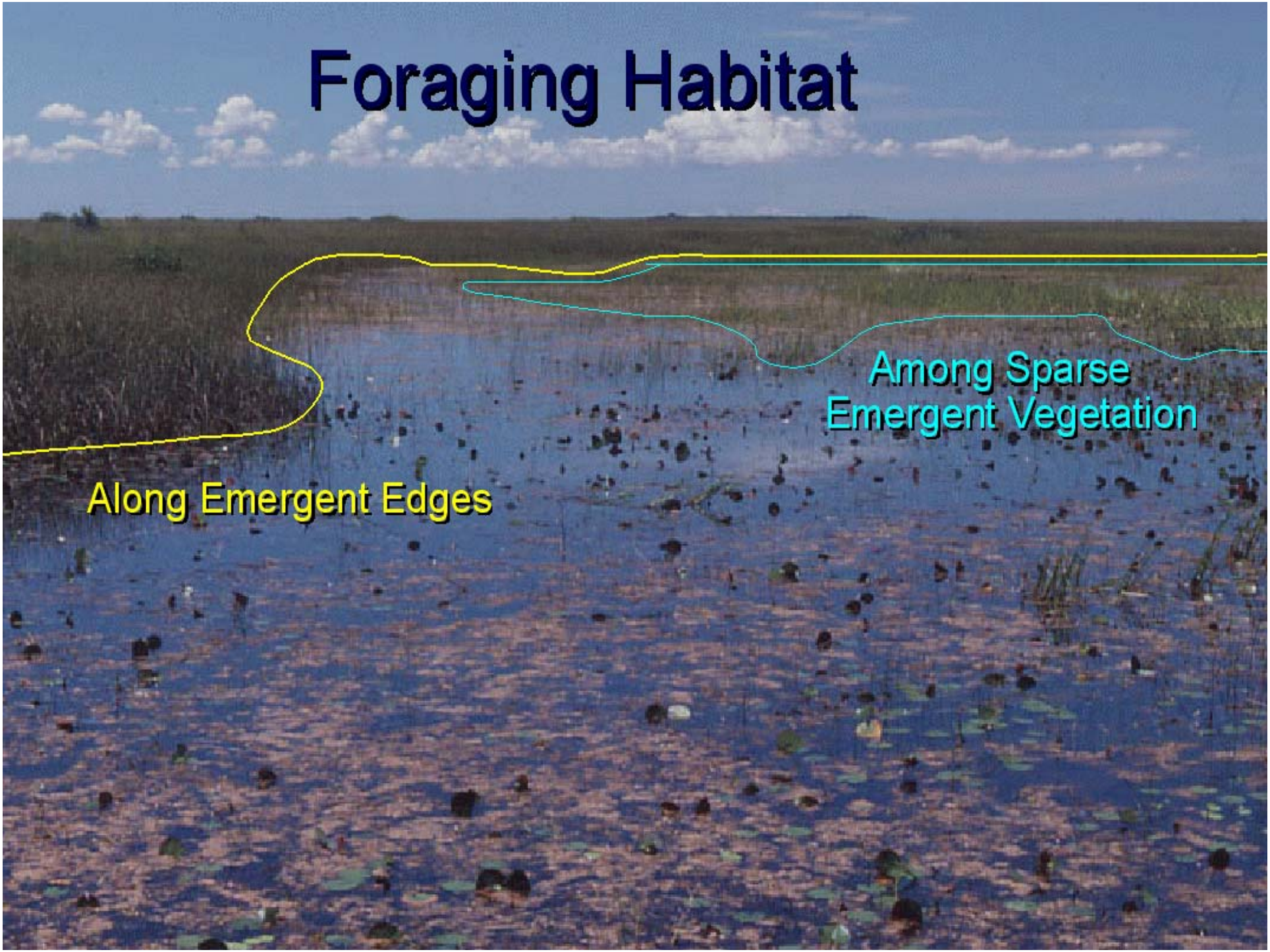
Confined to C. and S. FL

An Adaptive Management Poster Child


Too dry
Too wet
Nesting Habitat
Foraging Habitat
Primary Habitat Use
Shrub or Cypress
Hammock
Sawgrass
Wet Prairie
Slough
Open Water
Community Type
Elevation
Salix caroliniana
Myrica cerifera
Annona glabra
Taxodium ascendens
Cladium jamaicense
Eleocharis spp.
Panicum hemitomon
Nymphaea ordorata
Utricularia spp.
Primary Plant Species
Drier
Hydrologic Gradient
Wetter

Foraging

Foraging Habitat



Primary Nesting Habitats

Willow or
Cypress Stands

Isolated
Shrubs or Trees

Thick
Herbaceous
Vegetation

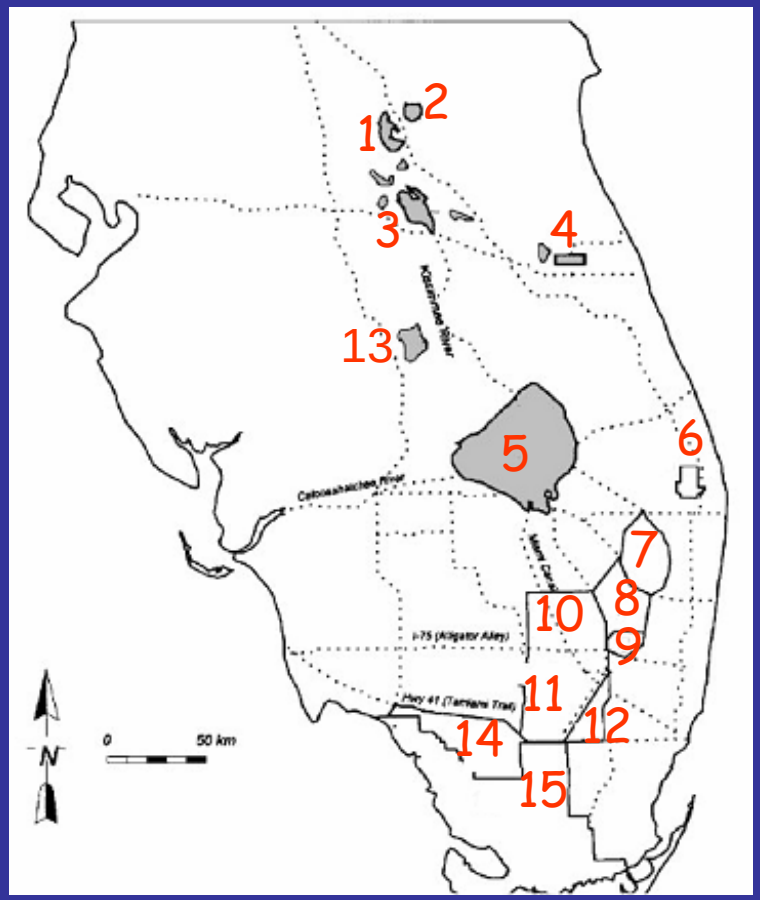
STUDY DESIGN

It's Survival Stupid!
Or is It?

Airboat surveys during breeding season

Nest Monitoring → Reproduction

Mark-Resight →
- Survival
- Recruitment/λ
- Movement



STUDY DESIGN cont.

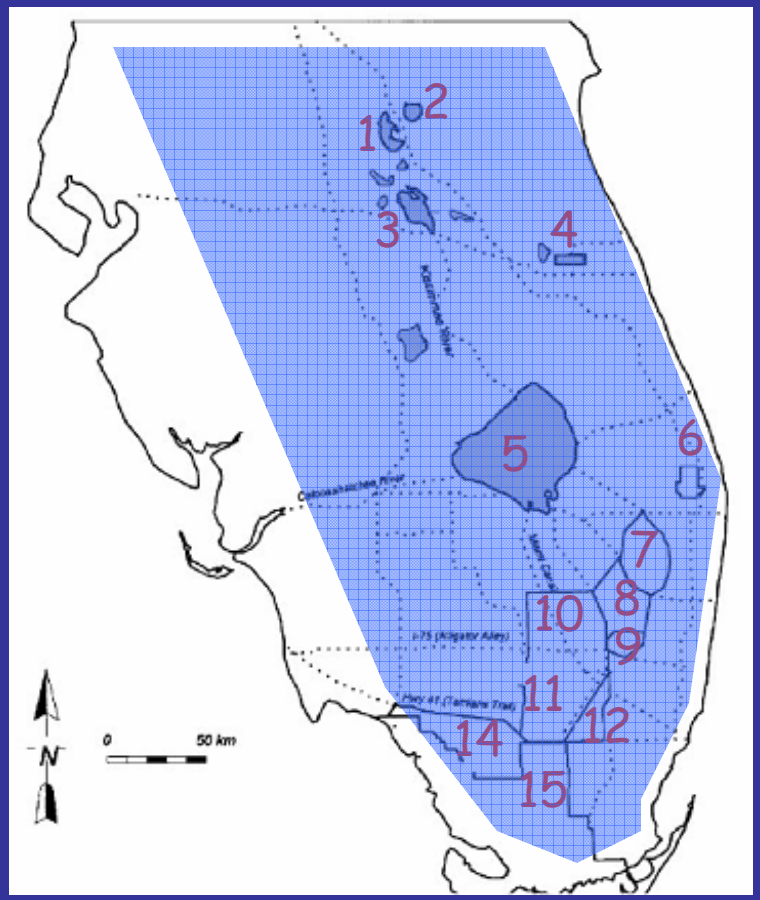
Radio telemetry (all year long)

1992-1995 Monthly sampling (Aircraft/Airboat)

