

# Survival and Population Growth of the American crocodile (*Crocodylus acutus*)

Venetia Briggs-Gonzalez<sup>1</sup>, Christophe Bonenfant<sup>2</sup>, Mathieu Basille<sup>1</sup>, Michael Cherkiss<sup>3</sup>, Jeffrey Beauchamp<sup>1</sup>, Frank Mazzotti<sup>1</sup>

<sup>1</sup> University of Florida, <sup>2</sup> Université de Lyon, <sup>3</sup> U.S. Geological Survey



## Introduction

Survival and population growth of the American crocodile (*Crocodylus acutus*), a federally threatened species, is affected by habitat degradation. In southern Florida, the species is at the margin of its northernmost distribution and may also be at the limit of its ecological tolerances. As a large, long-lived, highly fecund species they do not conform to the slow-fast life-history patterns. Here we assess how life-history strategy affects sensitivity of population growth rates to demographic rates of the American crocodile.



Current distribution of the American crocodile



Adult American crocodile

## Methods

We used a long-term capture-recapture study of 35+ years of monitoring American crocodiles at Florida Power & Light Turkey Point Nuclear Power Plant (TP). Crocodiles were captured, measured, weighed, and permanently marked.

### Age-specific survival rate

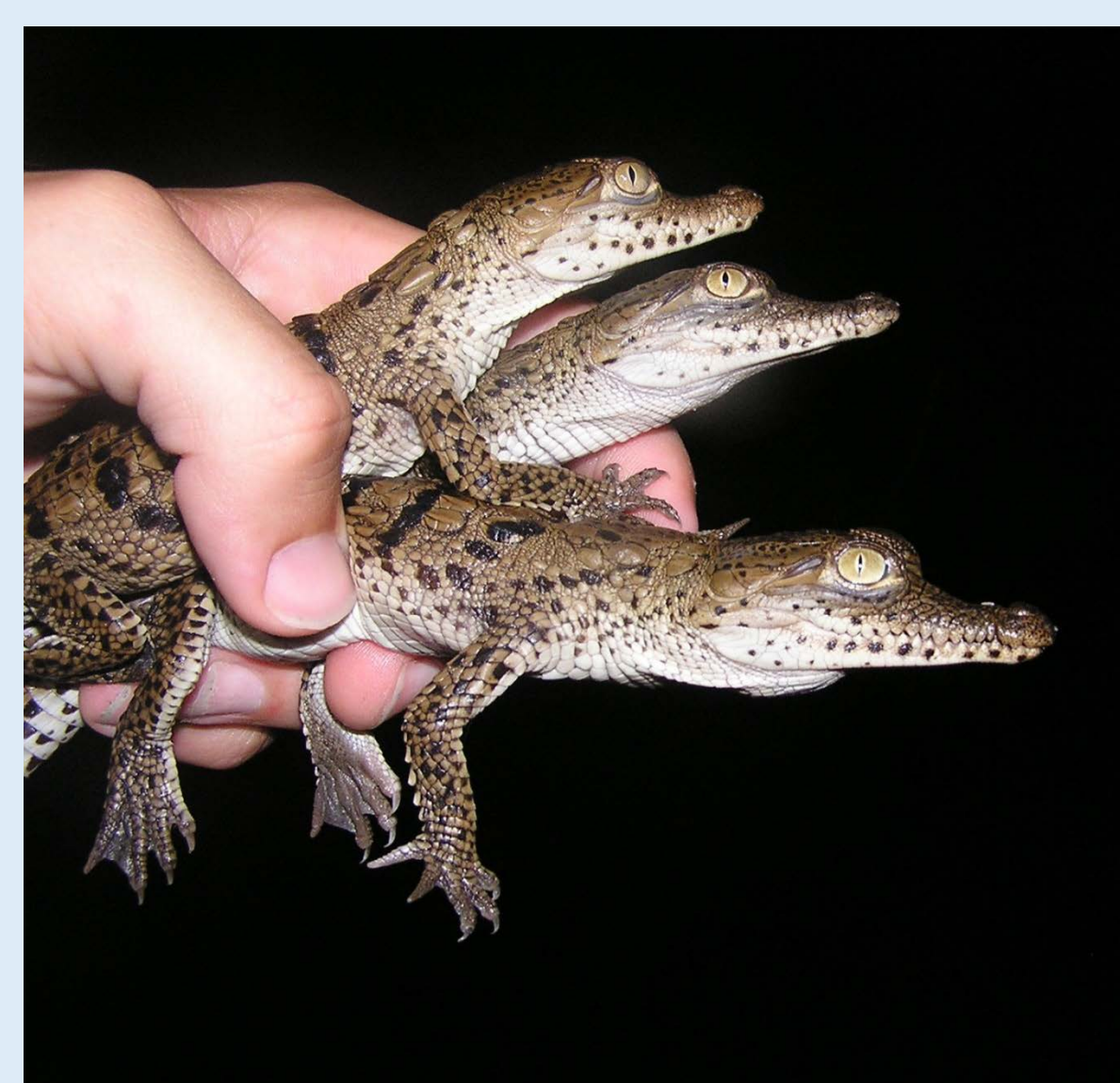
Modeled recapture rates, fit a full age-dependent survival model, and pooled age-classes showing similar survival rates.

