Flat-tailed Horned Lizard Demographic Monitoring in the Yuma Desert Management Area

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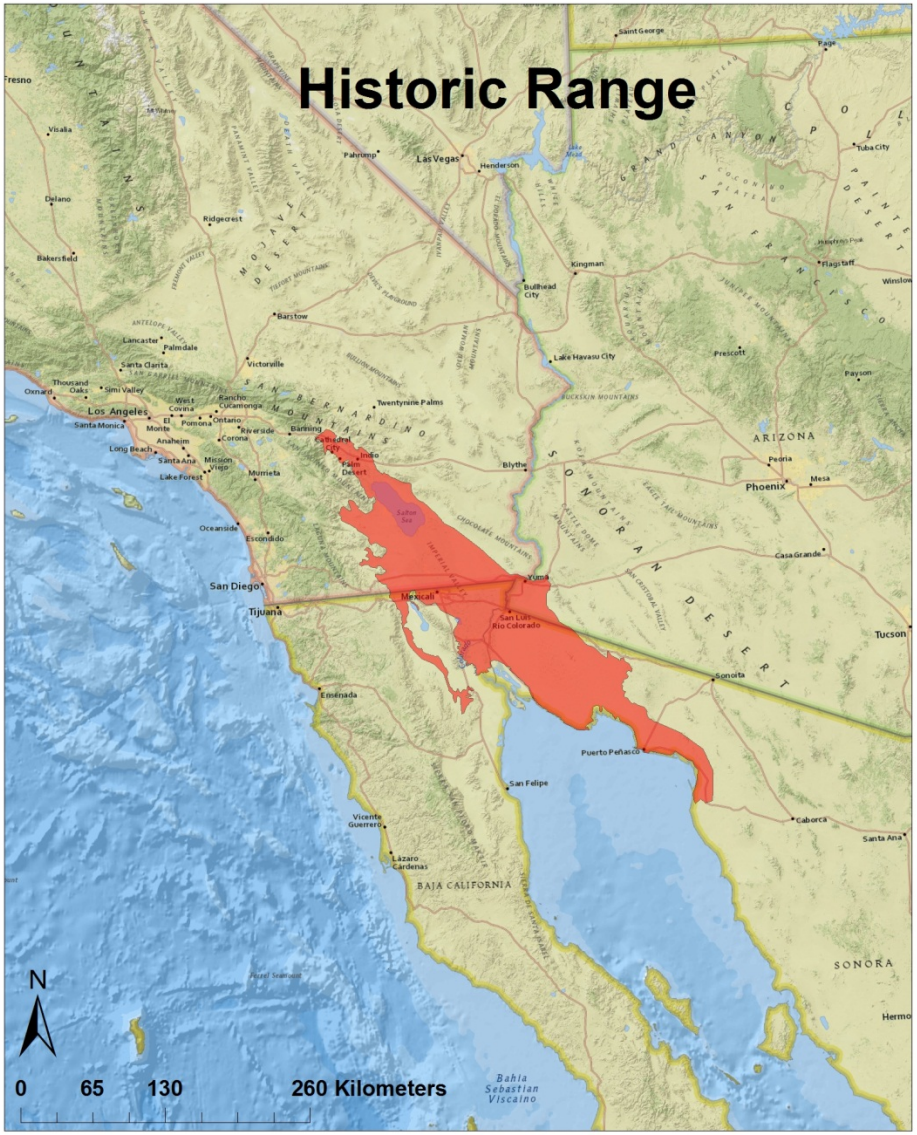
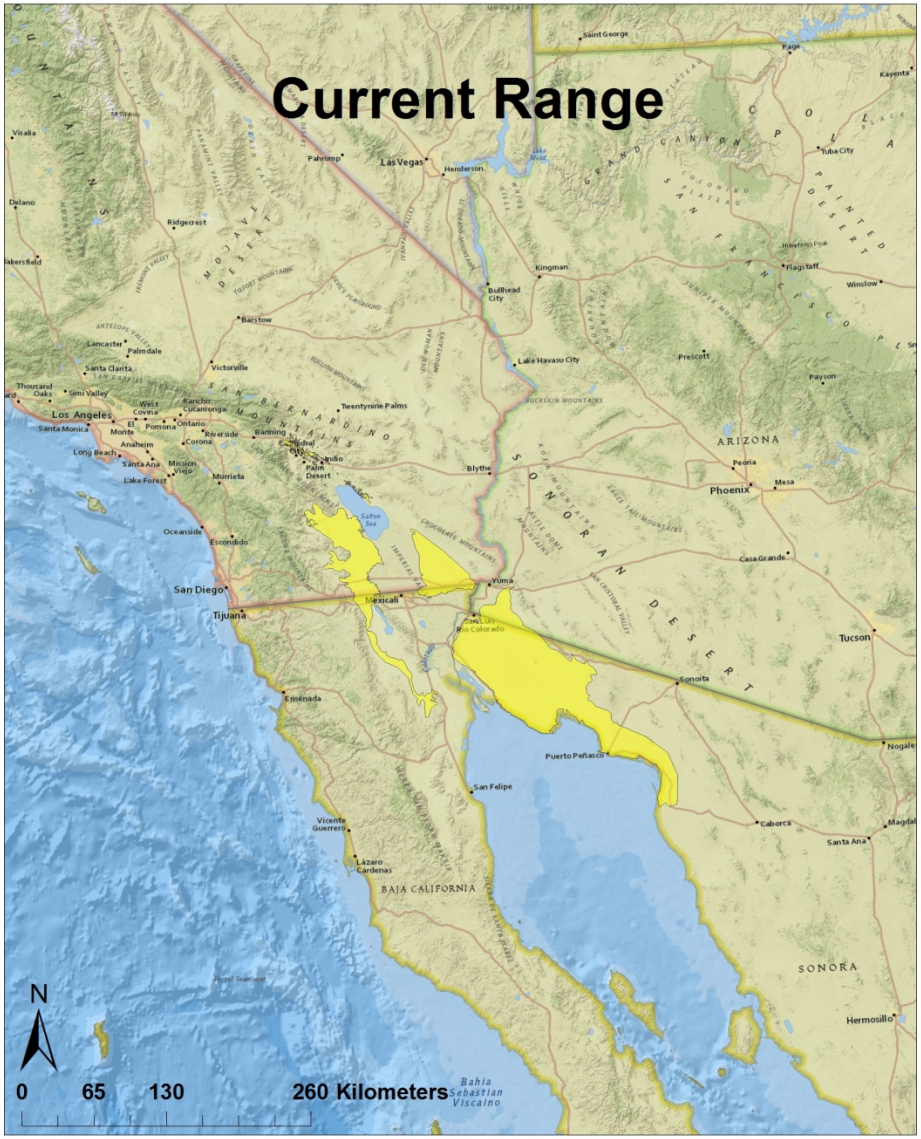
Flat-tailed Horned Lizard (*Phrynosoma mcallii*; FTHL)