2003-2008 Monthly sampling

Juvenile

- Movement
- Survival
- Recruitment



Banding Capture-Resighting

Between-Year Survival

Natal Philopatry

Breeding Dispersal

Population size
Movements

Radio Telemetry

Within-Year Survival

Movements

Reproductive Parameters

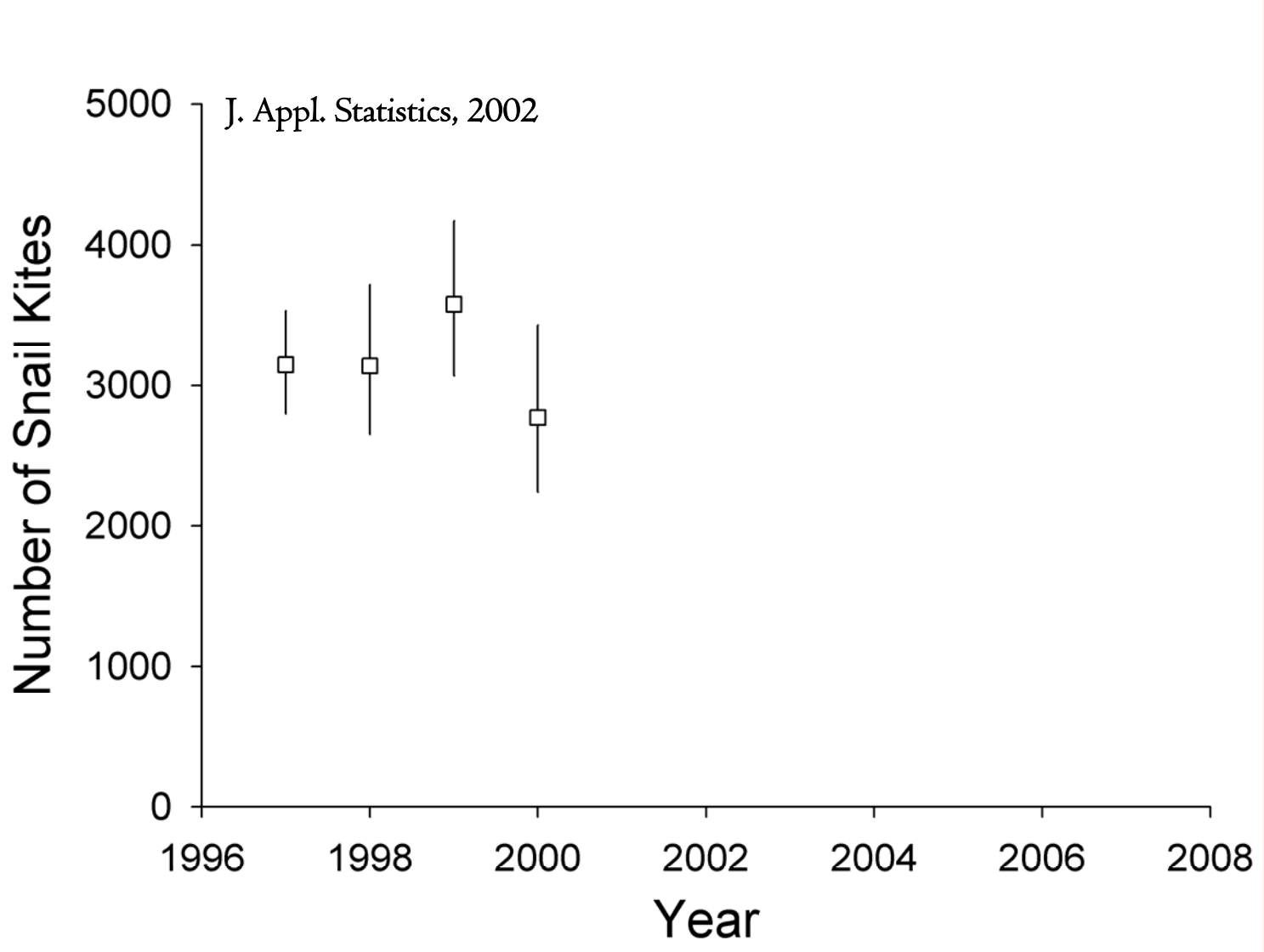
Recruitment

Nest Monitoring

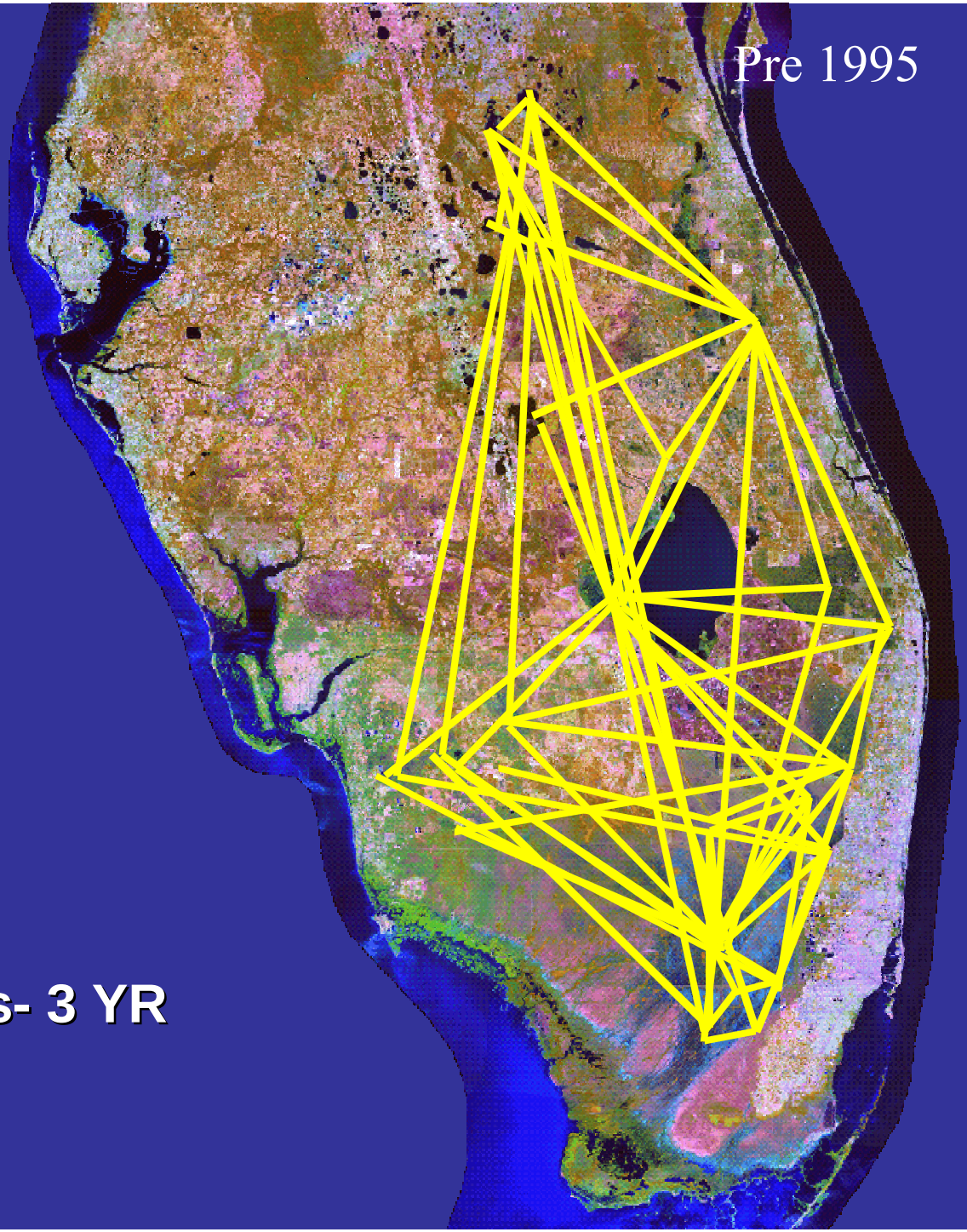
Nest Success

Number of Young

Superpopulation approach

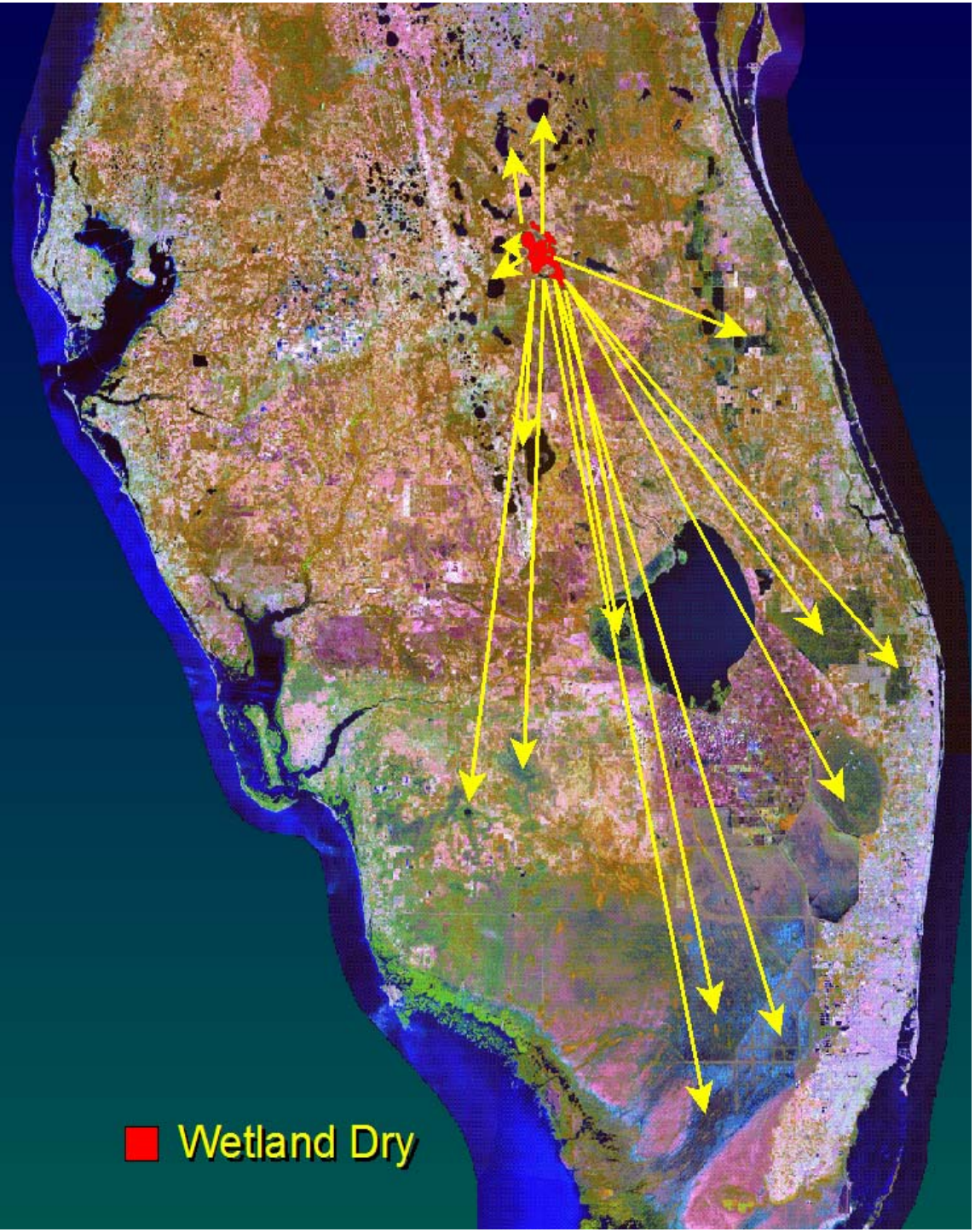


Oikos,1999

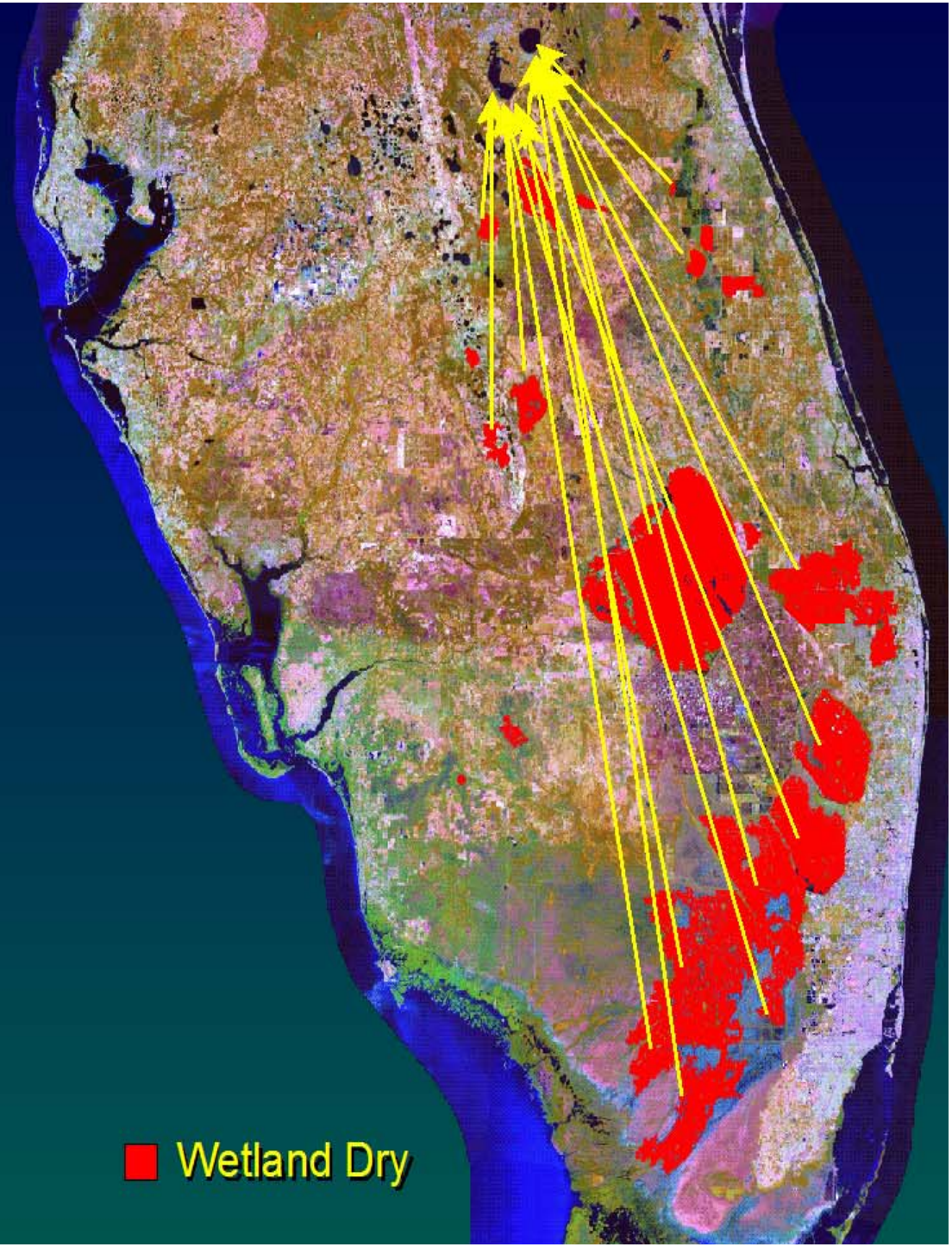


Kite Movements- 3 YR Summary

Local Drying Event

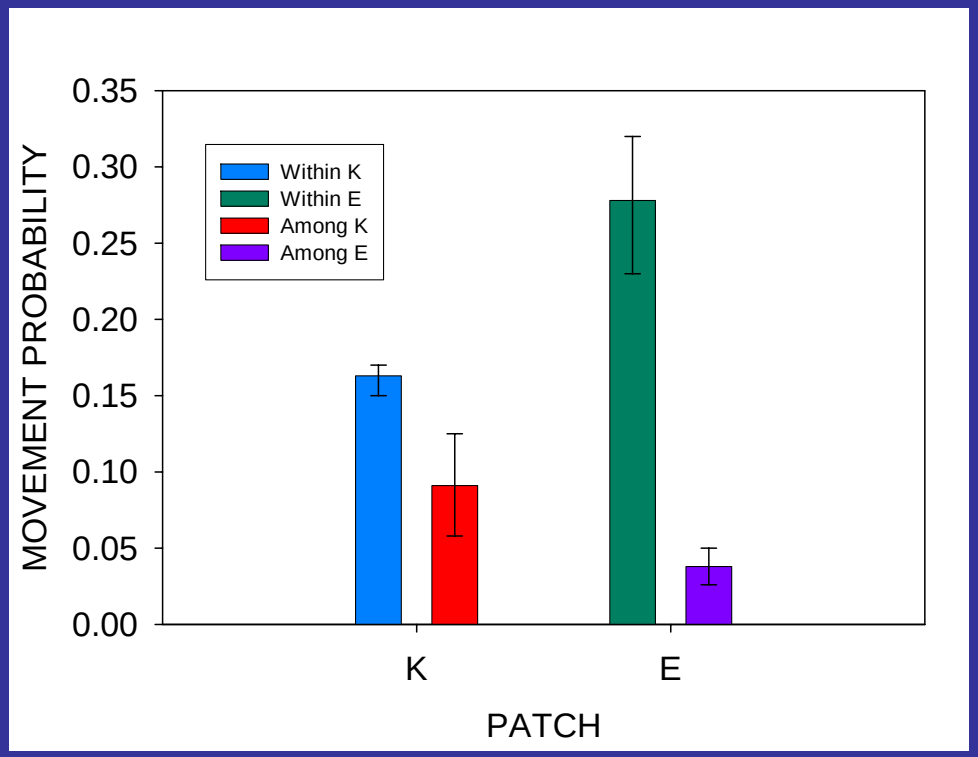


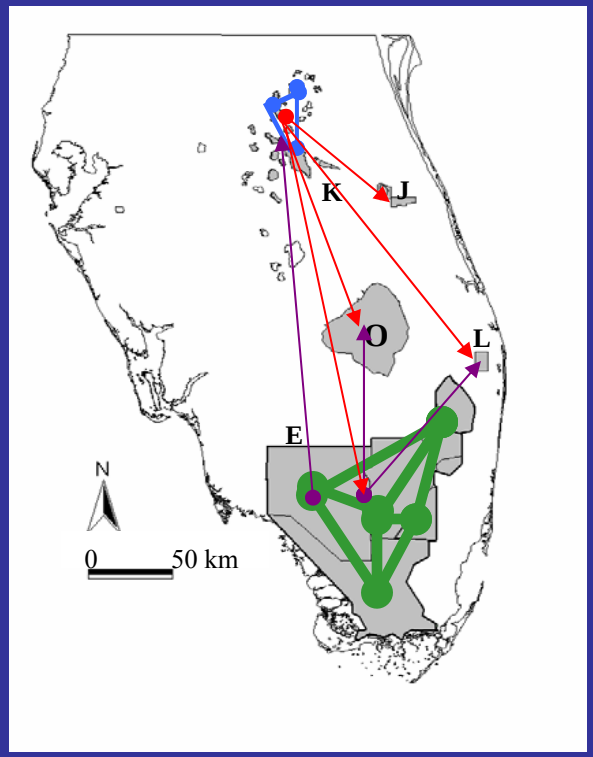
Widespread Drying Event



Journal Animal Ecol, 2006

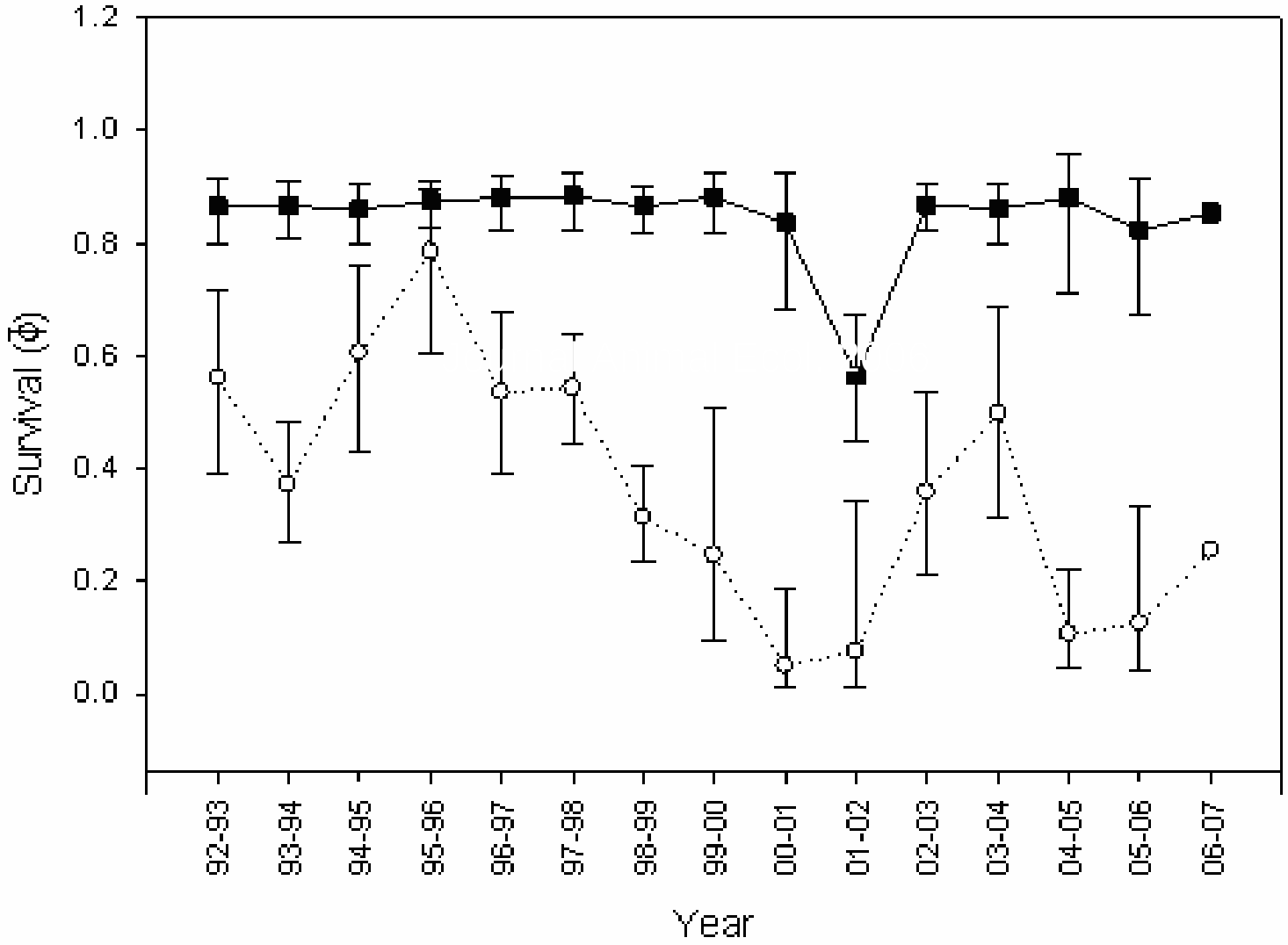
Monthly movements





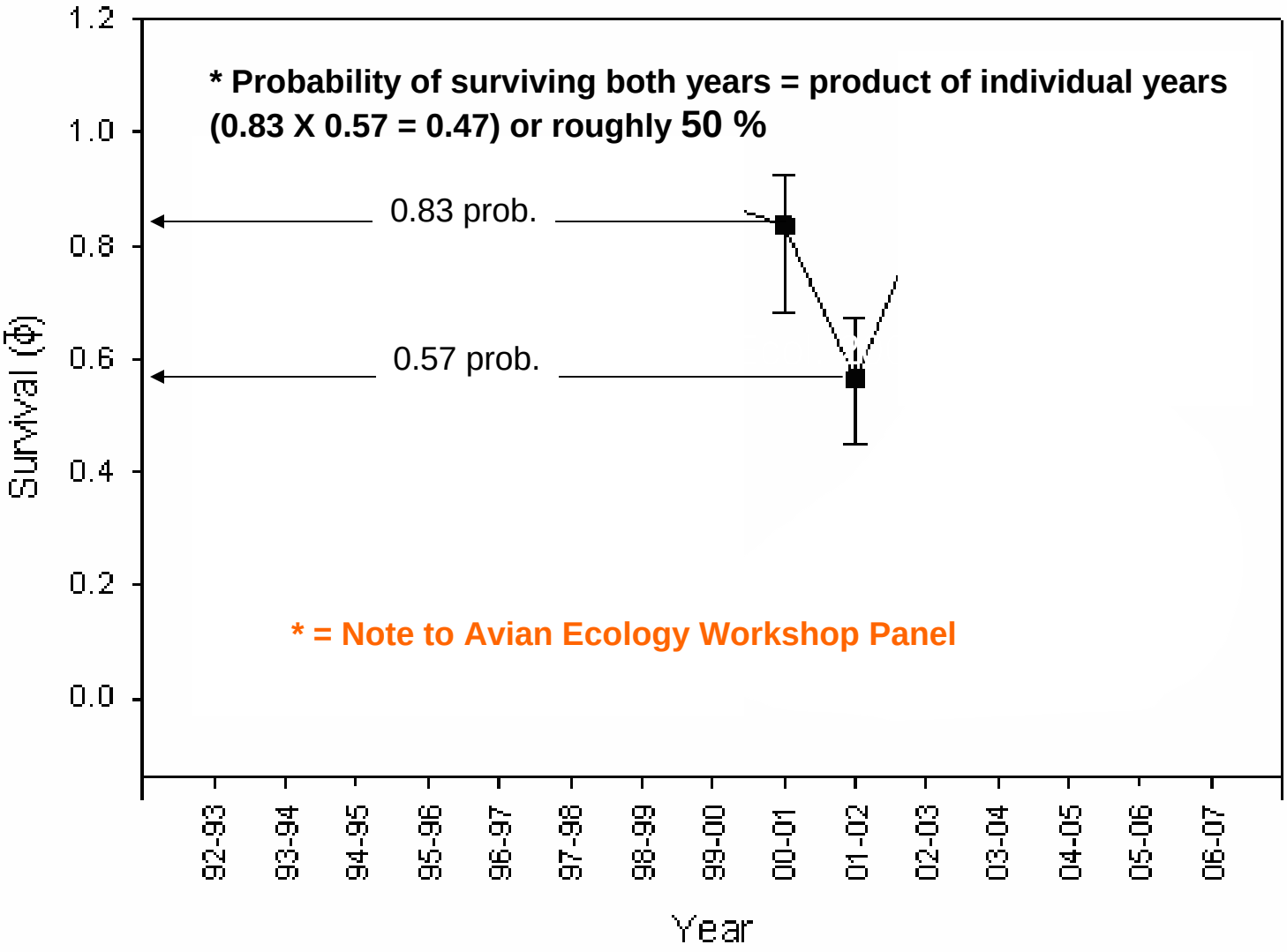
Journal Animal Ecol, 2006

Survival



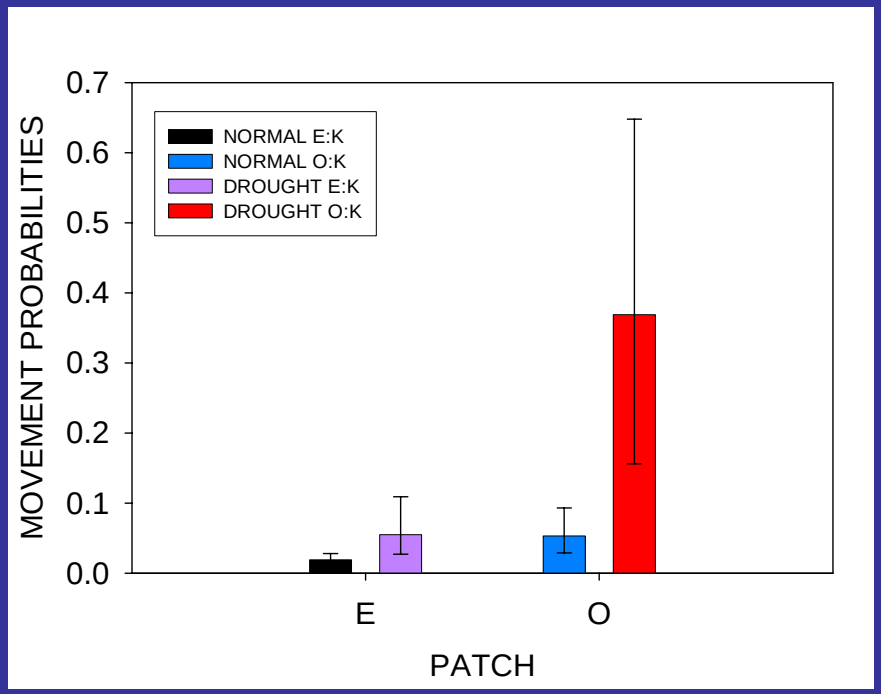
Survival

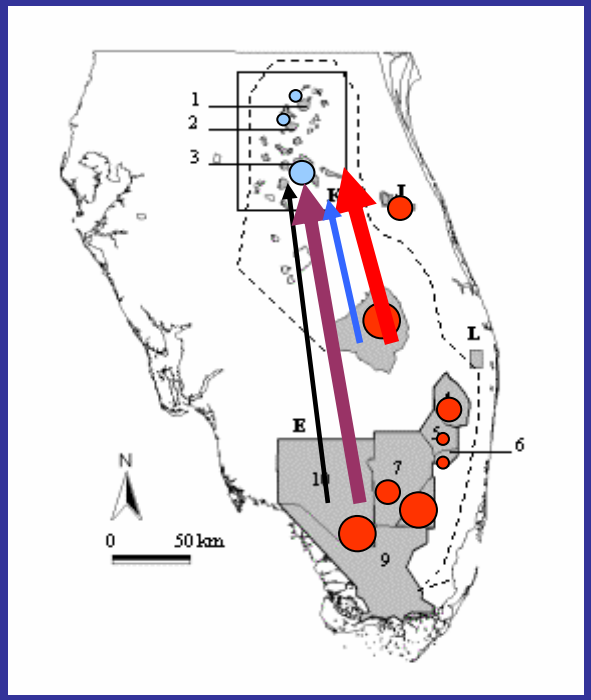
"Do the Math!"