### Age-specific Fecundity

Used reported values for fertility and clutch size for *C. acutus* in south Florida, and used growth curve analysis.

### Population Growth Rate

Created Leslie-Lefkovich matrix demographic model using capture-recapture data. Ran sensitivity analysis on relative importance of demographic rates to population growth rate.

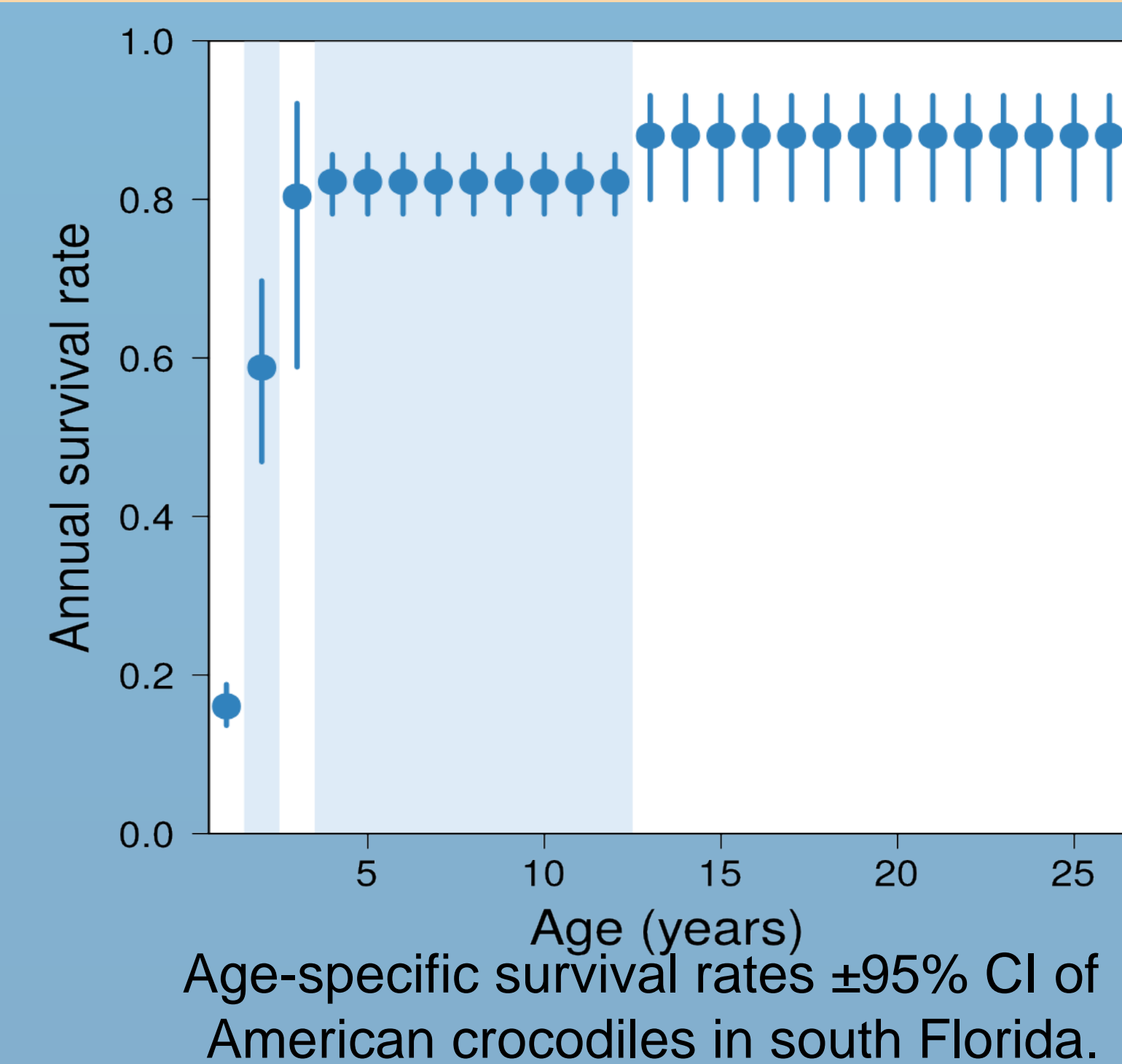


Hatchling American crocodiles

## Results

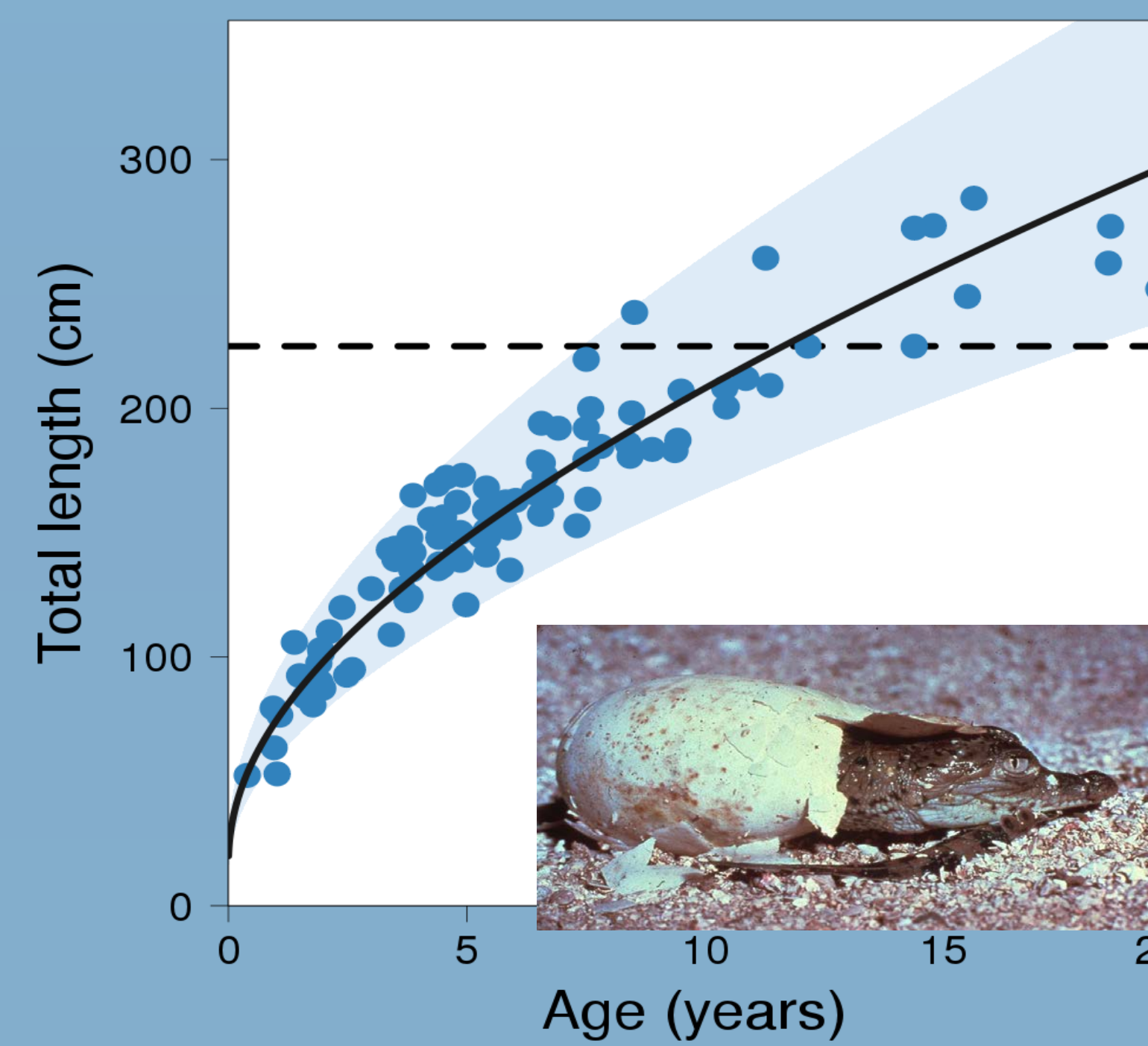
### Age-specific survival rate

7,427 hatchlings were marked 1976-2014 at TP, 380 were recaptured up to 25 years later. Survival rate was strongly age-structure but much higher than expected. Adults had very high survival rates after 12 yrs of age.