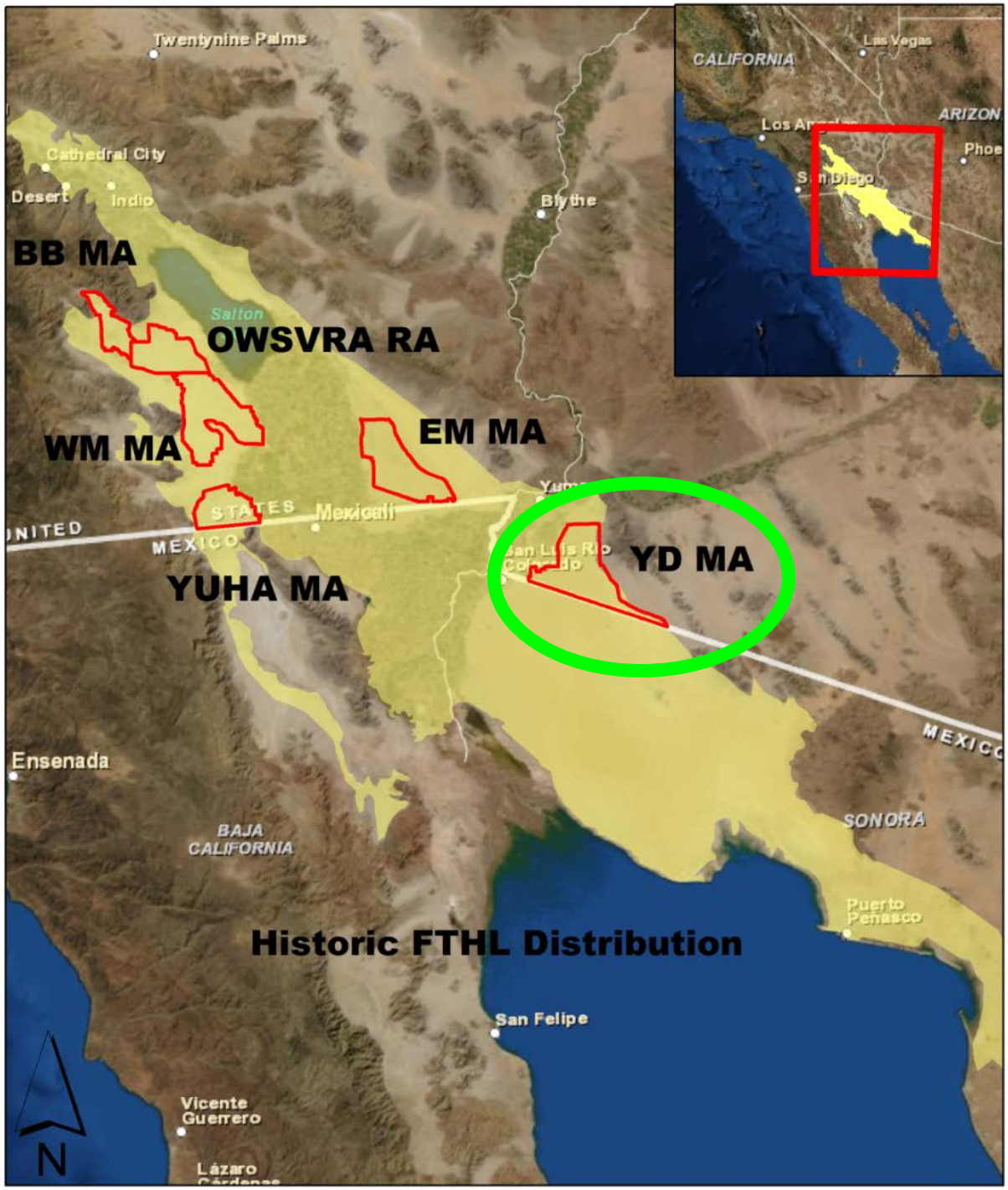
- LCR MSCP covered species
- Habitat:
  - Creosote-White Bursage Plant Assemblage in Sonoran Desert


Historic Range
N
0 65 130 260 Kilometers


Current Range
N
0 65 130 260 Kilometers

FTHL Interagency Coordinating Committee

- Established in 1994 by an MOU between multiple stakeholders (state, federal, and private).
- Developed Rangewide Management Strategy that identified specific actions and responsibilities of the signatories.
- Secure and maintain habitat for self-sustaining populations through establishment of 5 MAs and one RA (FTHL ICC 2003).
- Monitor FTHL yearly at all MAs (FTHL ICC 2008)
  - **Demography**
  - Occupancy

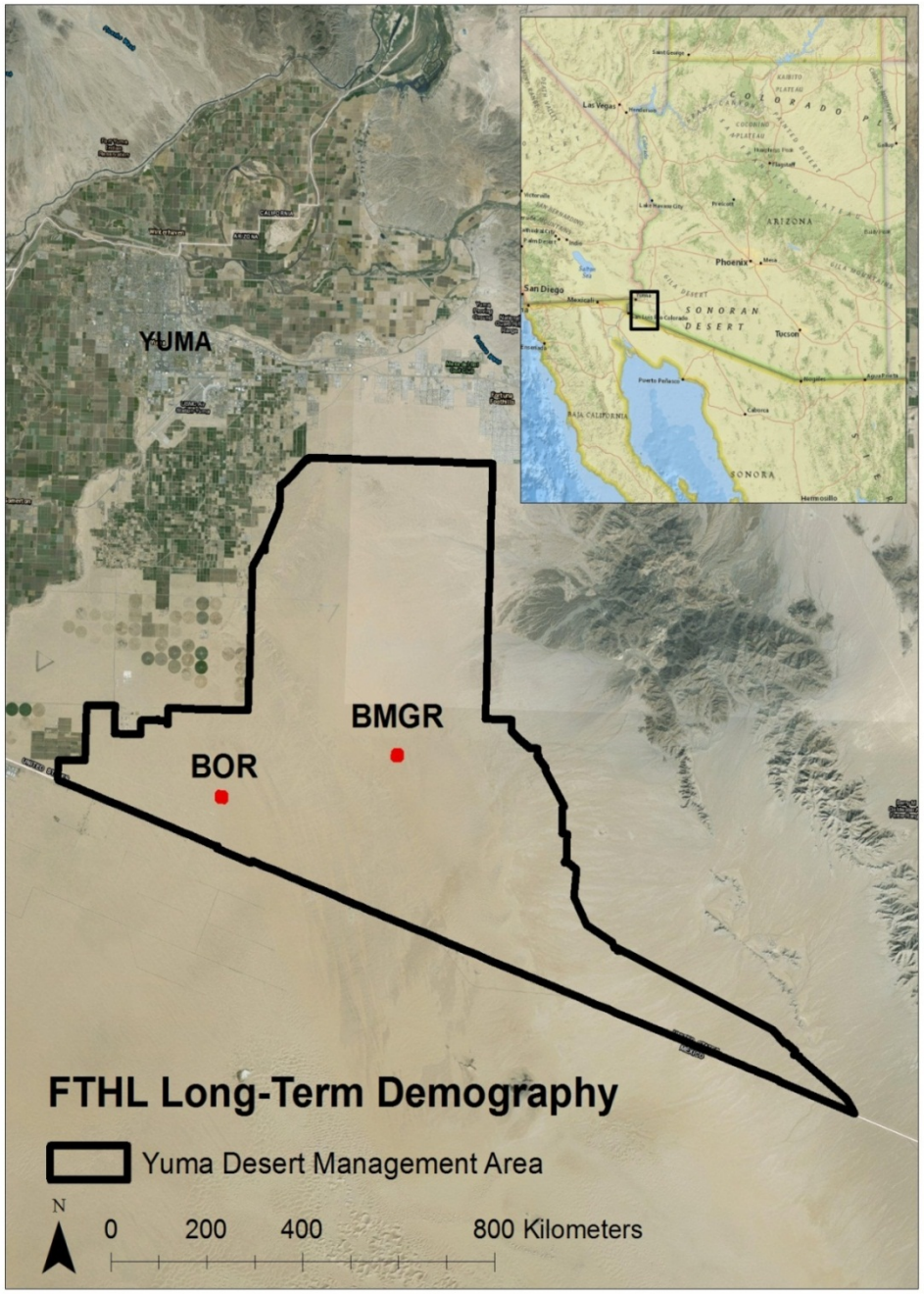

Twentynine Palms
Cathedral City
Desert
Indio
Blythe
BB MA
Salton
OWSVRA RA
WM MA
EM MA
STATES
Mexicali
UNITED
MEXICO
YUHA MA
San Luis Rio Colorado
YD MA
MEXICO
Ensenada
BAJA CALIFORNIA
SONORA
Puerto Peñasco
Historic FTHL Distribution
San Felipe
Vicente Guerrero
Lázaro Cárdenas
N
CALIFORNIA
Las Vegas
ARIZONA
Los Angeles
San Diego
Phoenix