Movement toward refugia

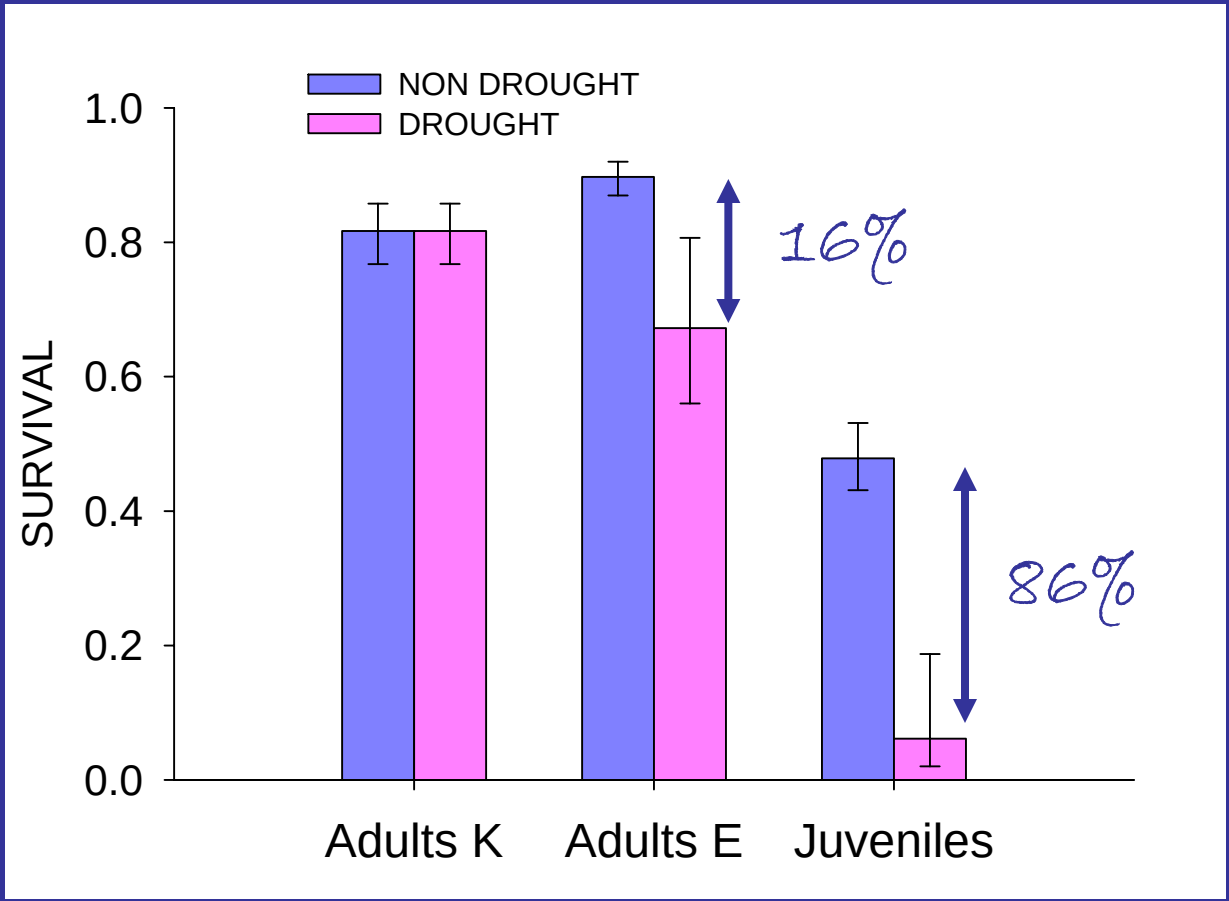
Oecologia 2007



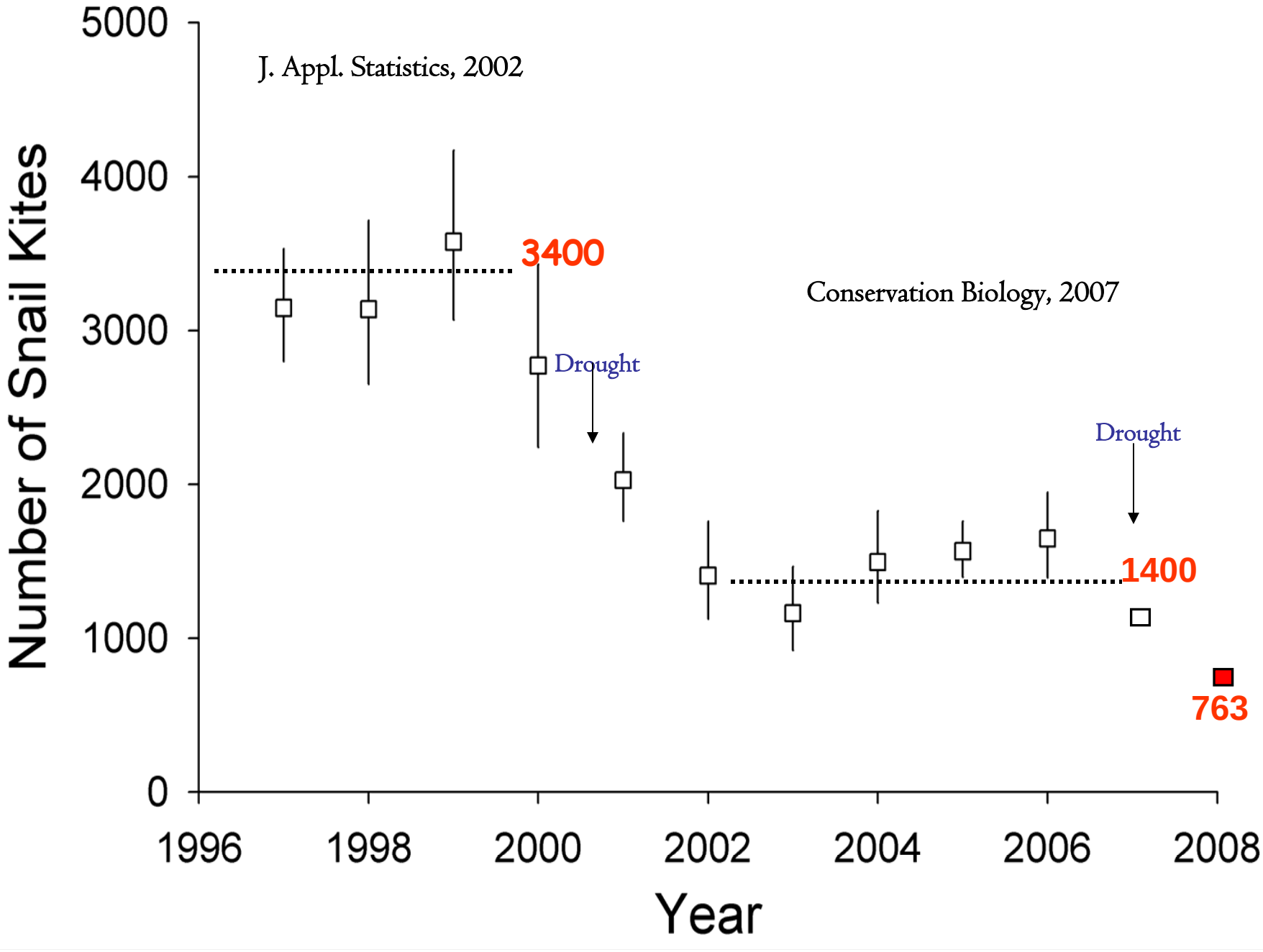


Drought (01-02) effect on survival

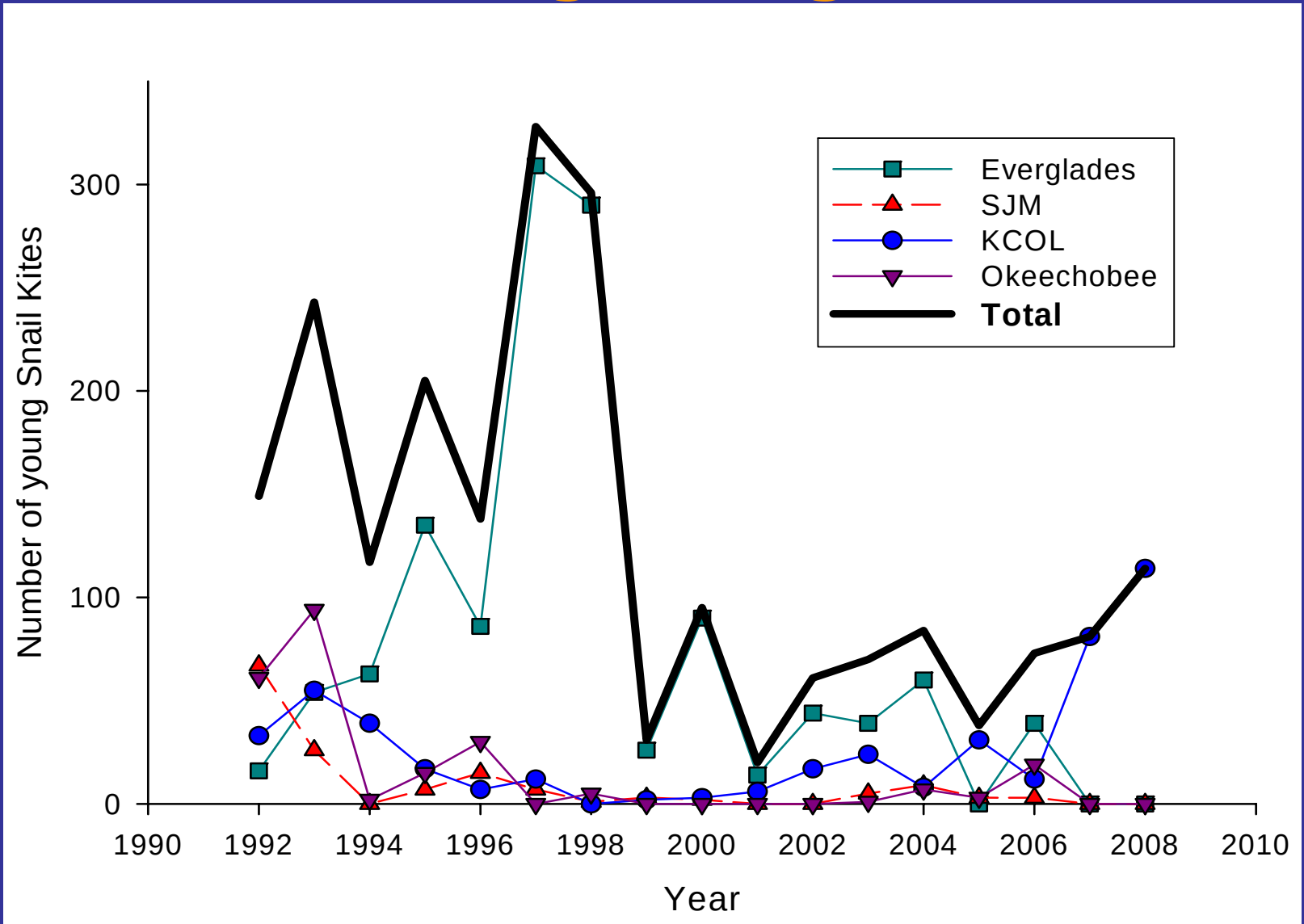
Oecologia 2007



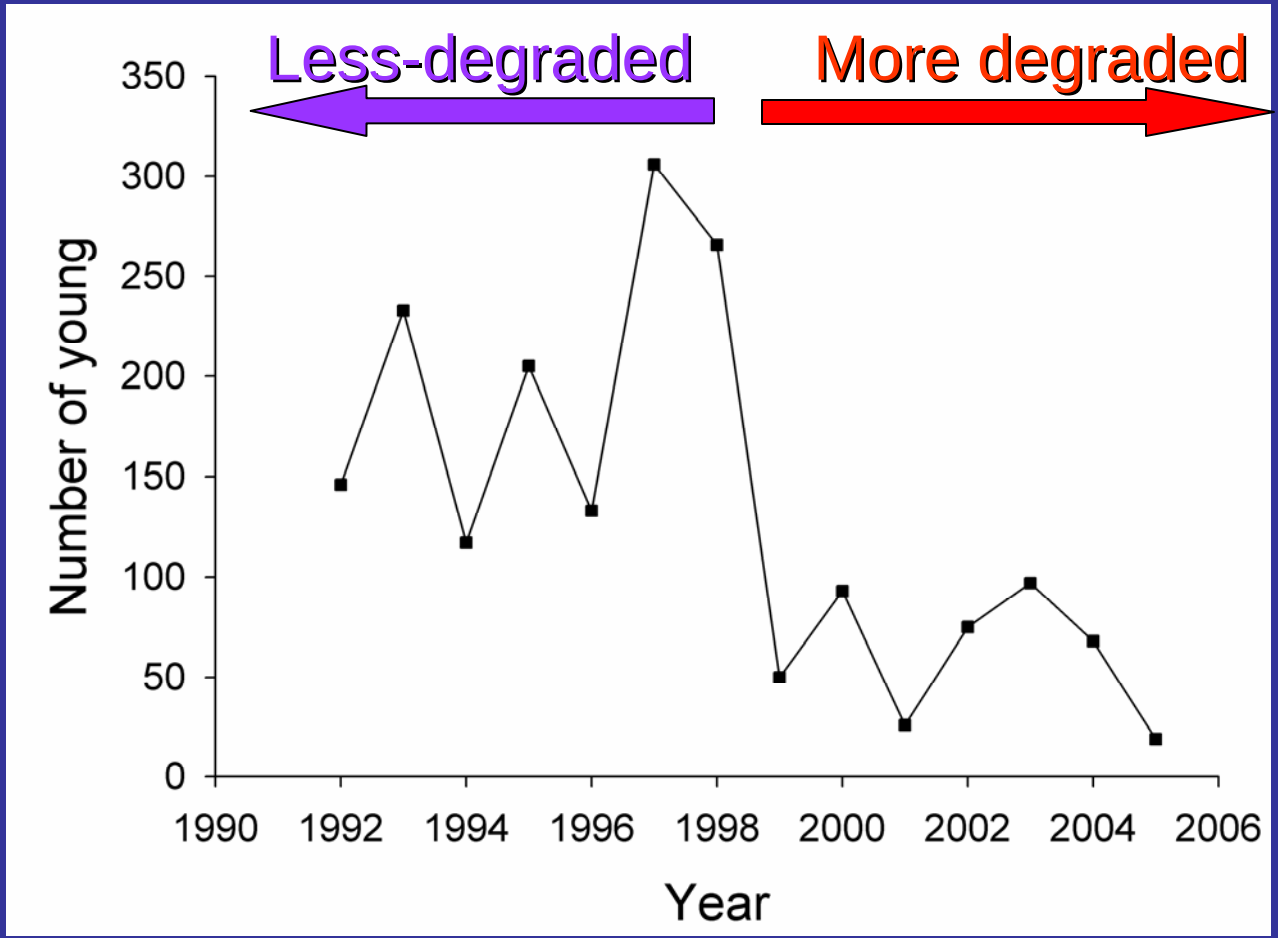
Superpopulation size



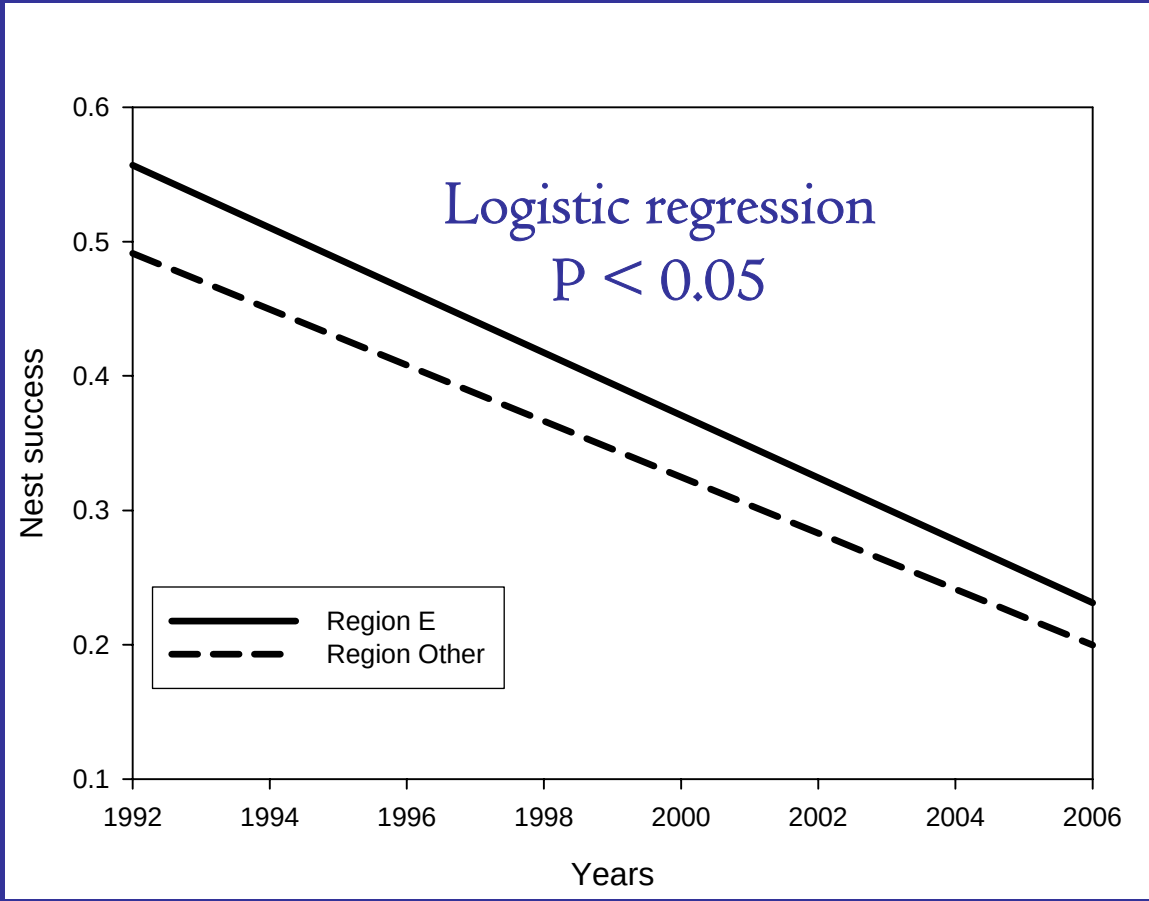
Young Fledged



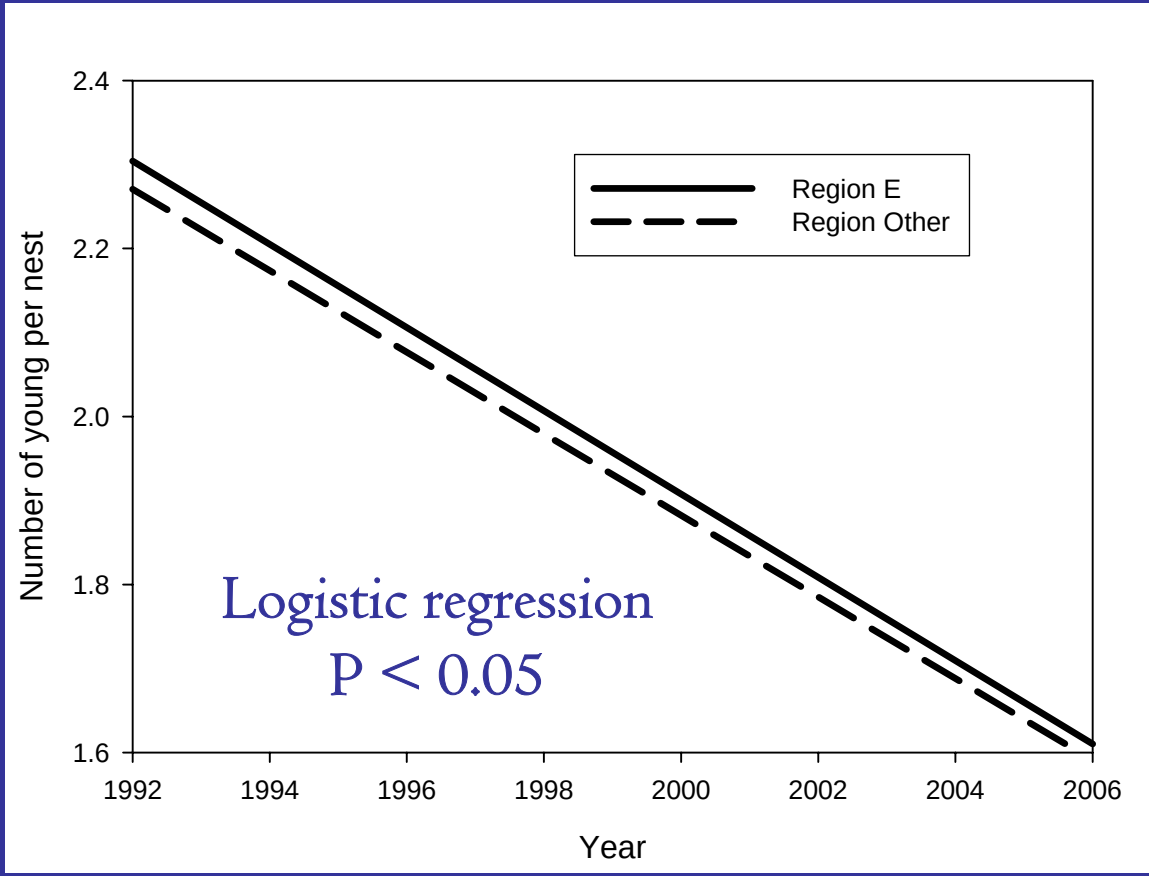
Number of young



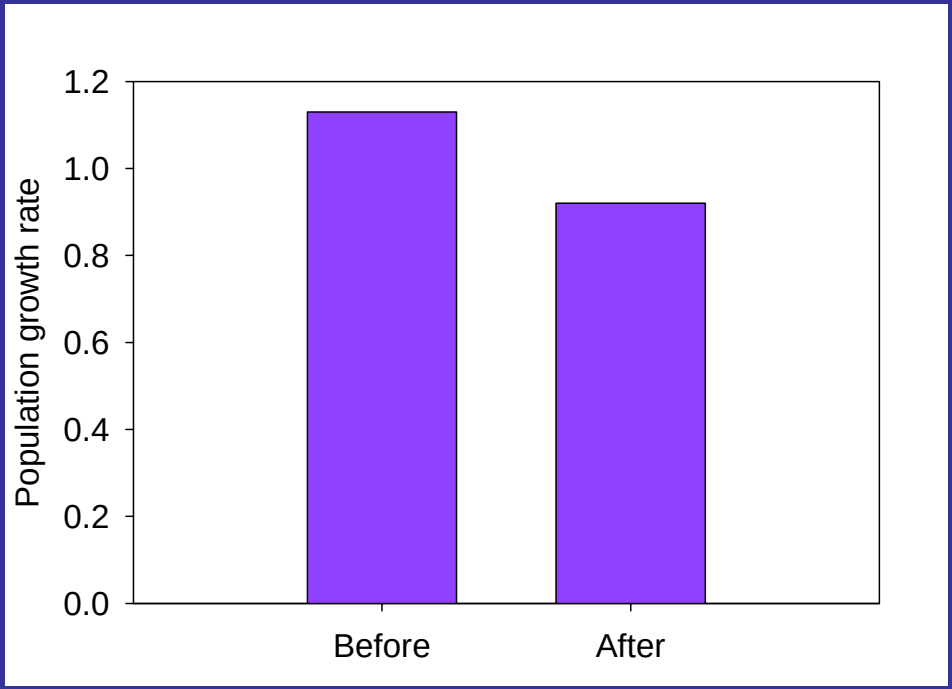
Nest Success



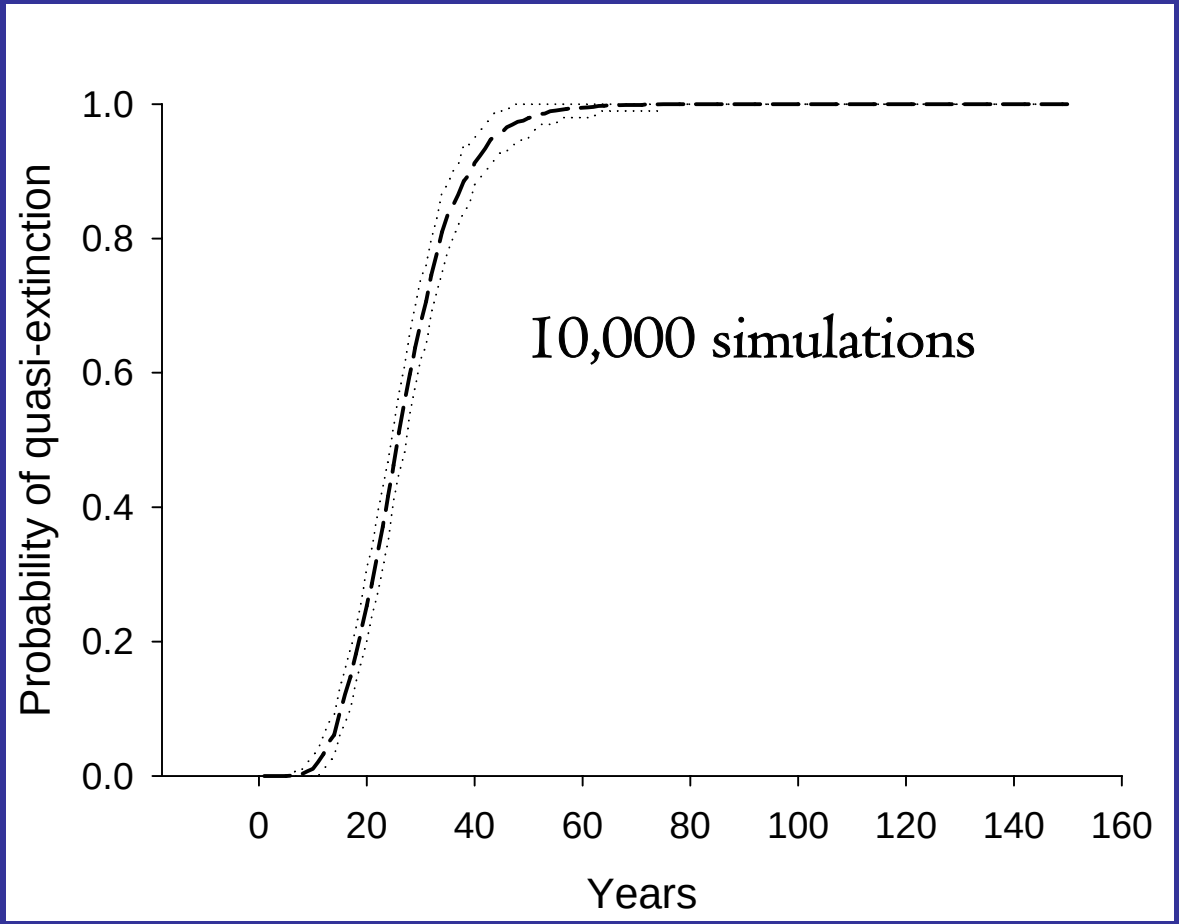
Number of young per nest



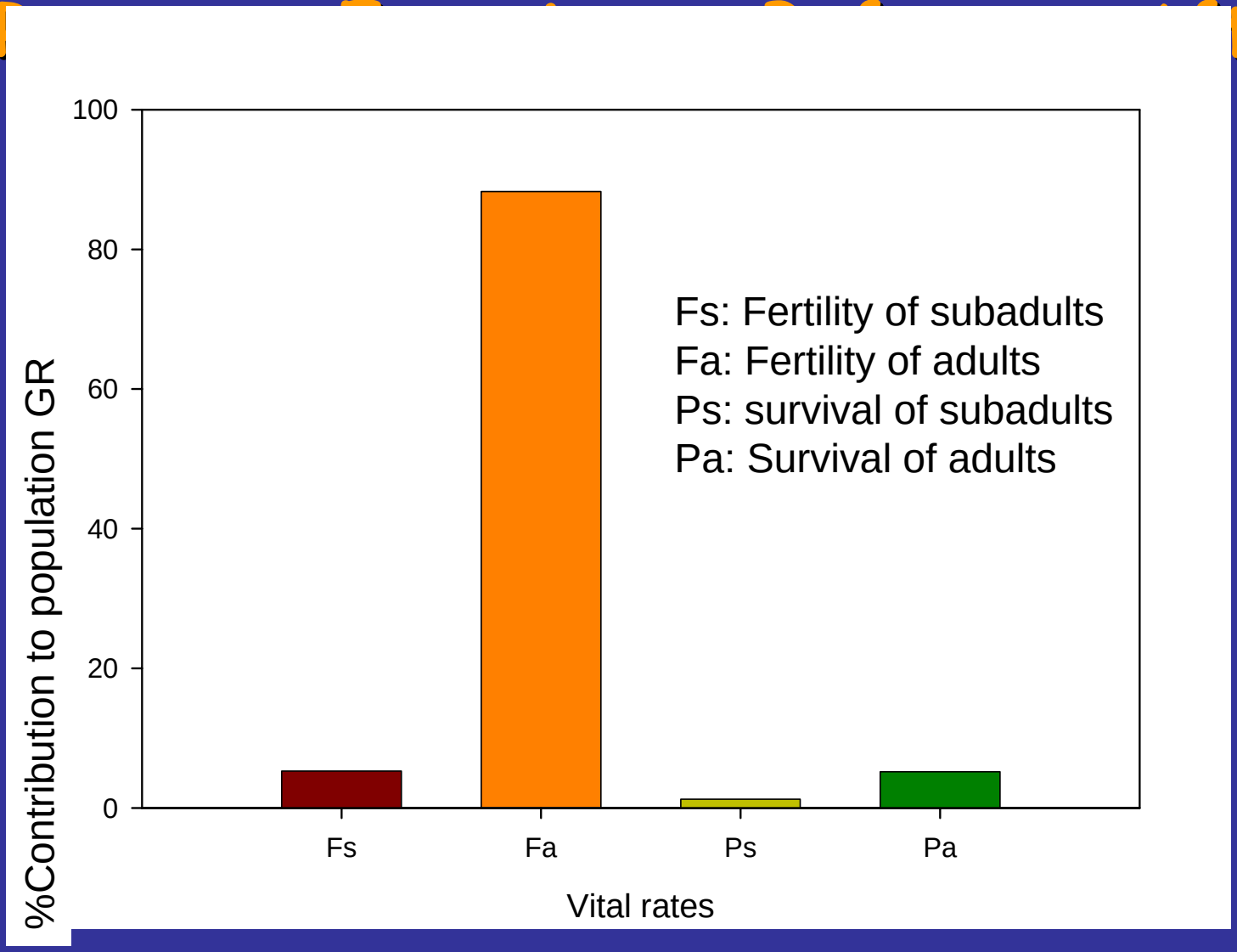
Population Growth Before vs After 1998



Probability of quasi-extinction



LT


100
80
60
40
20
0
%Contribution to population GR
Fs
Fa
Ps
Pa
Vital rates
Fs: Fertility of subadults
Fa: Fertility of adults
Ps: survival of subadults
Pa: Survival of adults

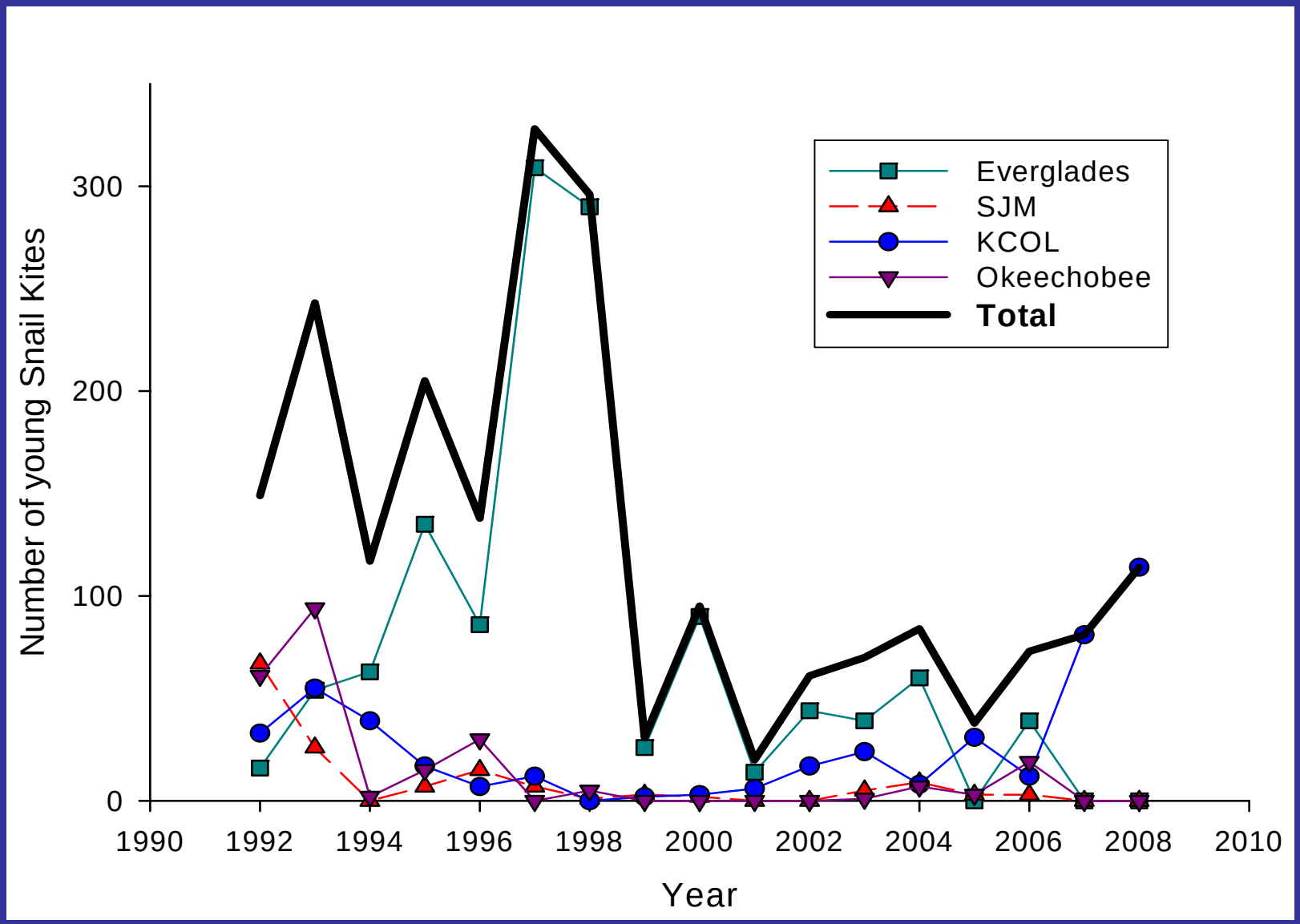
WCA3A is key!

1- Highest production

2- Greater Nest success and Number of young per nests

3- High natal philopatry (~95% for WCAs)

4- largest extent of connected suitable habitat


Number of young Snail Kites
300
200
100
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Year
Everglades
SJM
KCOL
Okeechobee
Total

Hypotheses explaining Kite decline

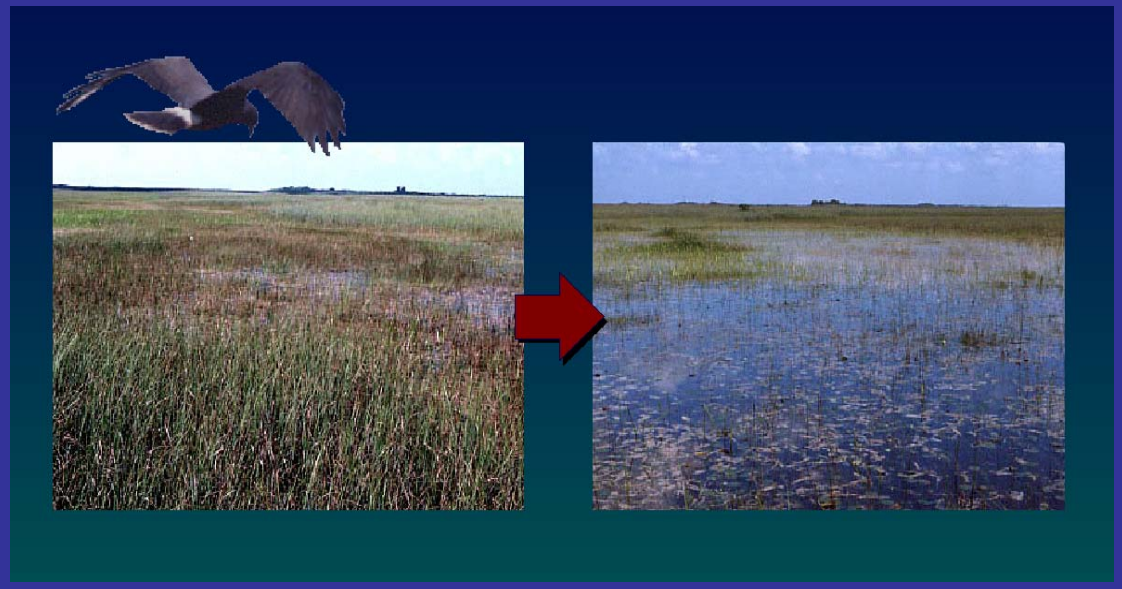
1- Hypothesis 1: Long term habitat degradation

2- Hypothesis 2: Increase in freq of drying events

3- Hypothesis 3: Both effects are at play

Hypothesis 1:Habitat alteration/degradation

- Prolonged hydroperiod, drought suppression:
  - *Shift in vegetation communities (Kitchens 2002; Powers and Kitchens 2006)
  - *Degradation of foraging and nesting habitats
  - *Ecological trapping (high to rapid lows)
- Reduced snail abundances (Darby et al.)