Objectives:

- **Survey two long-term demography plots established in 2008 on the Yuma Desert Management Area (YDMA)**
  - FTHL 8-year summary of captures
  - FTHL population estimates
  - **2015 Only: Colorado Desert Sidewinder population estimate*

Study Area:

- YDMA = 53,015 ha.
  - **BMGR-** Barry M. Goldwater Range
  - **BOR-** Bureau of Reclamation
- 9 hectare plots



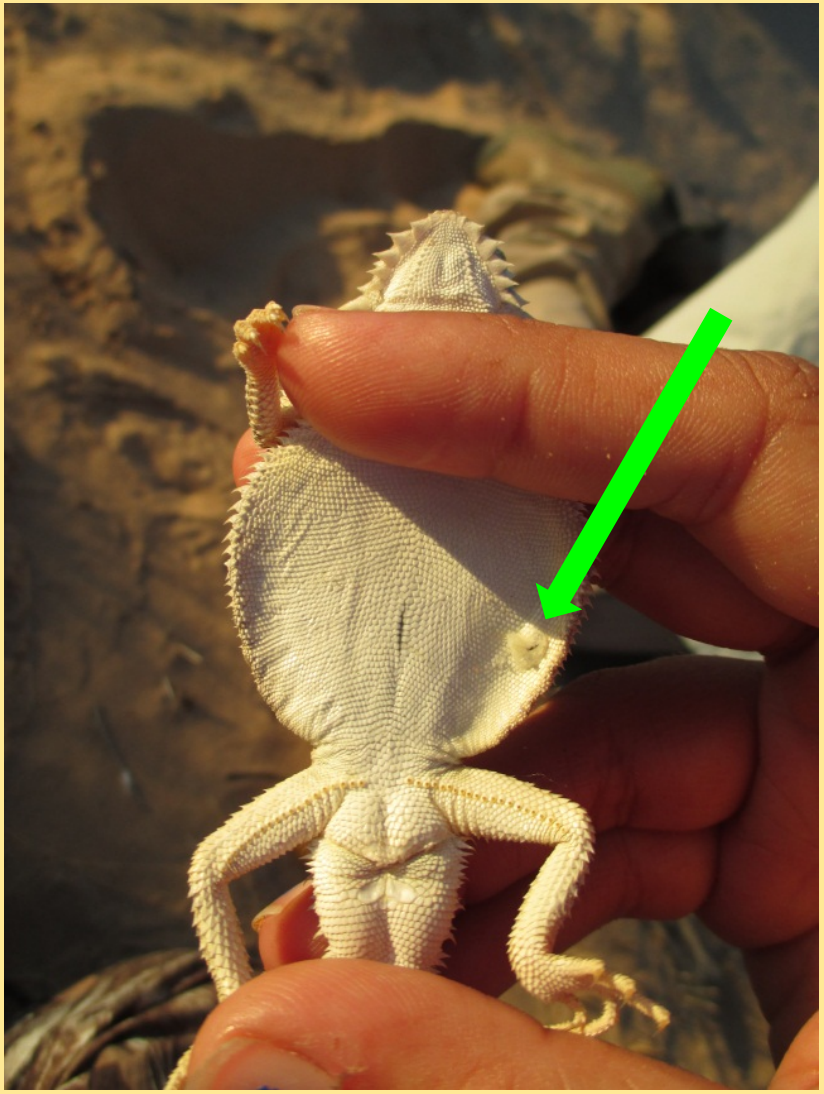
Methods: Surveys

- 10 day surveys per plot
- Walk transects (20 m apart)
- **Tracking and Visual Encounters**

Methods: Captures

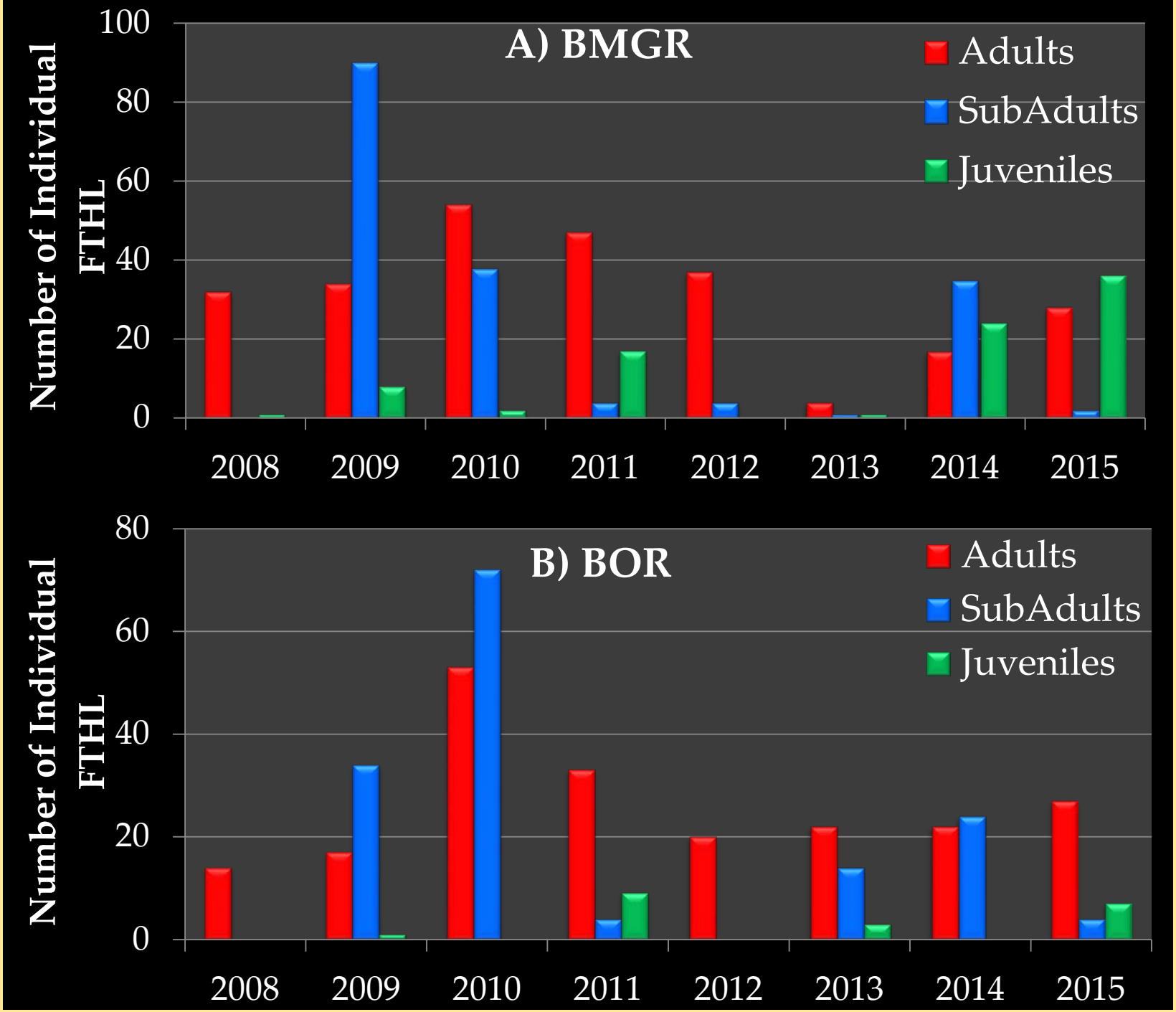
- Morphology
  - SVL, mass, gender

- Permanent marking
  - FTHLs:
    - PIT tag, SVL ≥ 40 mm
    - Toe clip, SVL < 40 mm
  - Sidewinders:
    - PIT Tag, SVL >180 mm