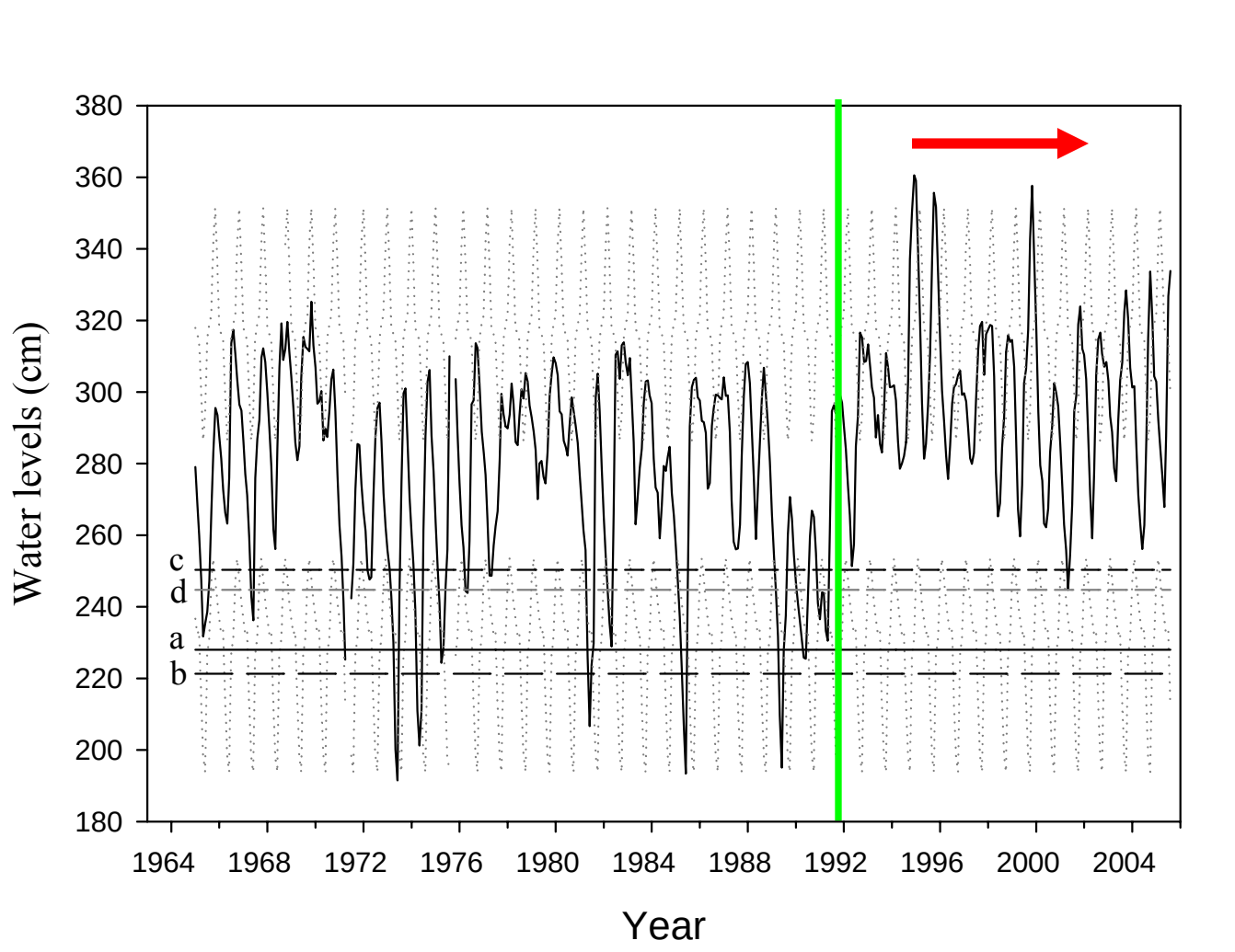
Hypothesis 1 cont.: reduction in K

1- Reduction in apple snail availability

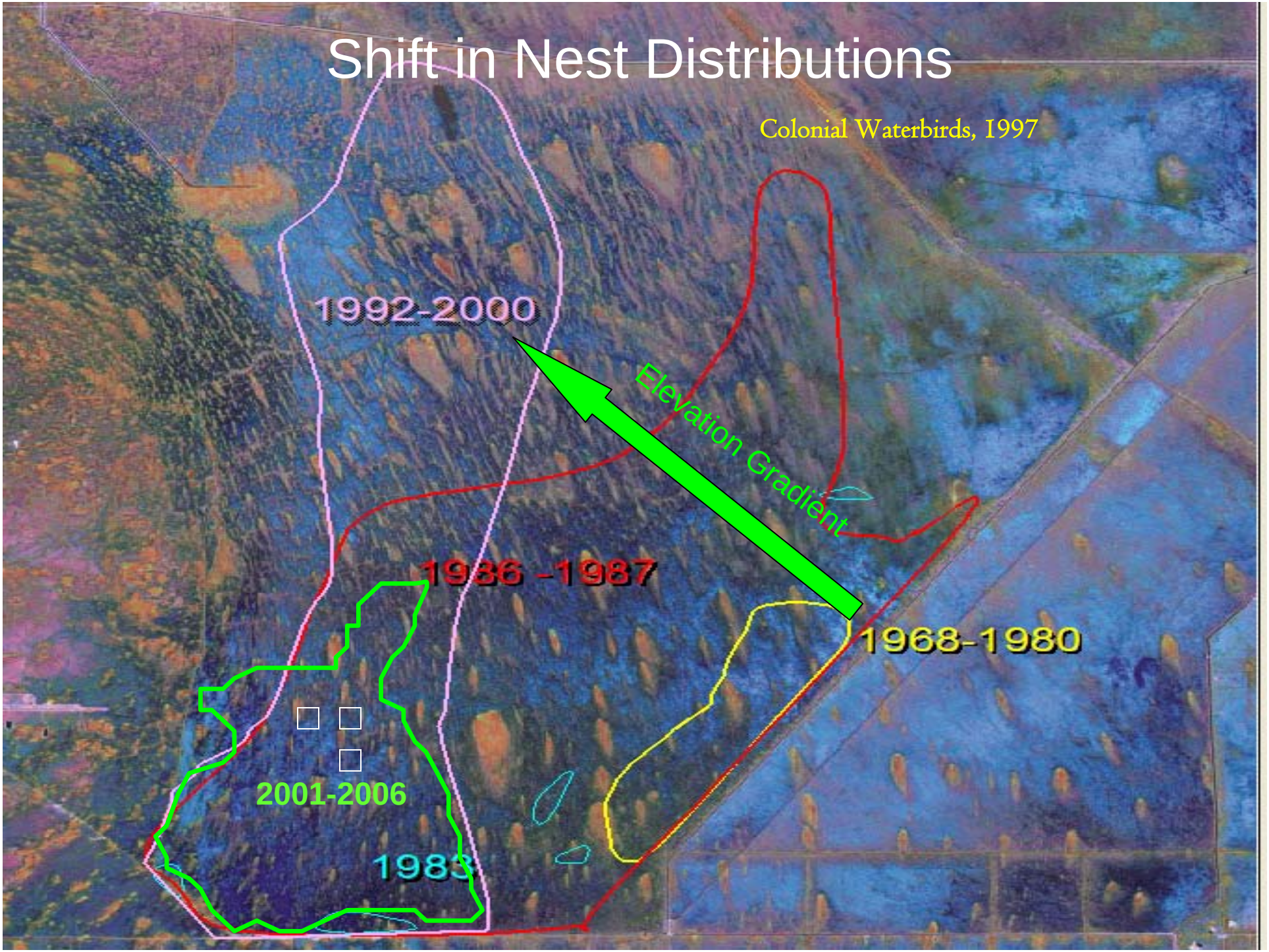
2- Reduction in suitable foraging habitat

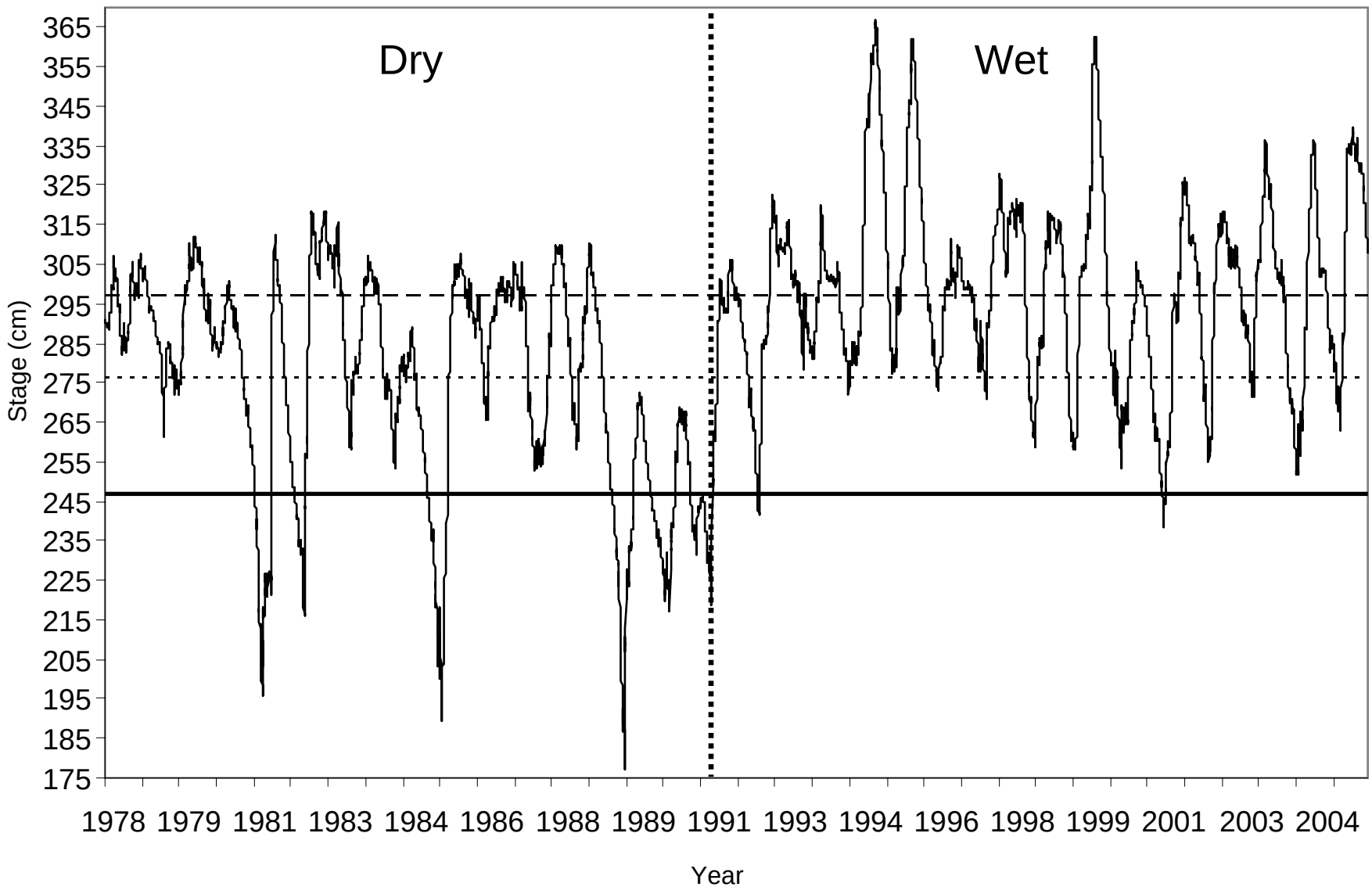
3- Reduction in suitable nesting substrate