FTHL Summary of Captures

Variable	2015			2008-2015
	BOR	BMGR	Total	
Total Captures	90	145	235	**1,645**
Individual Lizards	**34**	**54**	88	**702**
Individual Males	16	24	40	331
Individual Females	18	30	48	370


A) BMGR
Adults
SubAdults
Juveniles
Number of Individual
FTHL
100
80
60
40
20
0
2008
2009
2010
2011
2012
2013
2014
2015
B) BOR
Adults
SubAdults
Juveniles
Number of Individual
FTHL
80
60
40
20
0
2008
2009
2010
2011
2012
2013
2014
2015

FTHL Population Modeling

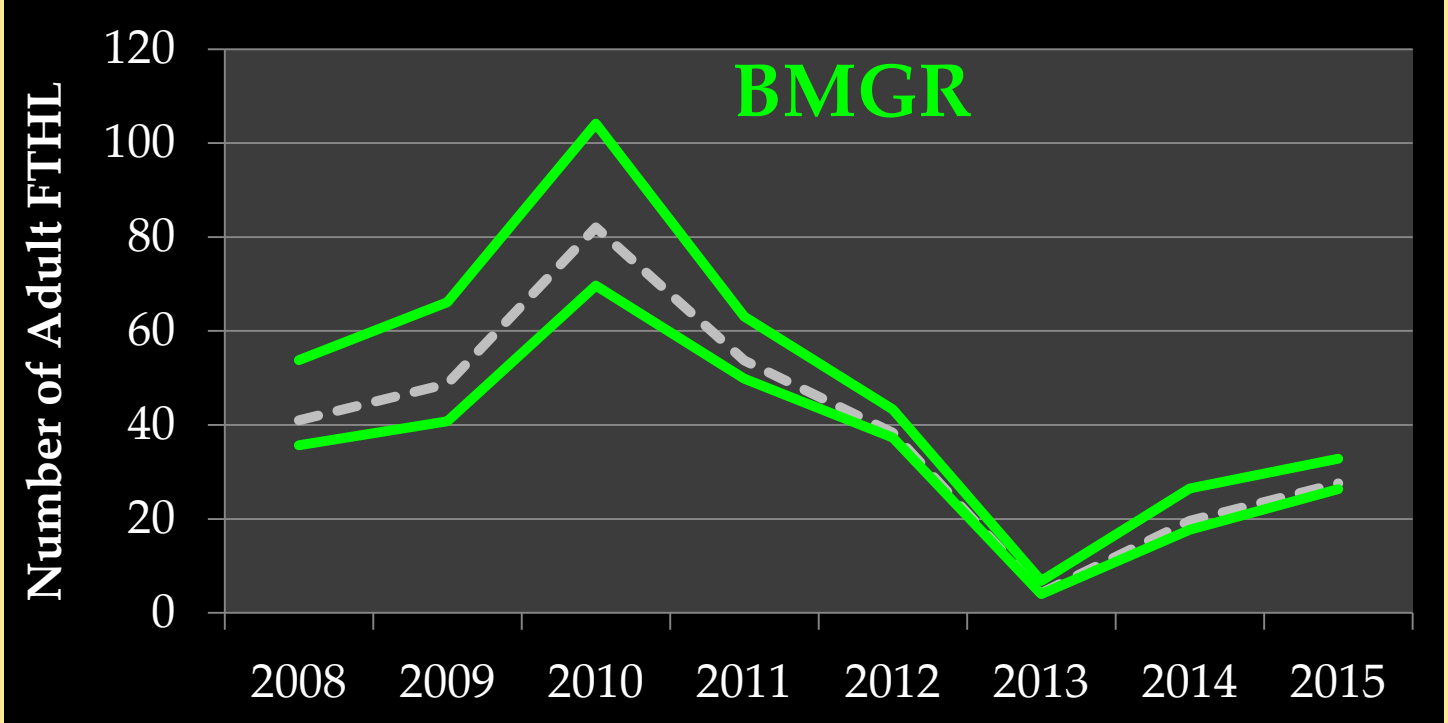
- Utilized data from all years, 2008-2015
- **Robust design multi-year model** (Program MARK)
  - Estimates **population size**
  - Adult lizards only

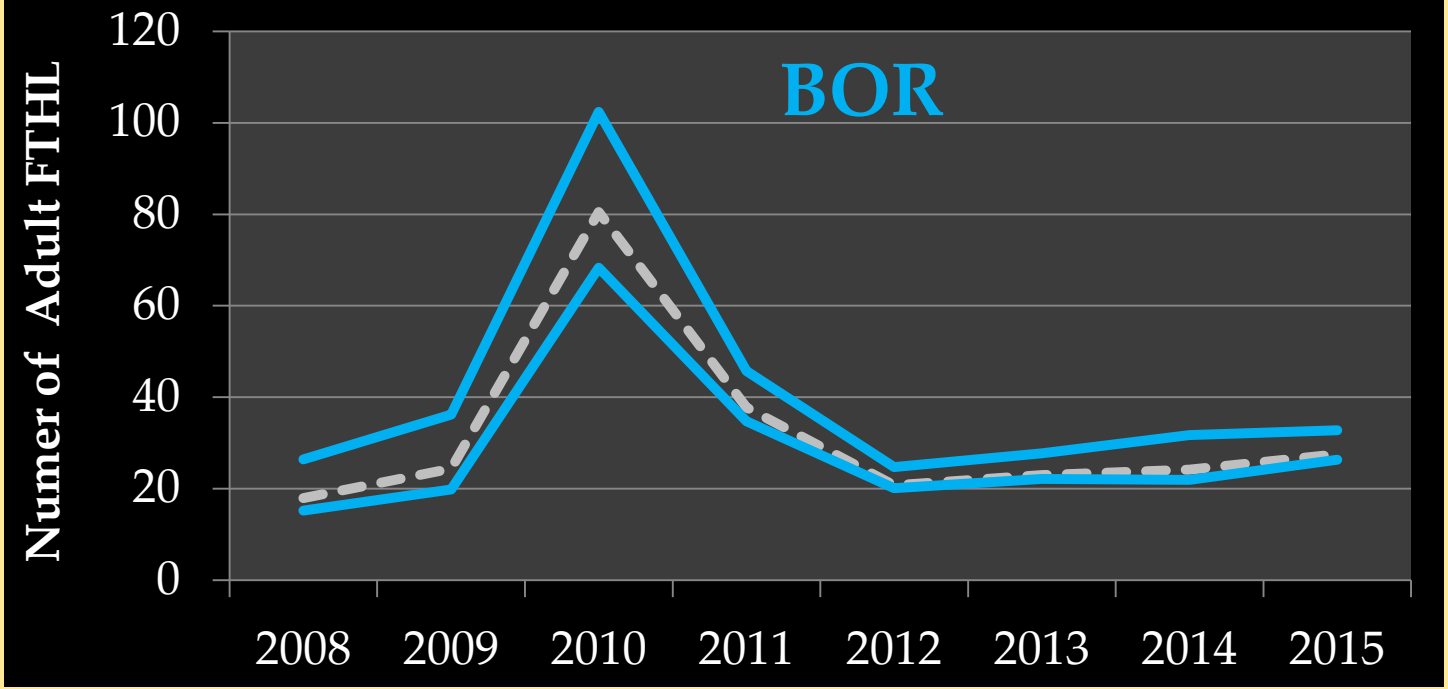
FTHL Population Model

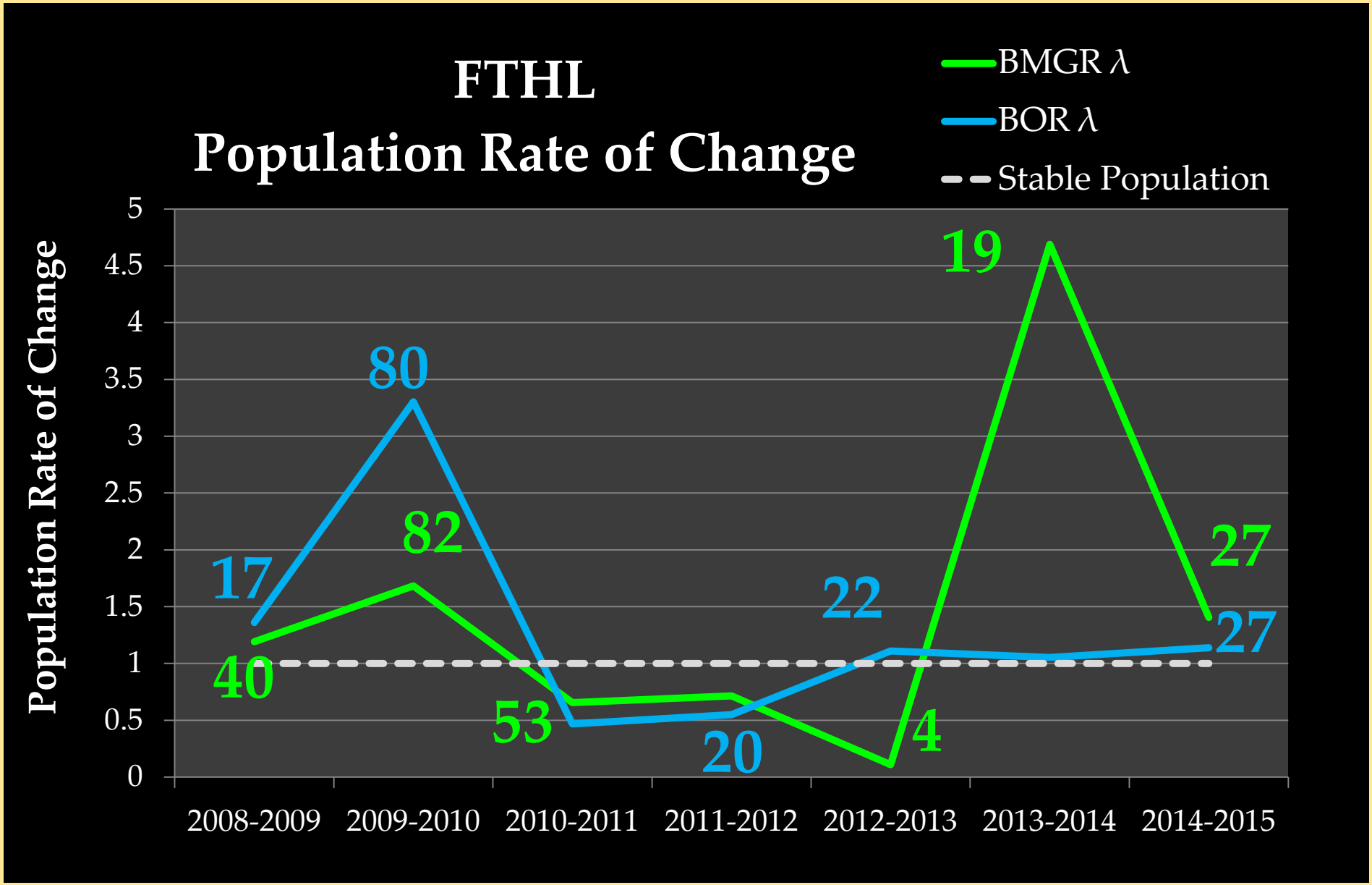
- Parameter:
  - Survivorship, **ϕ**
  - Emigration, **ϒ ″**
  - Immigration, **ϒ ′**
  - Capture, **p**
  - Recapture, **c**

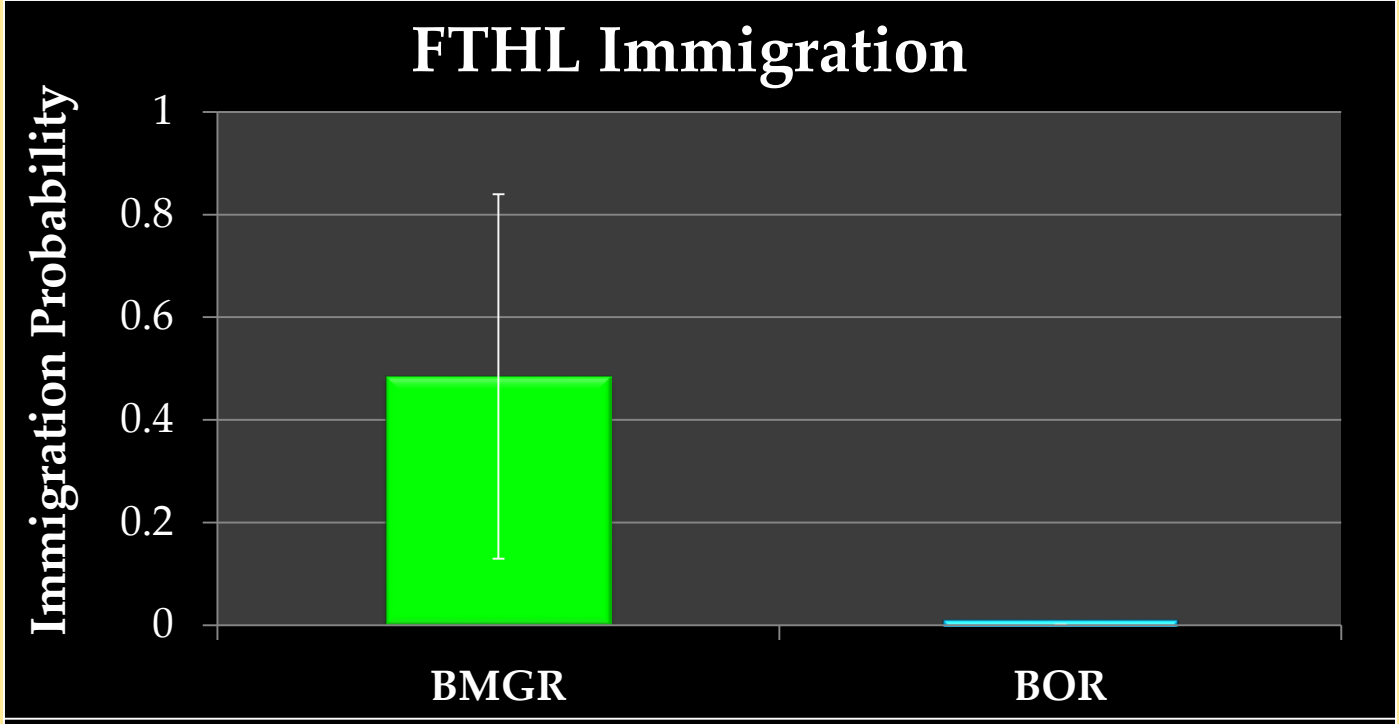
- Structure:
  - (**.**) = constant
  - (**t**) = per year
  - (**g**) = per plot