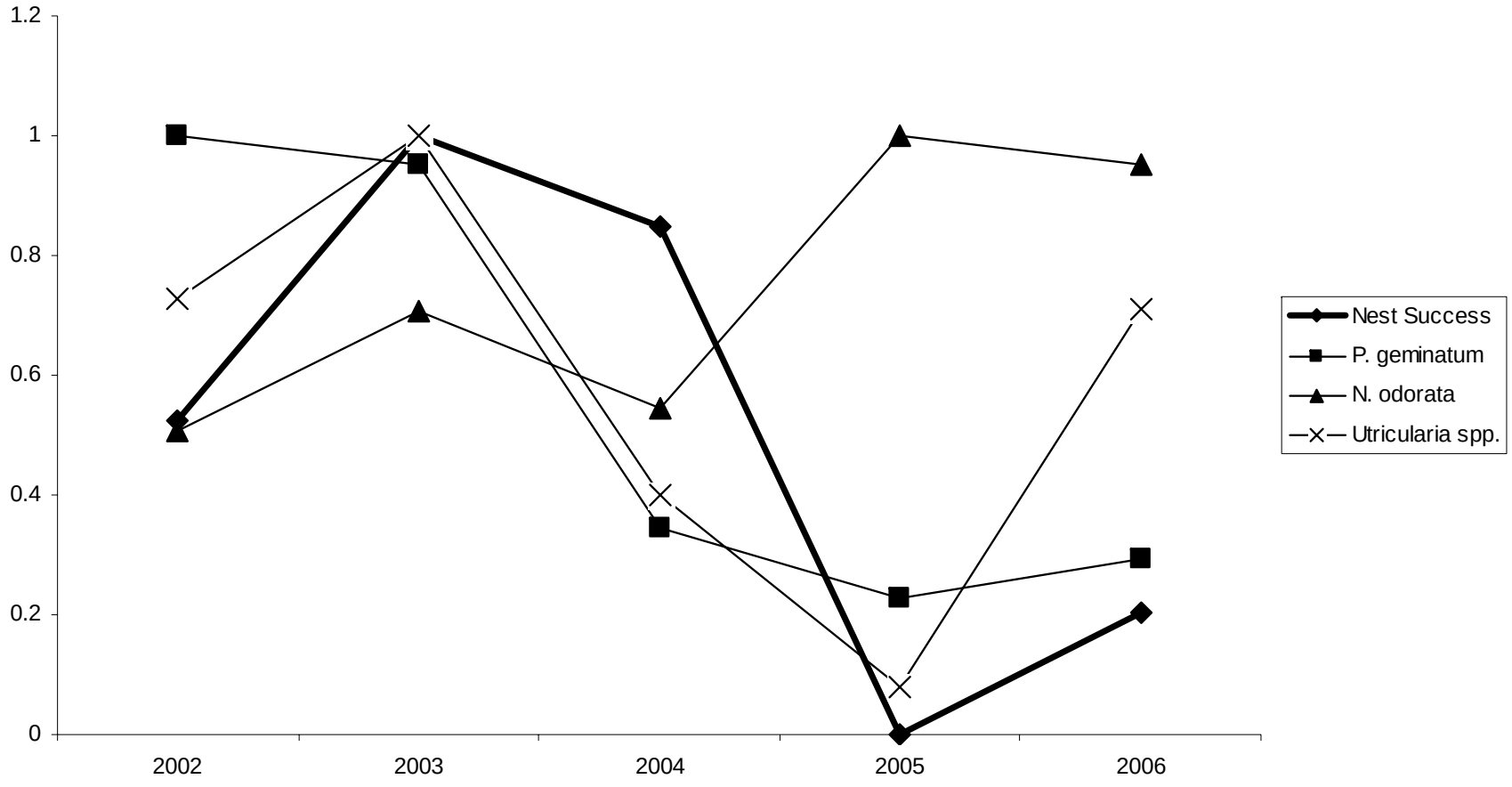
Hydrograph of WCA3A

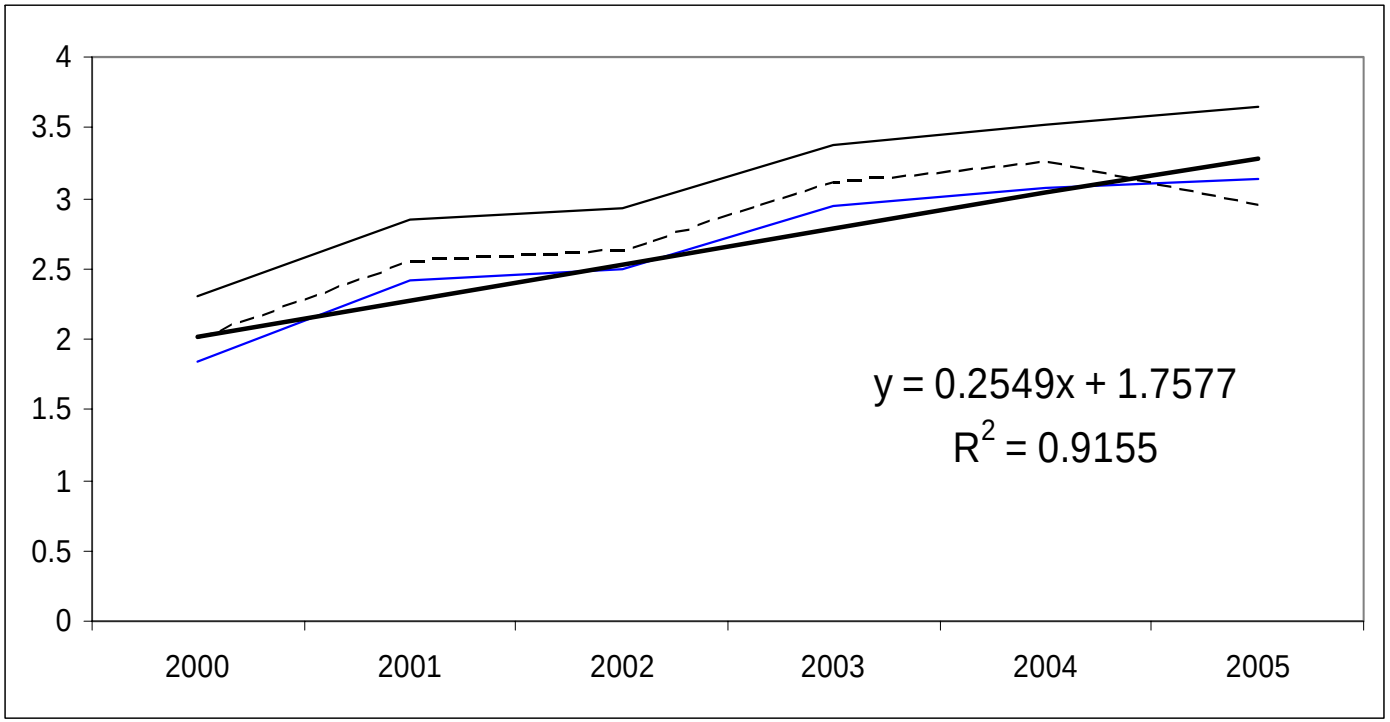


Shift in Nest Distributions

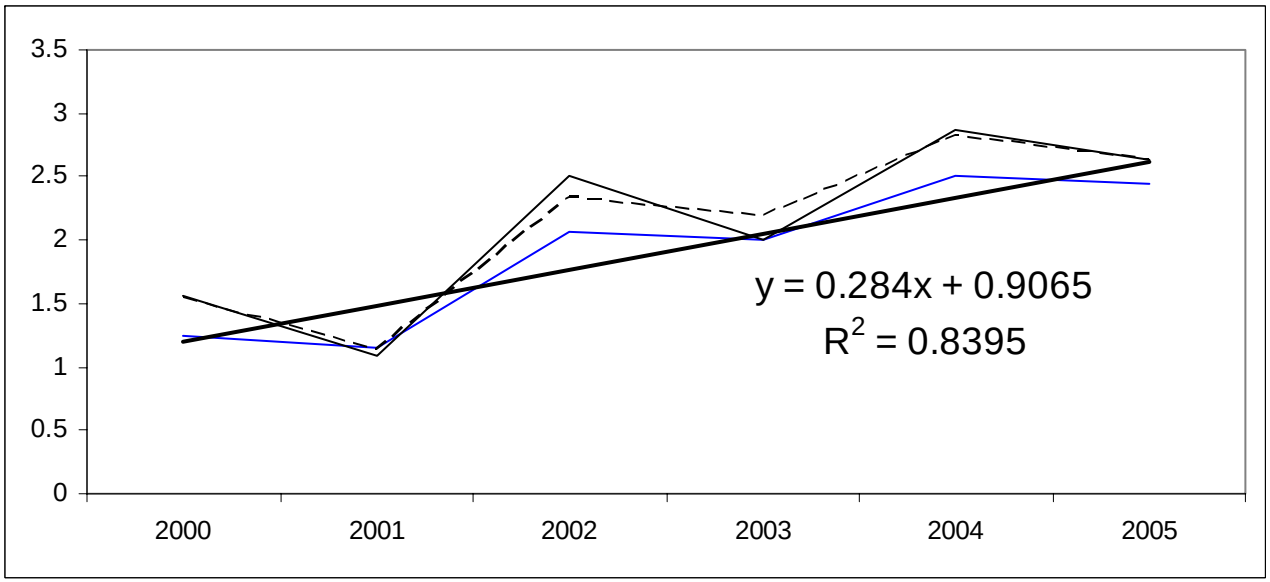



Dry
Wet
Stage (cm)
365
355
345
335
325
315
305
295
285
275
265
255
245
235
225
215
205
195
185
175
1978
1979
1981
1983
1984
1986
1988
1989
1991
1993
1994
1996
1998
1999
2001
2003
2004
Year


1.2
1
0.8
0.6
0.4
0.2
0
2002
2003
2004
2005
2006
Nest Success
P. geminatum
N. odorata
Utricularia spp.

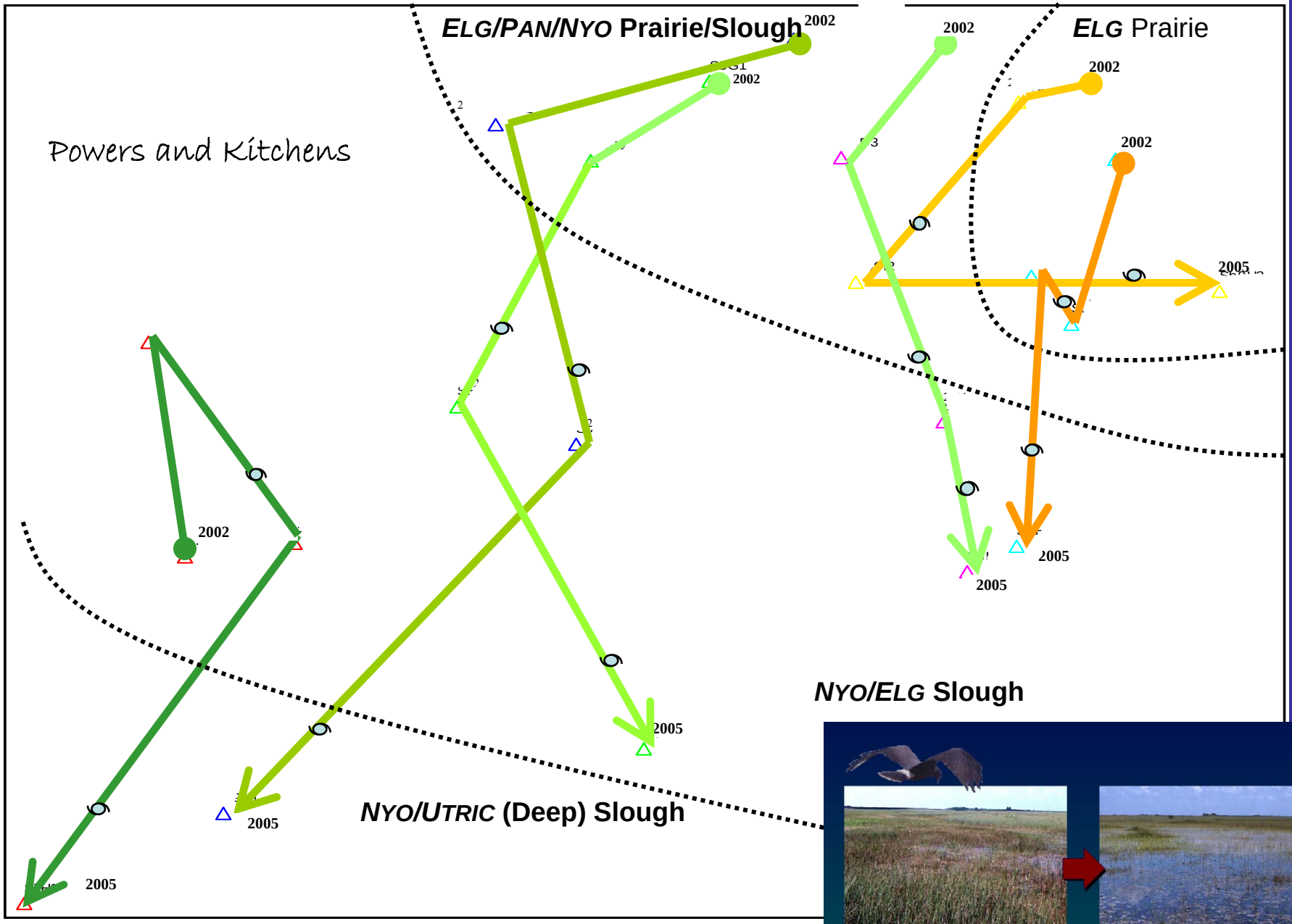

4
3.5
3
2.5
2
1.5
1
0.5
0
2000
2001
2002
2003
2004
2005
y = 0.2549x + 1.7577
R2 = 0.9155

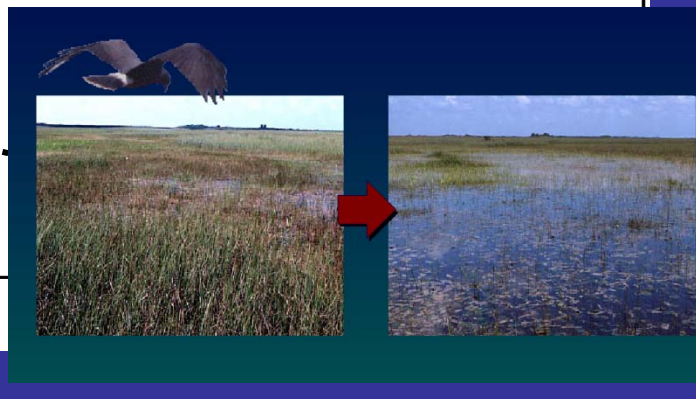
Maxes

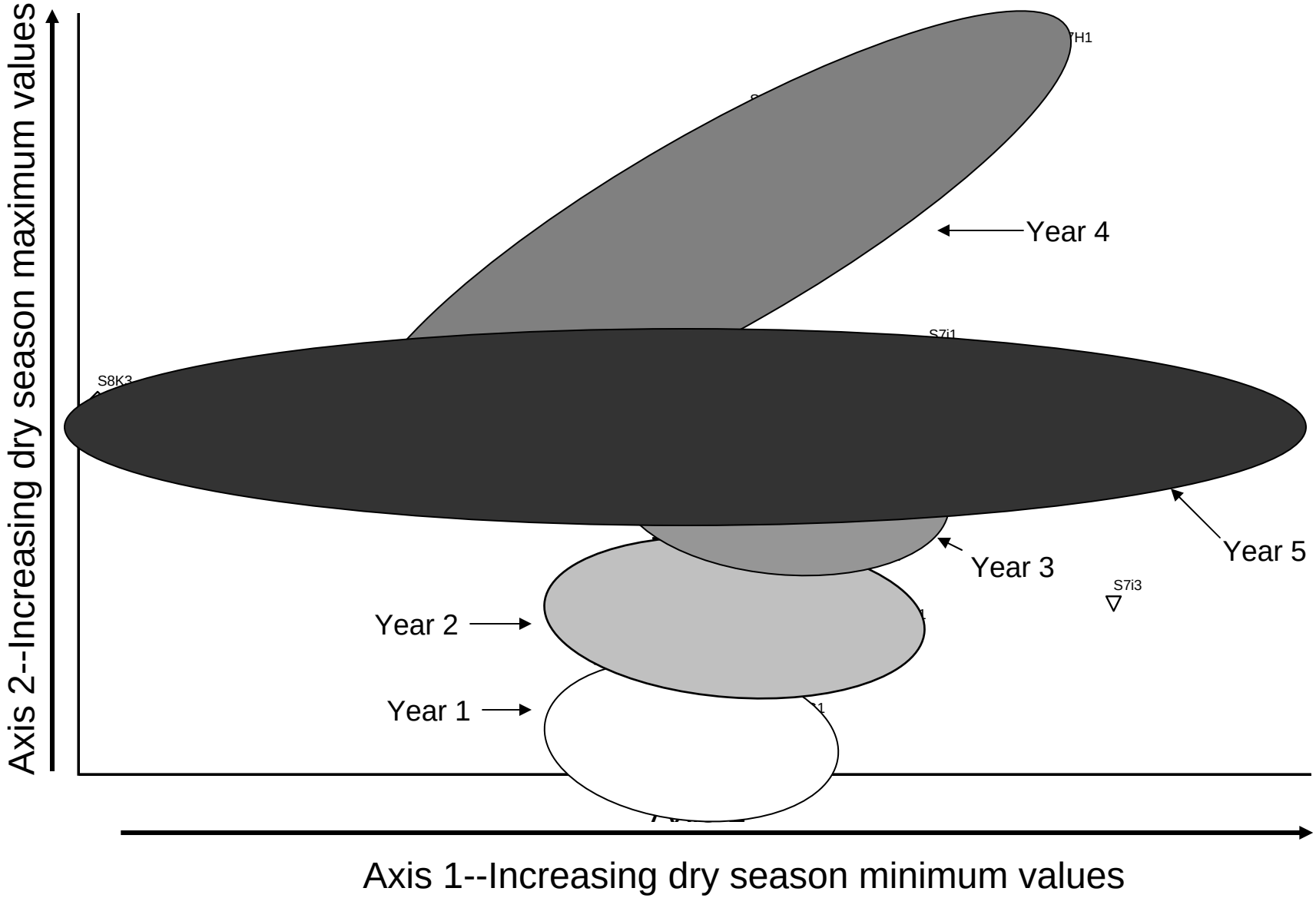

3.5
3
2.5
2
1.5
1
0.5
0
2000
2001
2002
2003
2004
2005
y = 0.284x + 0.9065
R2 = 0.8395

Range

Wet season NMS with frequency on Plots 7, 8, and 9

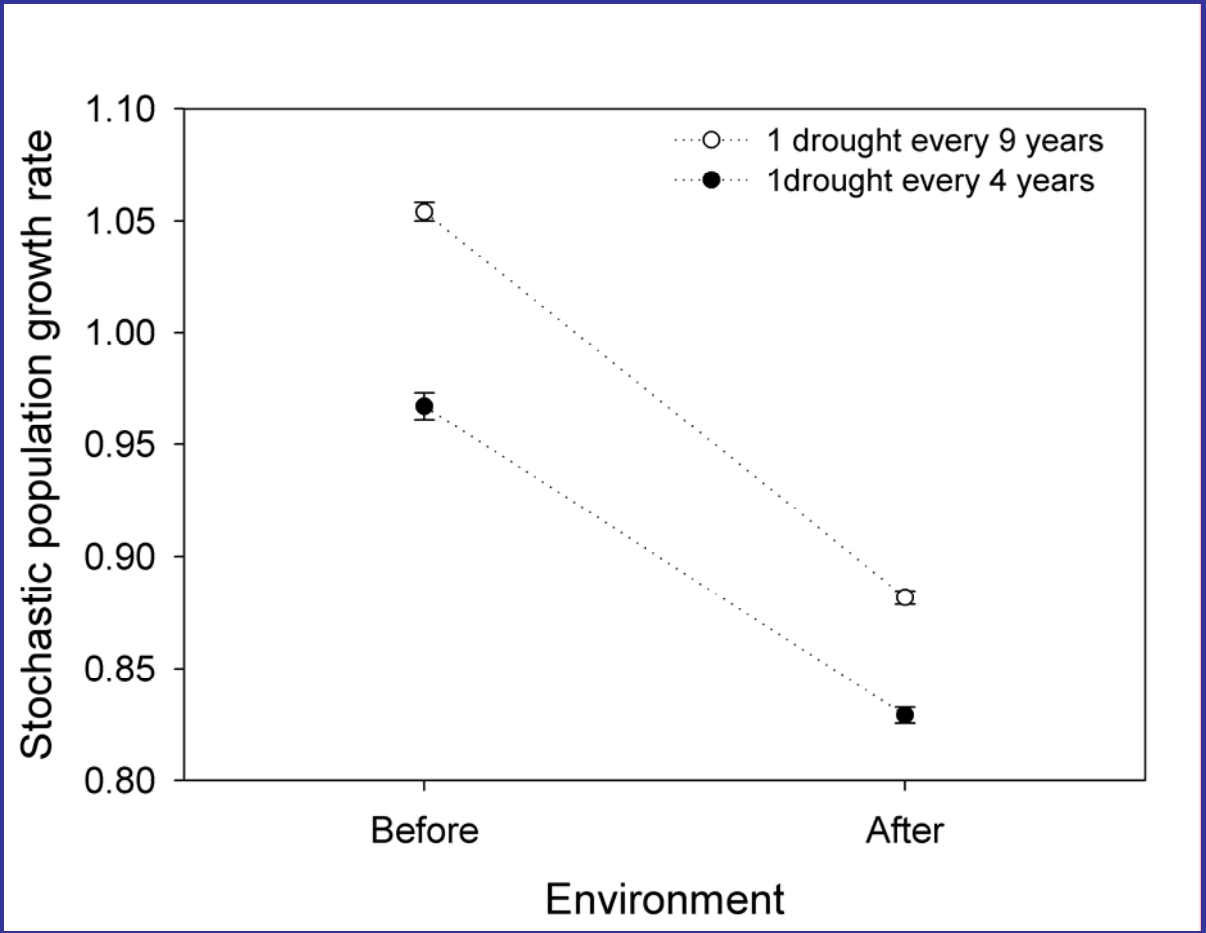






Zweig and Kitchens in review

Hypothesis 1: Hab. deg. Effect on Growth Rate



Increase in drying event frequency

1- Identification of three year categories:

-Drought, Dry and Wet

2- Hydrological indicators:

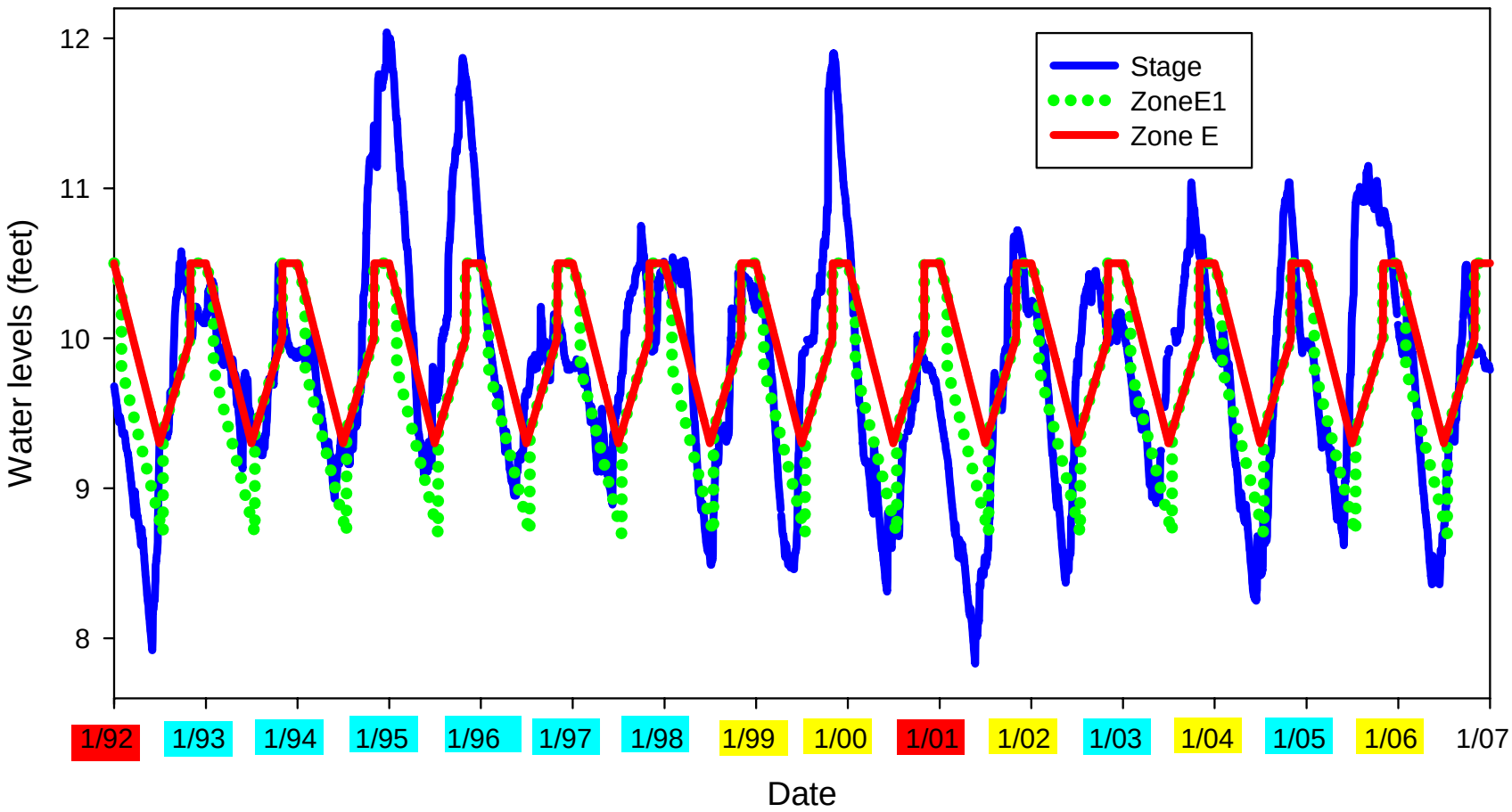
-Intensity of dry:

->min water levels; average during March-June

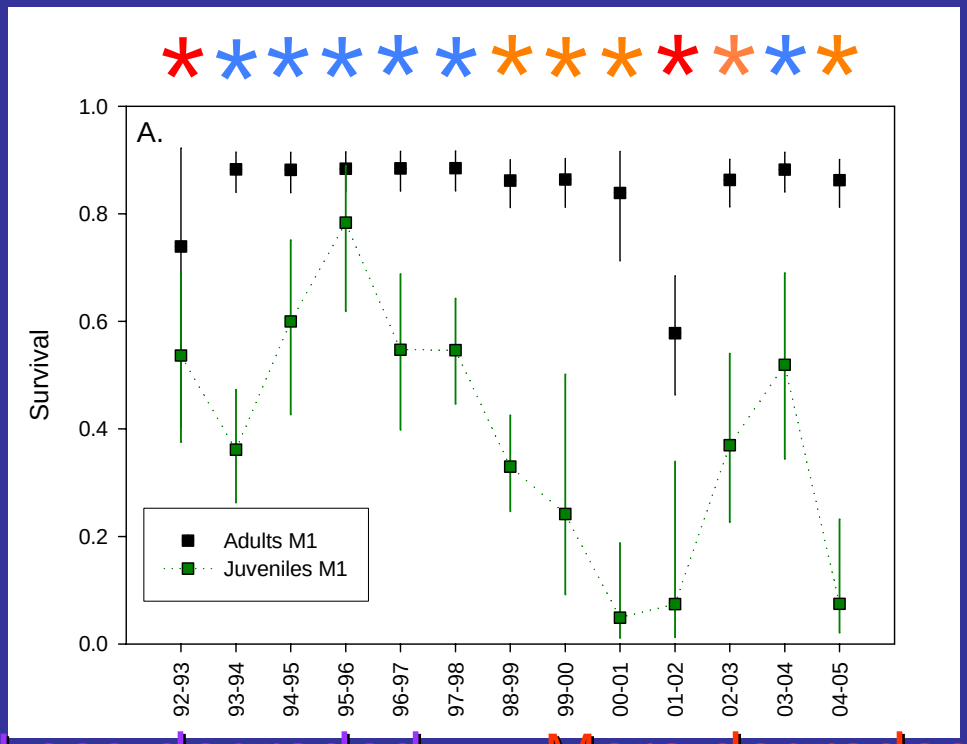
- Duration: # of days below threshold

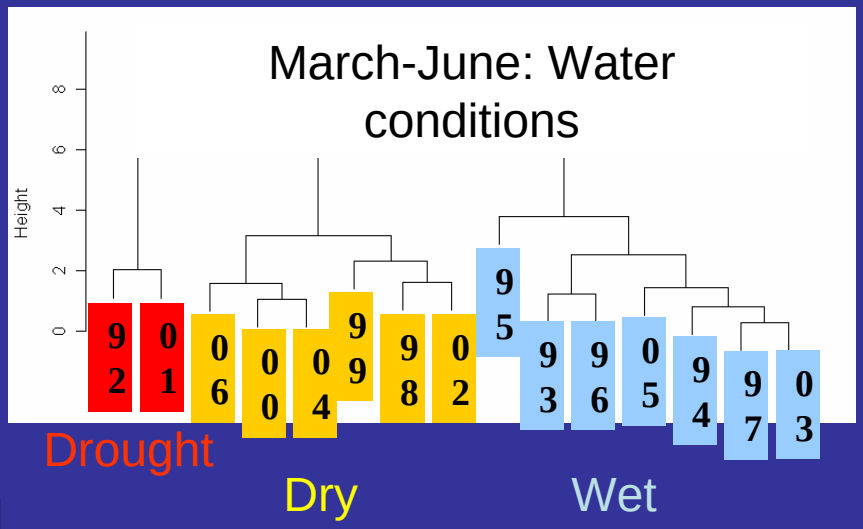
-Spatial extent of dry: # wetlands < 1SD

Water Management of WCA3A



Hypothesis 2: Increase in drying event frequency

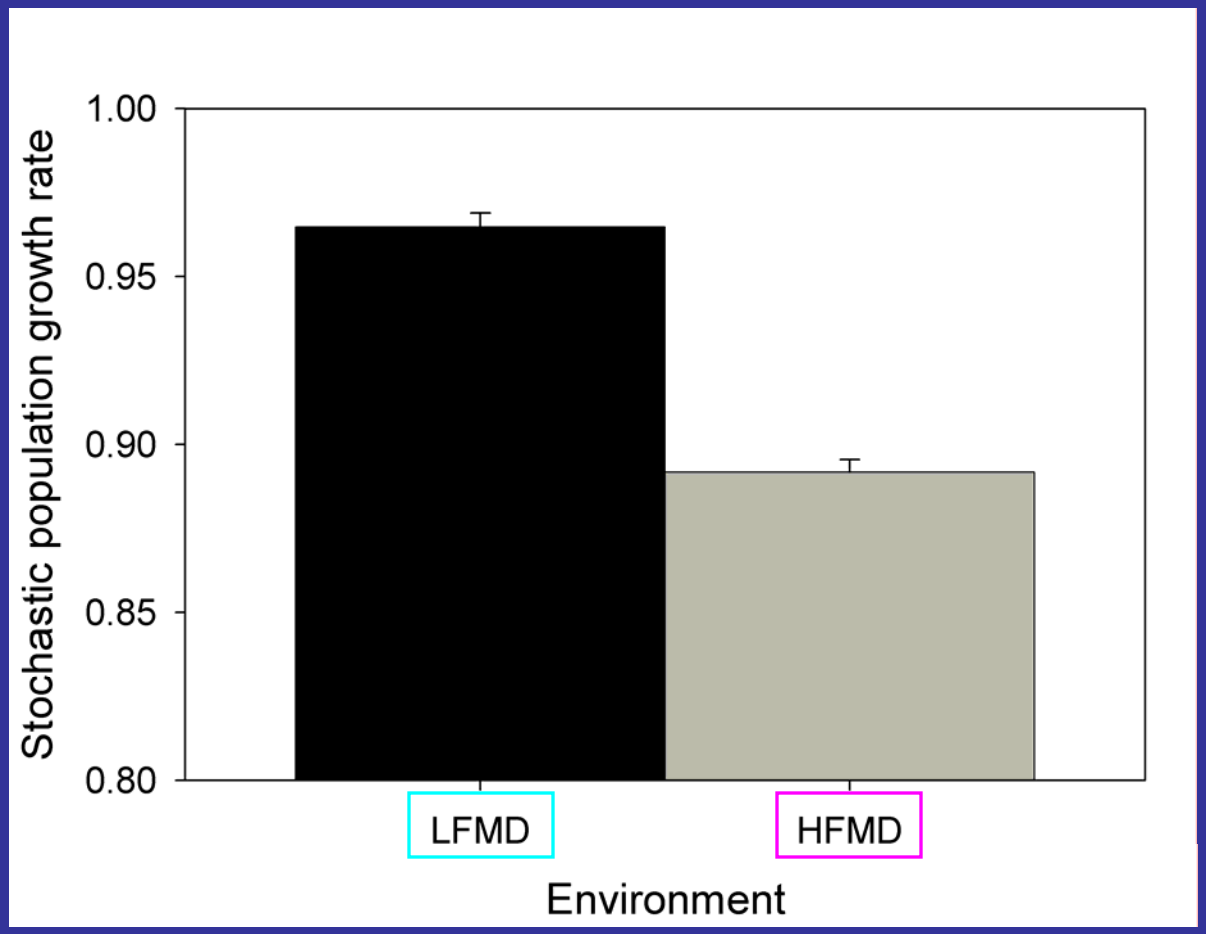




Less-degraded

More degraded

Hypothesis 2: Drying event freq
Population growth rate

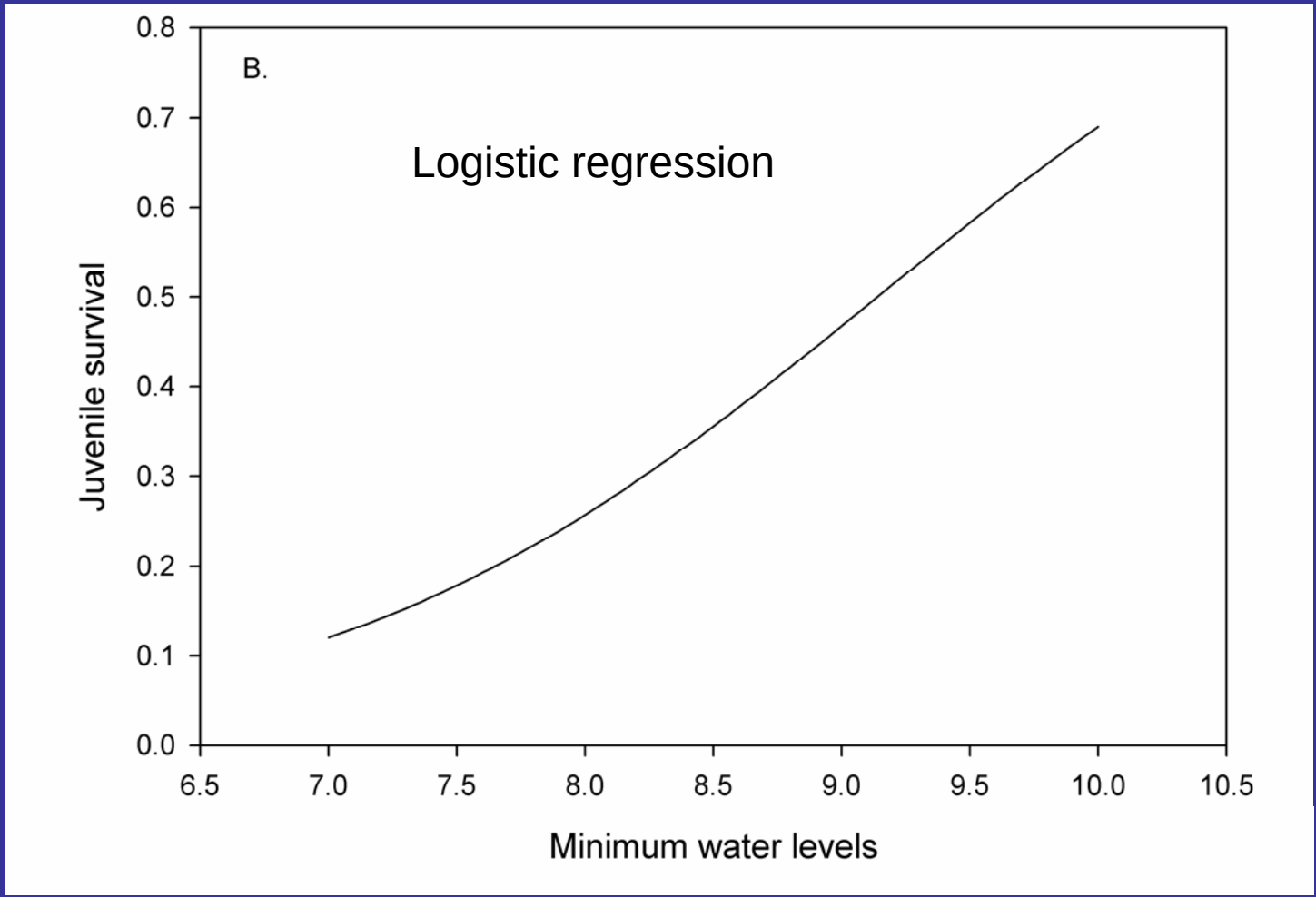


1992	R	1	1
1993	B	2	2
1994	B	3	3
1995	B	4	4
1996	B	5	5
1997	B	6	6
1998	O	7	7
1999	O	8	1
2000	O	9	2
2001	R	10	3
2002	O	11	4
2003	B	12	5
2004	O	13	6
2005	B	12	5

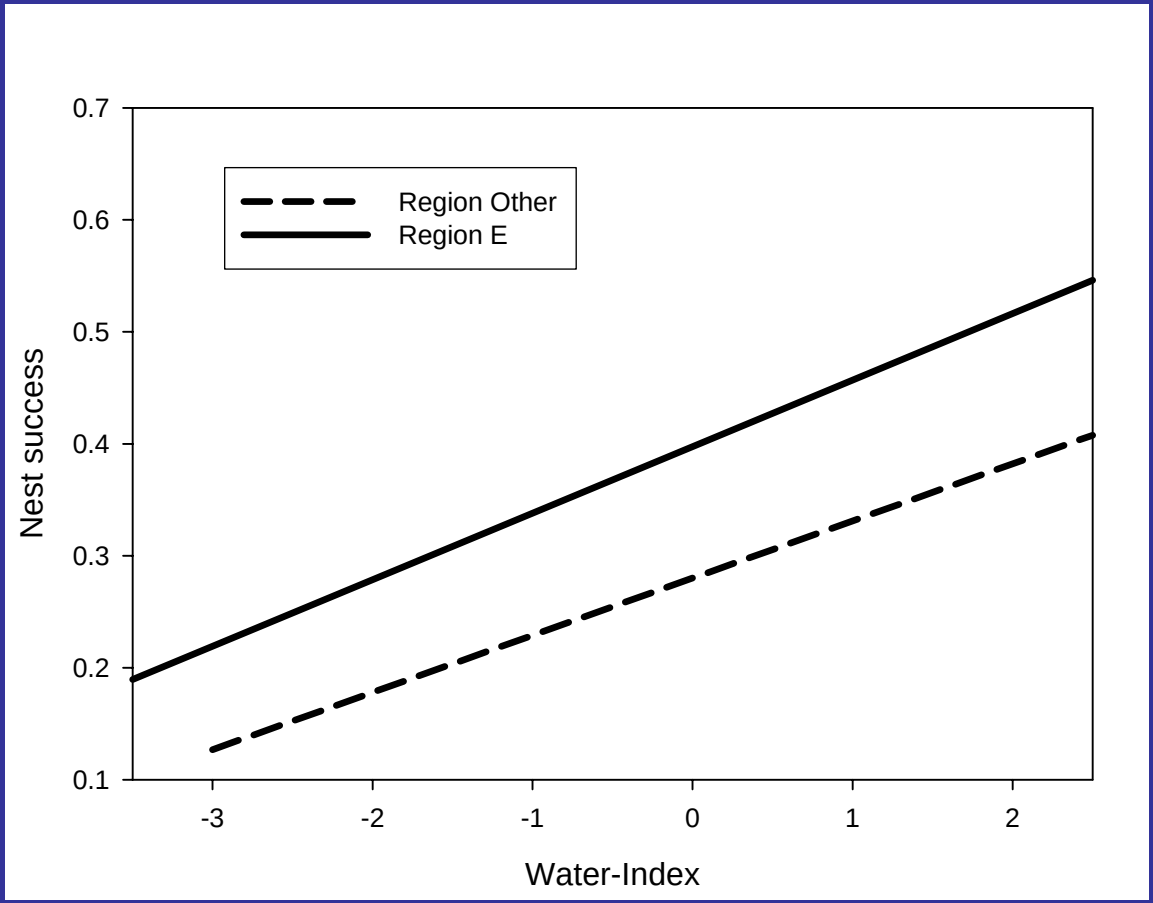
LFMD

HFMD

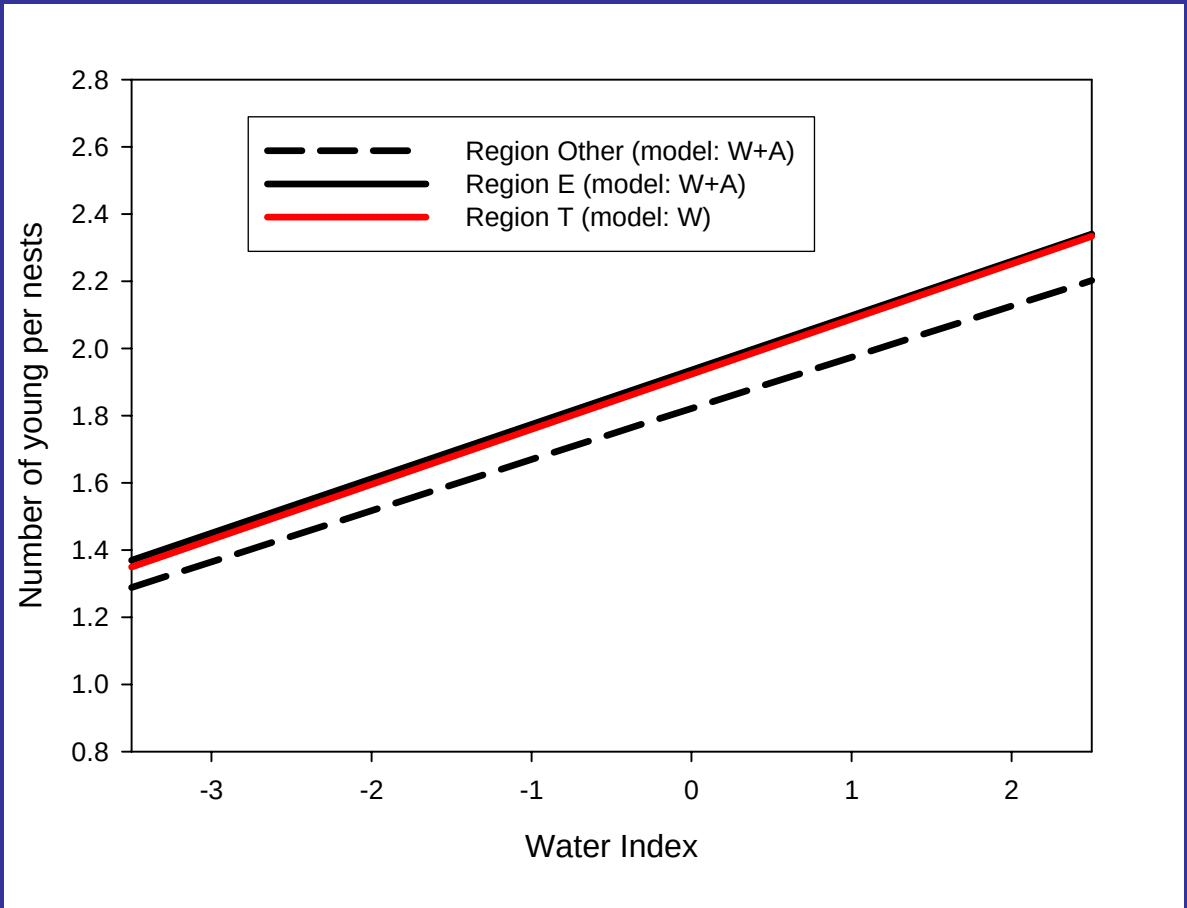
Hypothesis 2: Drying event freq. Survival