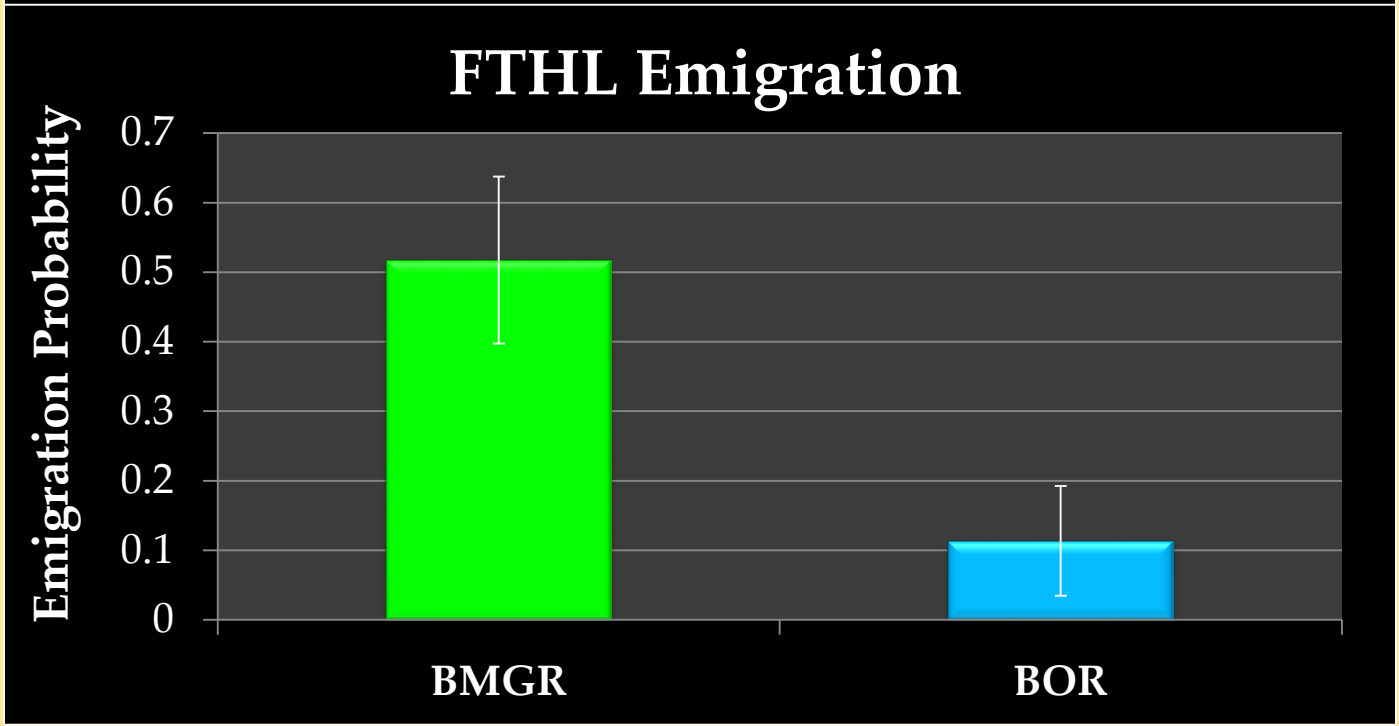
MODEL	
H_1	ϕ(.) ϒ ″(.) ϒ ′(.) p=c(.)
H_2	ϕ(g) ϒ ″(.) ϒ ′(.) p=c(.)
H_3	ϕ(t) ϒ ″(.) ϒ ′(.) p=c(.)
H_4	ϕ(g*t) ϒ ″(.) ϒ ′(.) p=c(.)
H_5	ϕ(g*t) ϒ ″(g) ϒ ′(g) p=c(.)

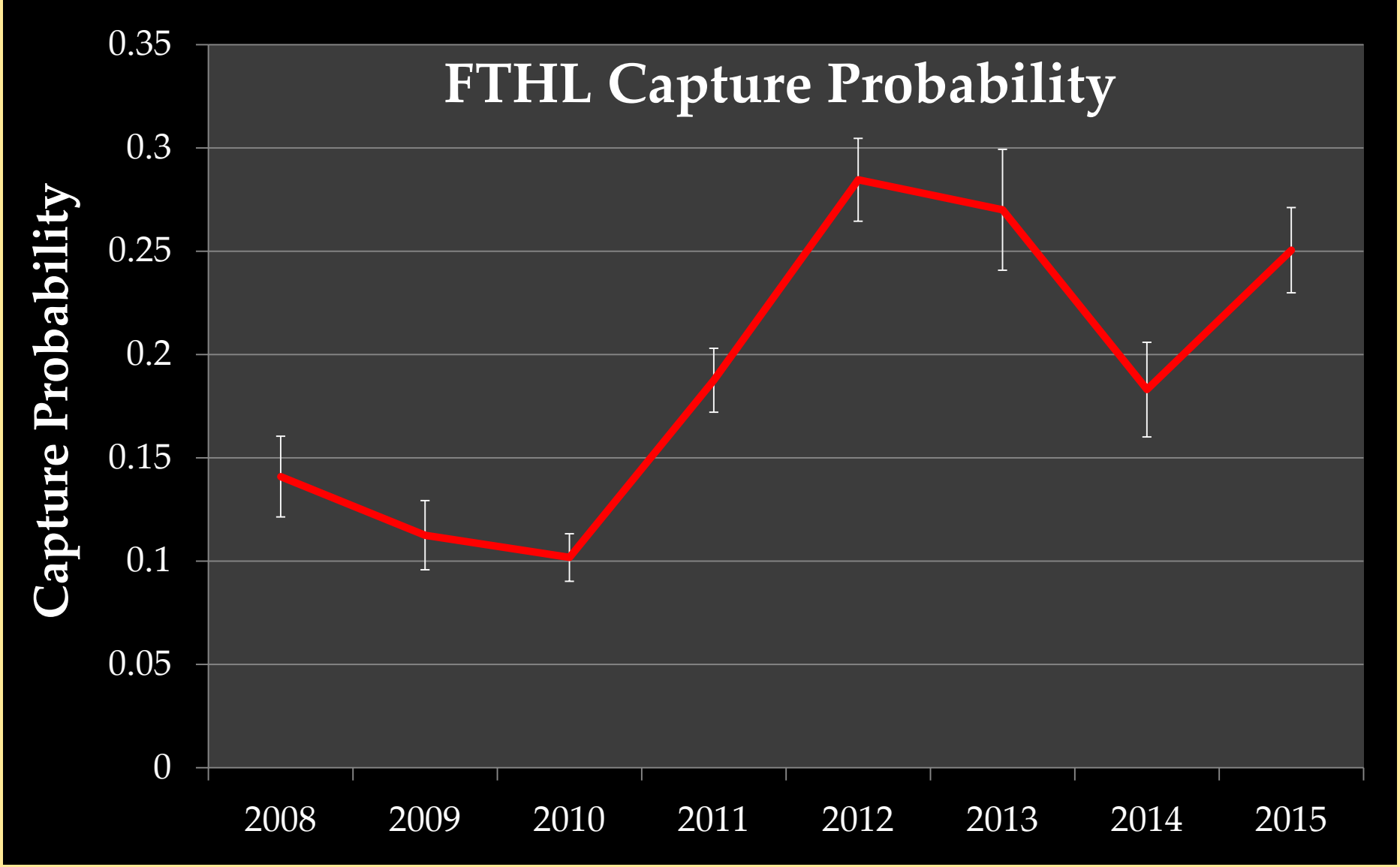

BMGR
Number of Adult FTHL
120
100
80
60
40
20
0
2008
2009
2010
2011
2012
2013
2014
2015


BOR
Numer of Adult FTHL
120
100
80
60
40
20
0
2008
2009
2010
2011
2012
2013
2014
2015

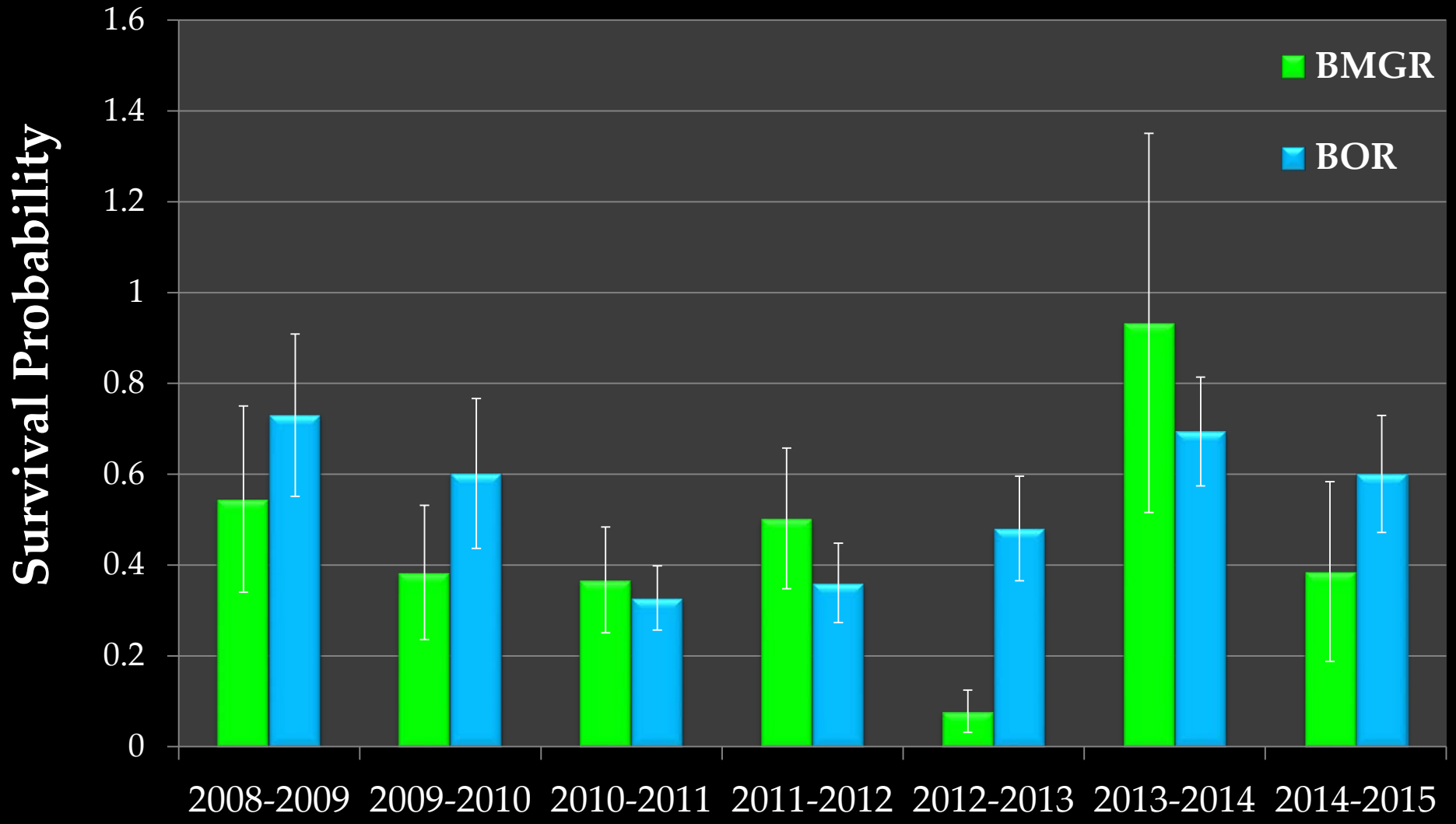

FTHL
Population Rate of Change
BMGR λ
BOR λ
Stable Population
Population Rate of Change
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
2008-2009
2009-2010
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
17
80
22
27
40
82
53
20
4
19
27