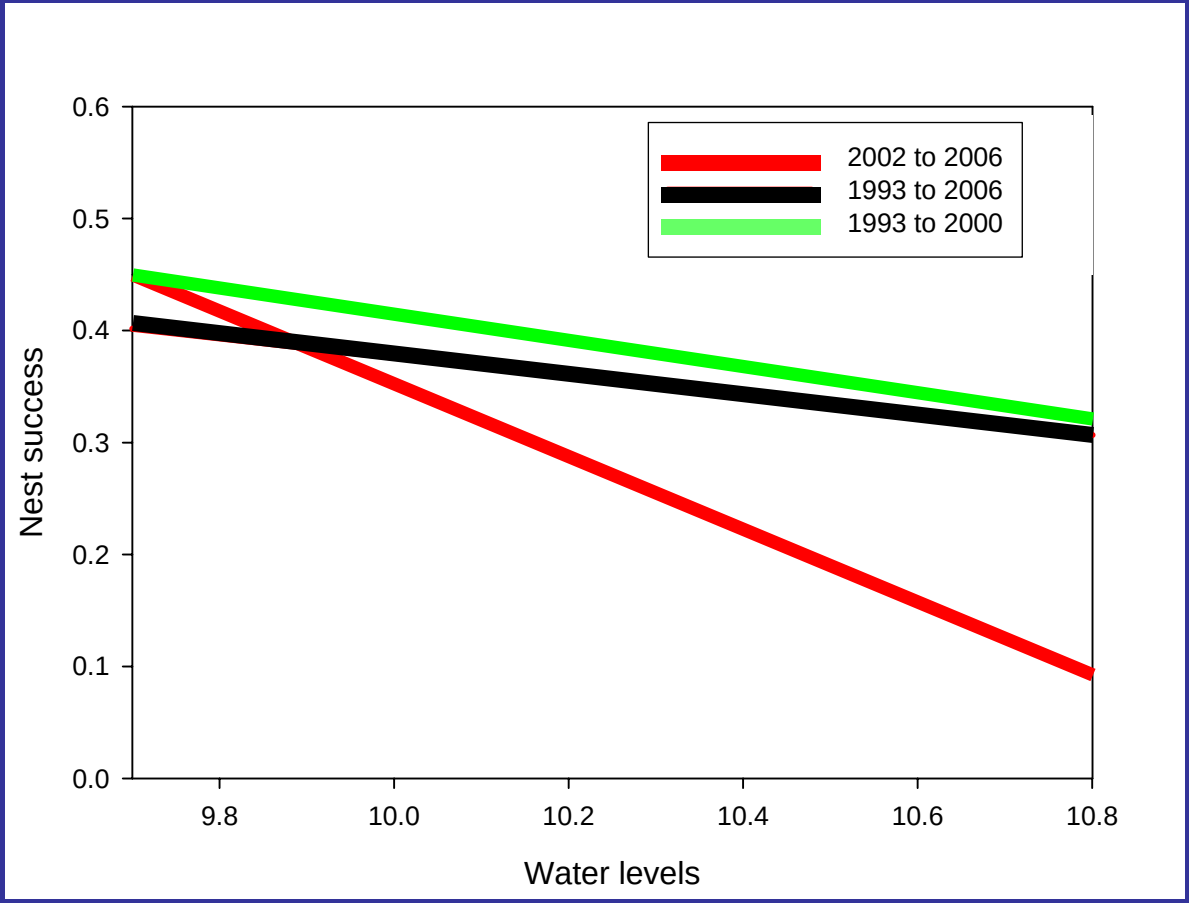
Hypothesis 2: Drying event freq. Nest success



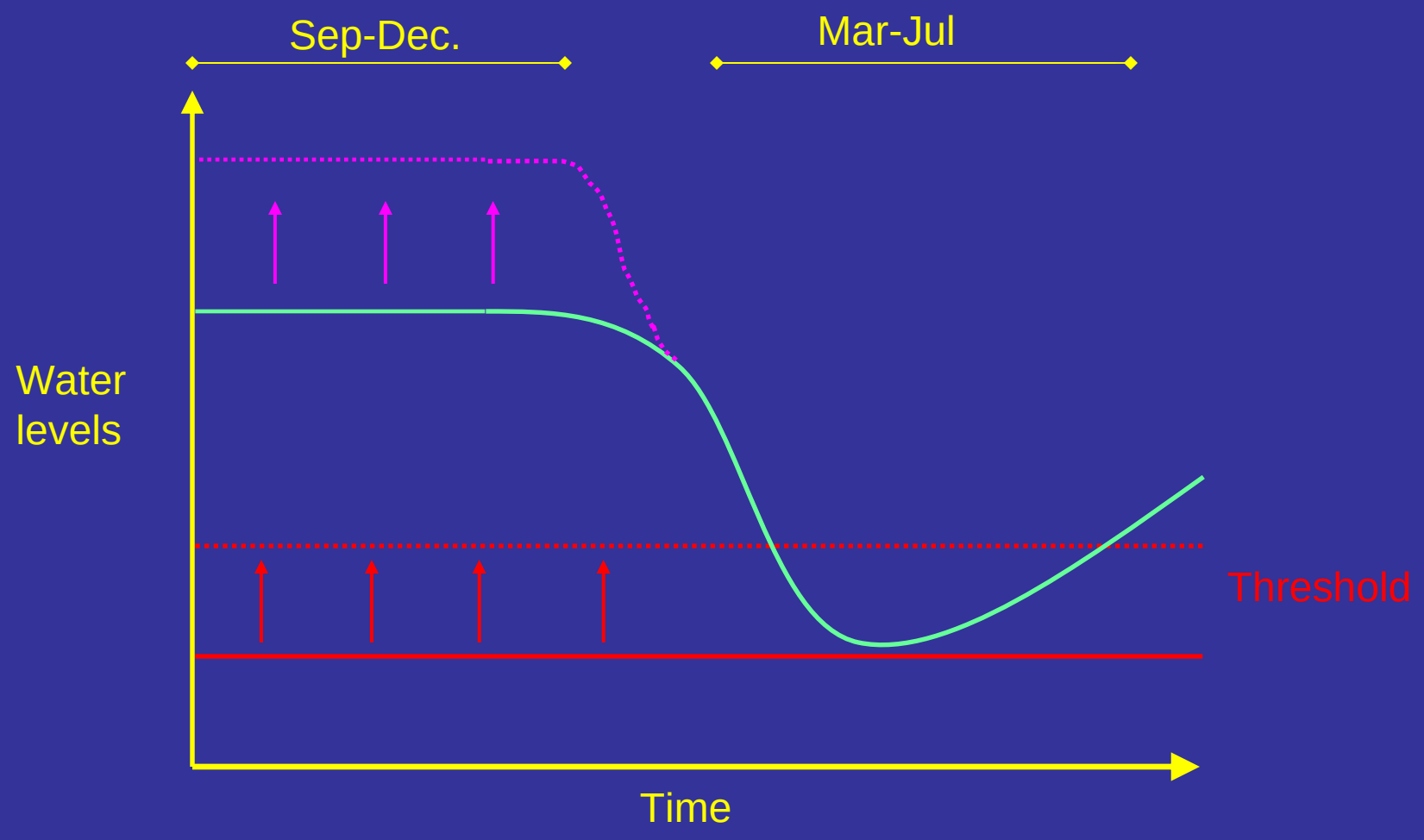
Hypothesis 2: Drying event freq. # young/nest



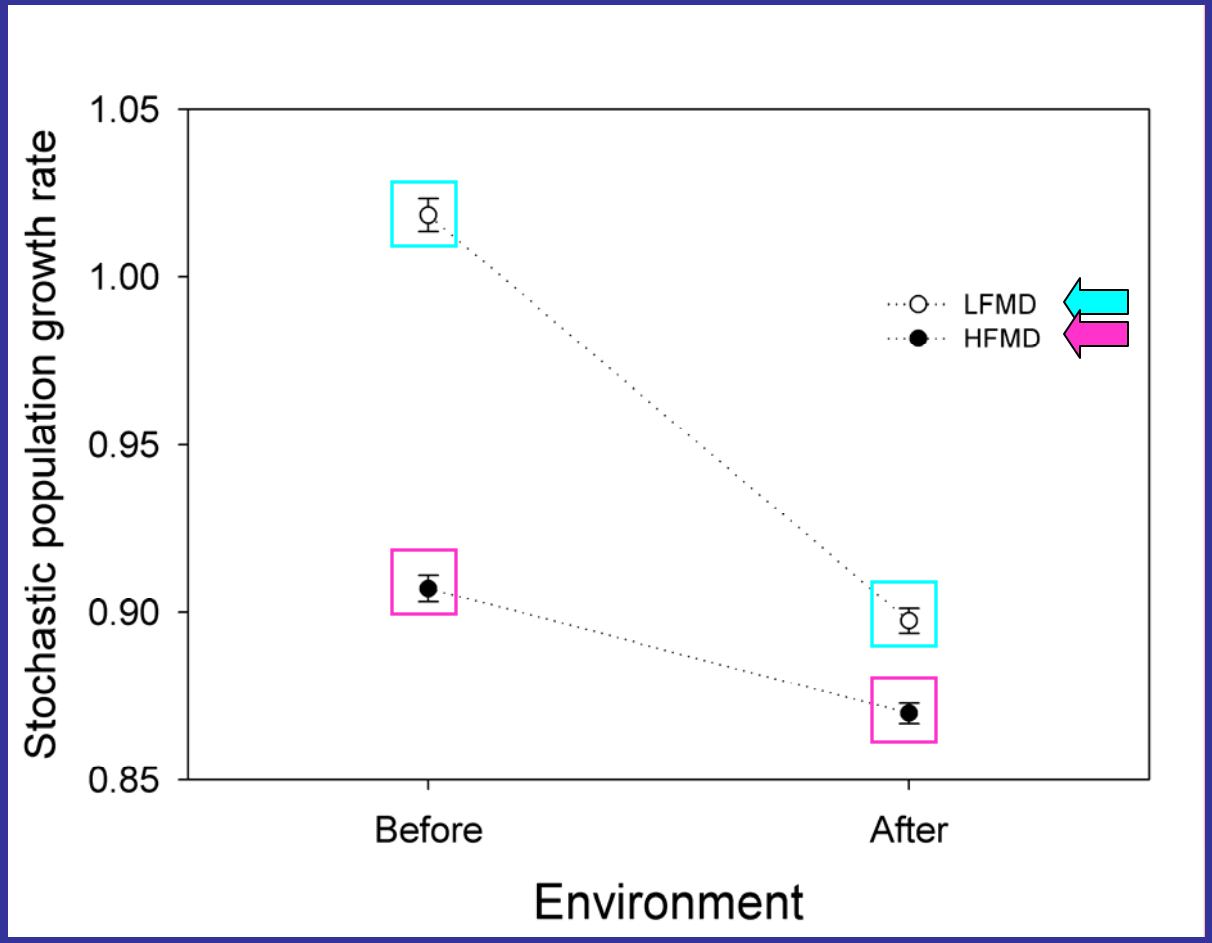
Sensitivity of nest success to HW prior to breeding



Hypothesis 3: Increase in drying events frequency & habitat conversion (extent and qual.)



Increase in drying events frequency & habitat conversion

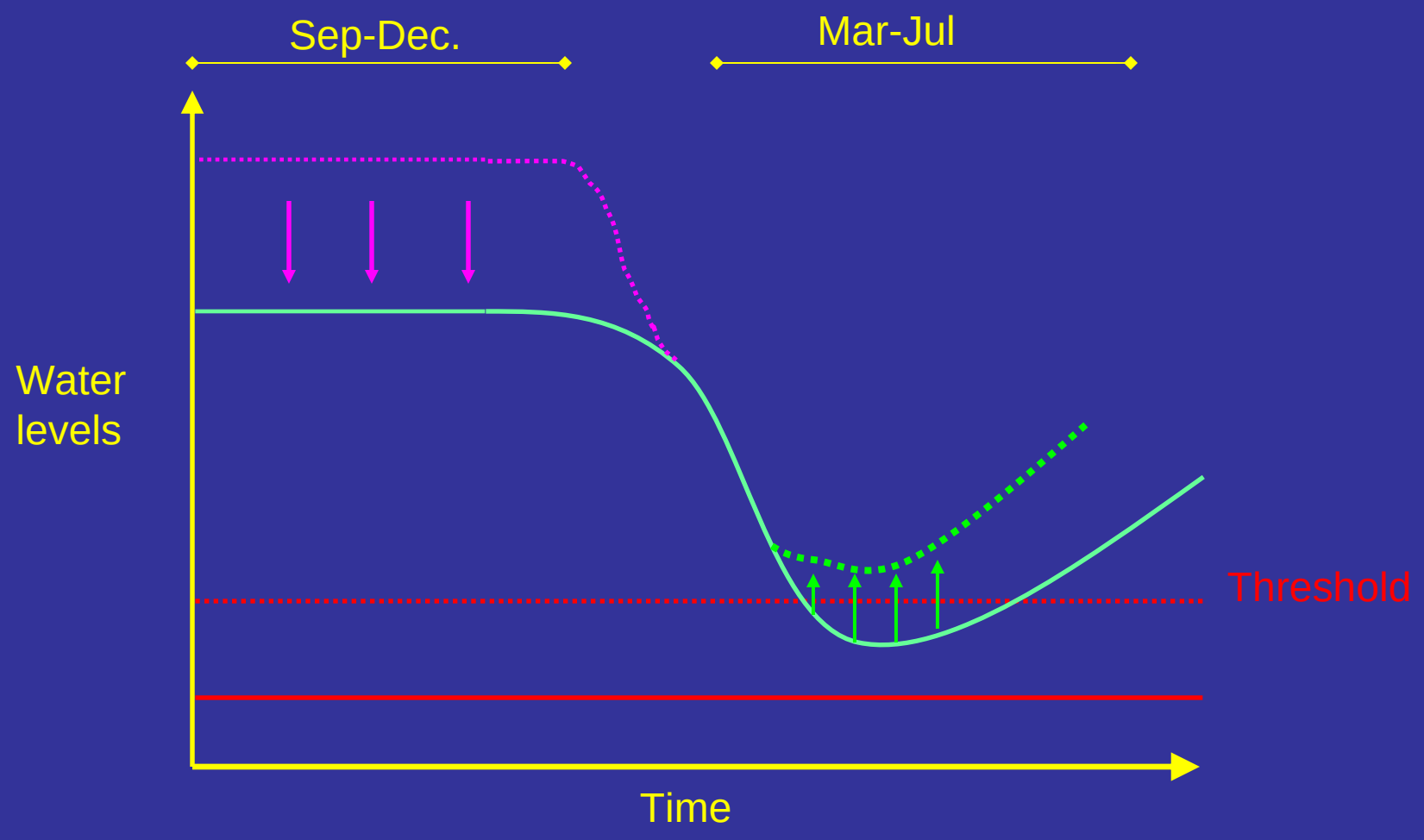
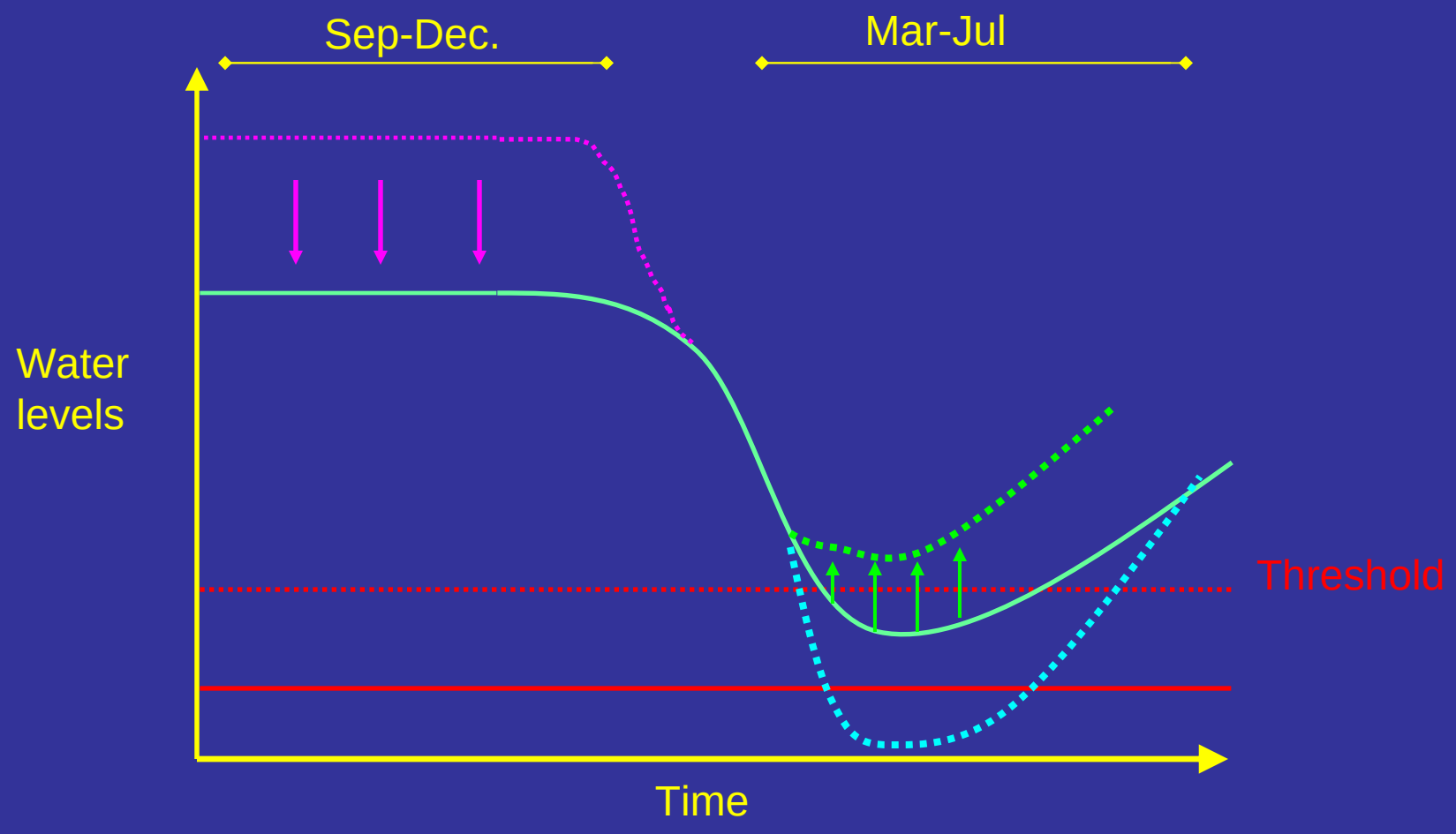


1992	R	1	1
1993	B	2	2
1994	B	3	3
1995	B	4	4
1996	B	5	5
1997	B	6	6
1998	O	7	7
1999	O	8	1
2000	O	9	2
2001	R	10	3
2002	O	11	4
2003	B	12	5
2004	O	13	6
2005	B	12	5

LFMD

HFMD

Management recommendation (1)



Management implications (2)