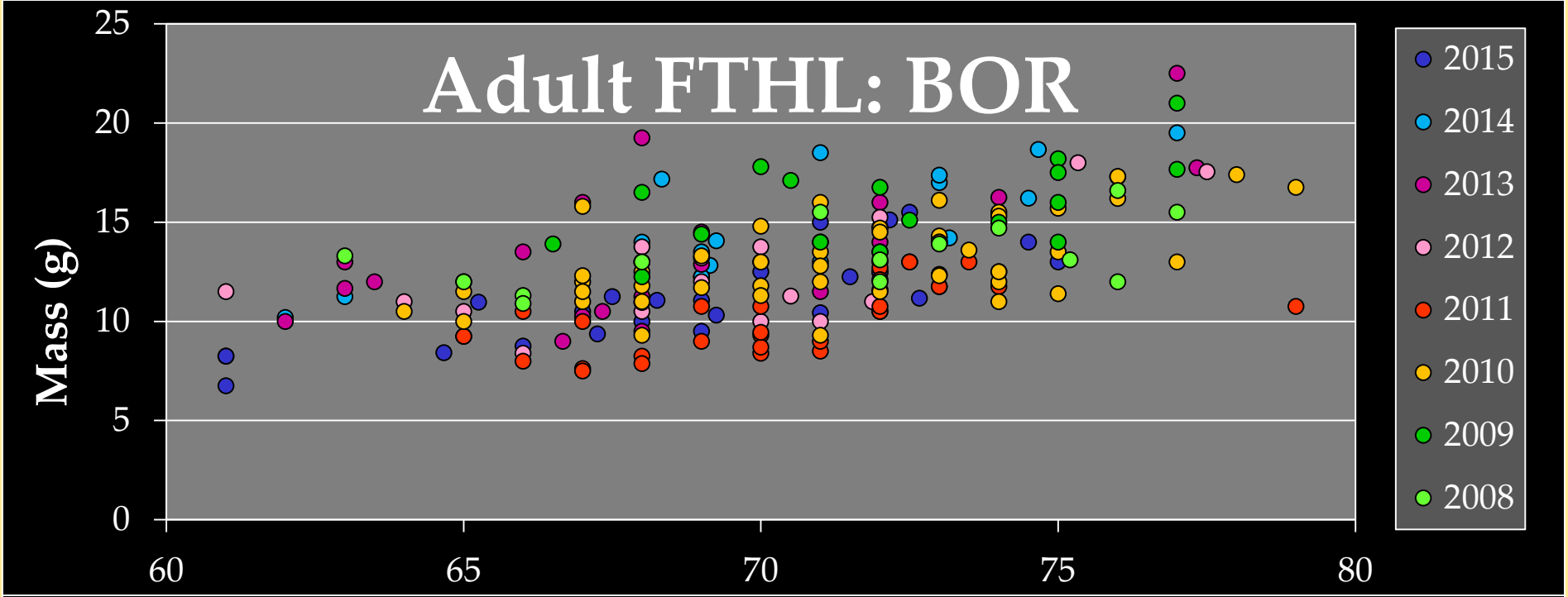

FTHL Immigration
Immigration Probability
1
0.8
0.6
0.4
0.2
0
BMGR
BOR

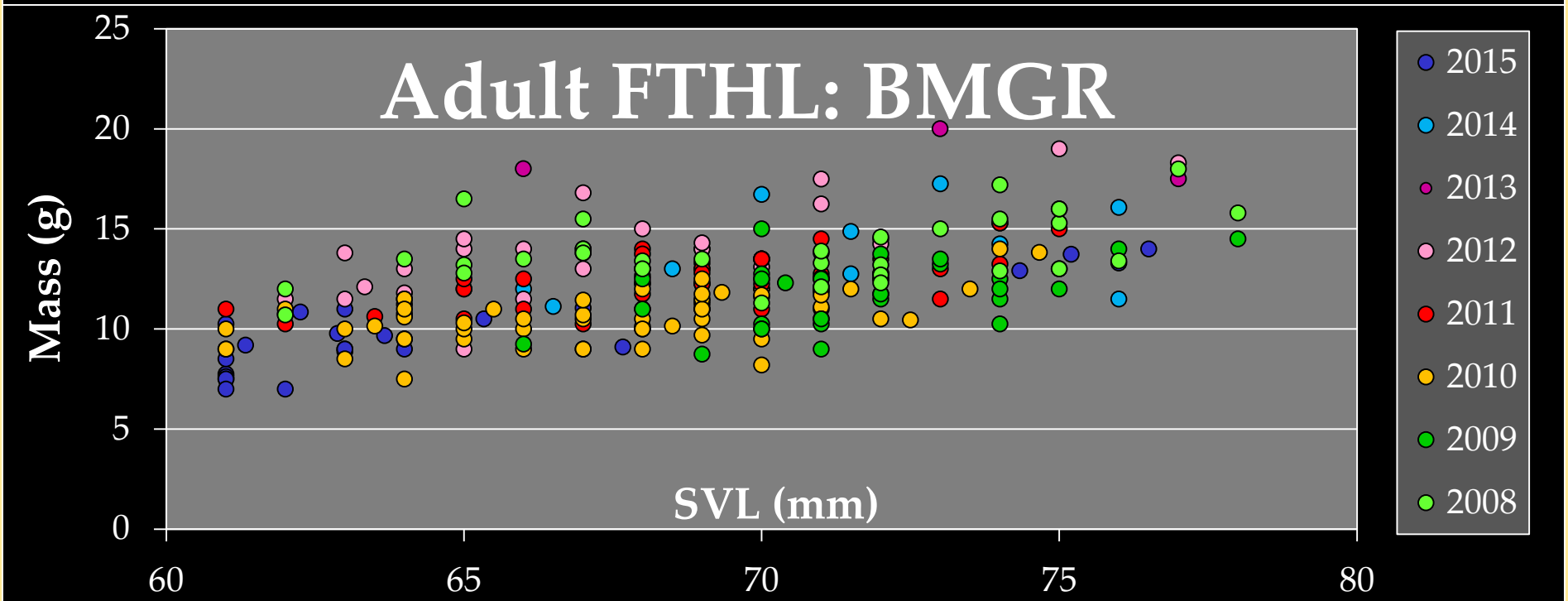

FTHL Emigration
Emigration Probability
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
BMGR
BOR


FTHL Capture Probability
Capture Probability
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
2008
2009
2010
2011
2012
2013
2014
2015

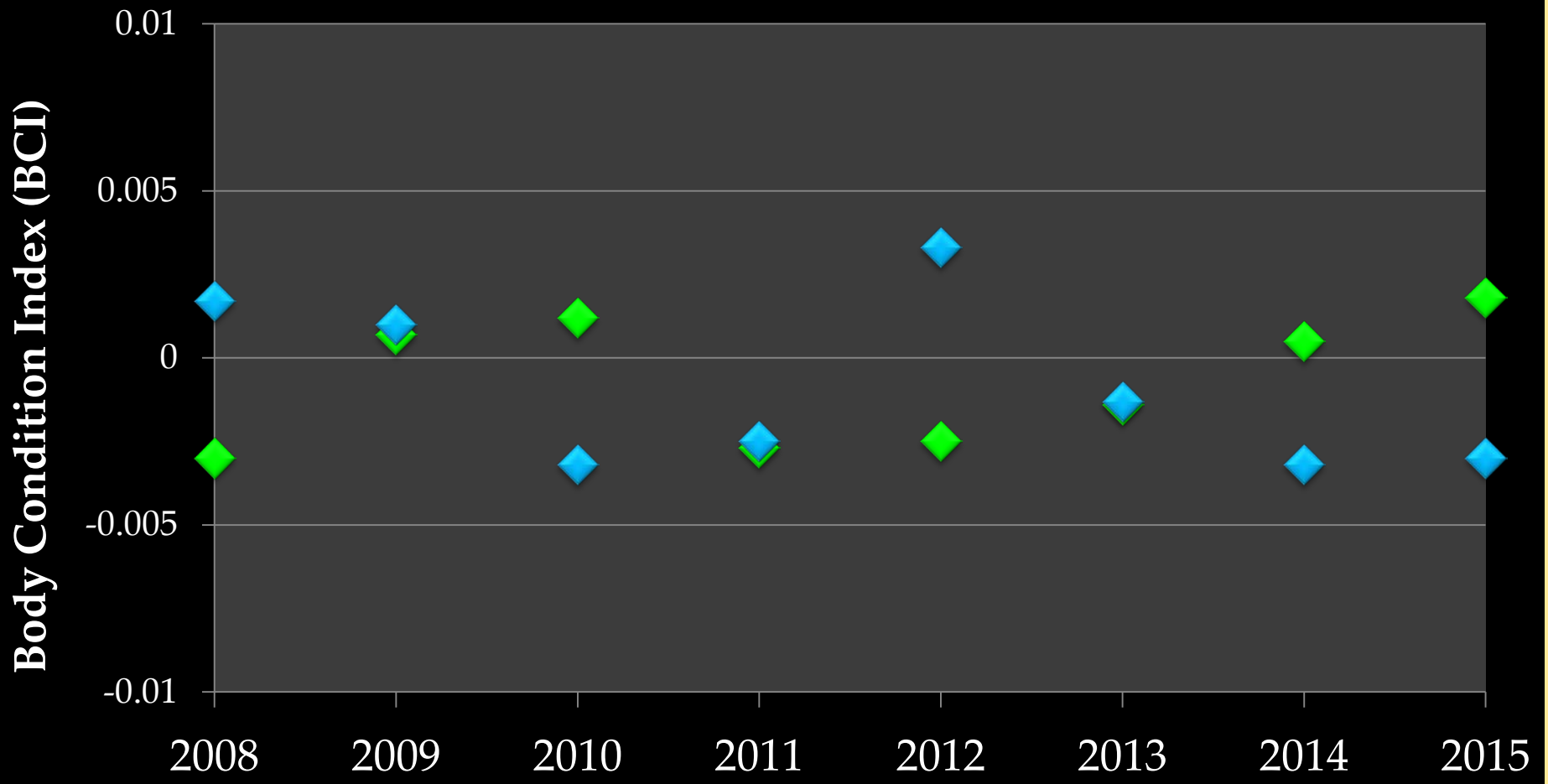
FTHL Survivorship




Adult FTHL: BOR
Mass (g)
25
20
15
10
5
0
60
65
70
75
80
2015
2014
2013
2012
2011
2010
2009
2008


Adult FTHL: BMGR
Mass (g)
SVL (mm)
25
20
15
10
5
0
60
65
70
75
80
2015
2014
2013
2012
2011
2010
2009
2008

Adult FTHL Body Condition (2008 to 2015)



BOR Mean BCI = -0.0009

BMGR Mean BCI = -0.0007

Sidewinder Modeling

- Parameter:
  - Capture, **p**
  - Recapture, **c**
- Structure:
  - (.) = constant
  - (**t**) = per day
  - (**g**) = per plot

Hypothesis	Model
H_1 (Null)	p = c (.)
H_2	p = c (g)
H_3	p = c (t)
H_4	p = c (g*t)

	BMGR	BOR	TOTAL
Number of Captures	33	40	73
Number of Individuals	30	34	64
Density (snakes/ha.)	3.33	3.78	n/a
Capture Rate	0.03 ± 0.009	0.03 ± 0.009	n/a
Population Estimate	115.5 ± 36.9	131.7 ± 41.7	n/a

Conclusions

- FTHL Population size **increasing** on both plots
- Both plots **above** replacement levels
- Survivorship is near estimate for other populations of FTHL
- Sidewinders are more dense than previously expected
- **NEED MORE DATA!!!**

Future Efforts:

- Continue surveys to reduce error and improve models for both FTHL and Sidewinders
- Remove BMGR 2013 data from analysis
- Explore models using juvenile and sub-adult data as well as adult data
- Investigate possible influences for fluctuations in population estimates and survivorship: precipitation, predator populations, body condition, etc.
- Population Viability Analysis
  - *In progress (Rangewide)*

Acknowledgements

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- Thanks to Woodrow Crumbo, Eddie Moreno, Keith Sullivan, Dennis Abbate, and Javier Gonzalez for conducting surveys in 2015 and to all field crews the past 8 years.
- Thanks to Renee Wilcox, Pam Kennedy, Michael Ingraldi and Tim Wade at AGFD for administrative assistance.