### Age-specific Fecundity

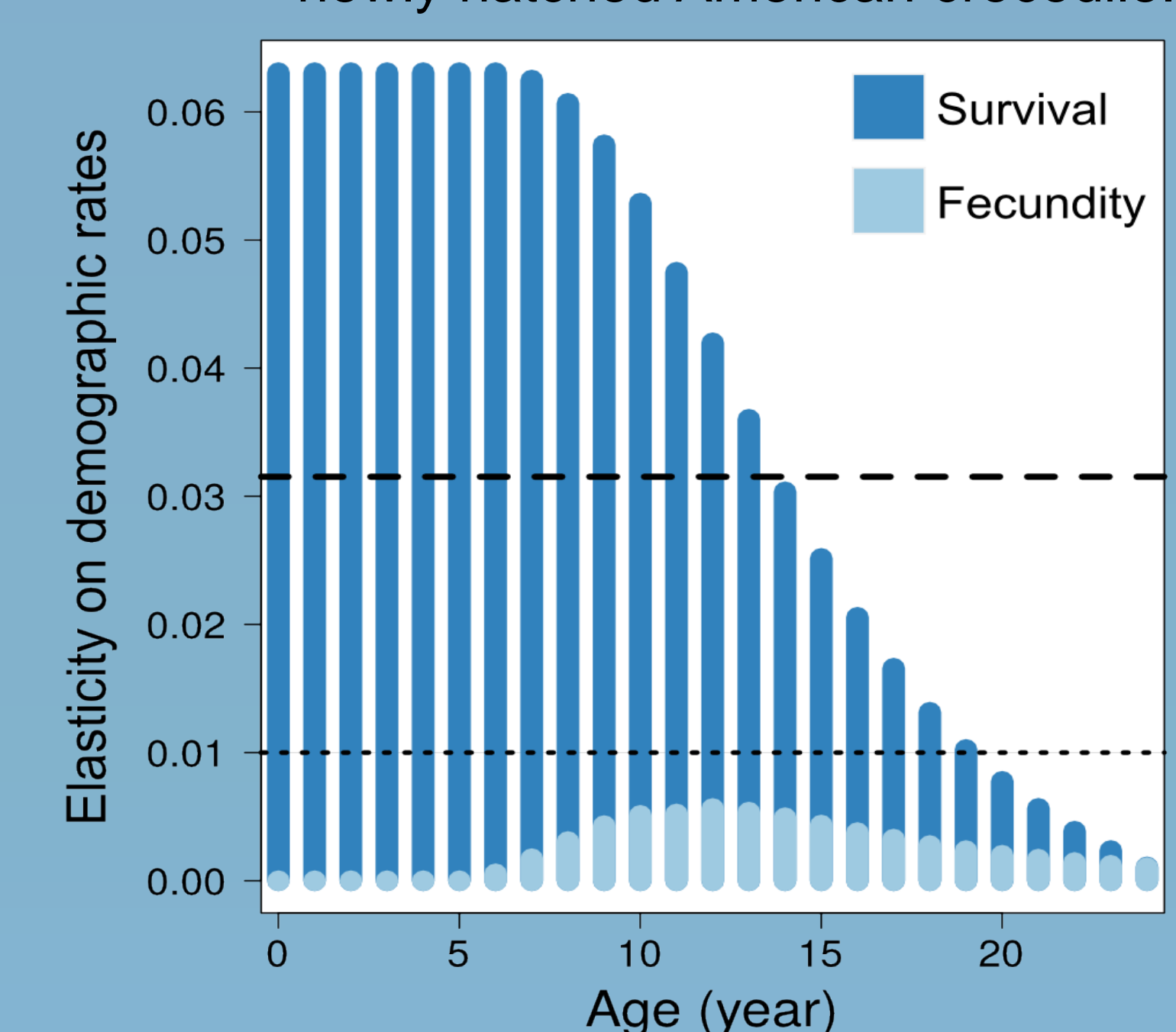
Growth rate was highest for hatchlings and decreased with age but did not plateau. Estimated clutch size in south Florida is 38±9 eggs, and reproductive size is 225cm. Age at first reproduction was 7 yrs of age and increased steadily until age 18 when 100% of females were said to be reproducing. Age-specific fecundity ranged from 0.45-22.2.



Growth as a function of age. Dashed line represents adulthood at 225cm; Insert of a newly hatched American crocodile.

### Population Growth Rate

Estimated asymptotic population growth rate  $\lambda = 1.040$ ; TP population has been increasing by 4% each year. Generation time was  $T = 16.2$  yrs. Elasticity analysis shows that population growth rate is most sensitive to survival of crocodiles during pre-reproductive periods. Fecundity did not have a significant effect on  $\lambda$ . Population growth rate decreased with age of crocodiles.



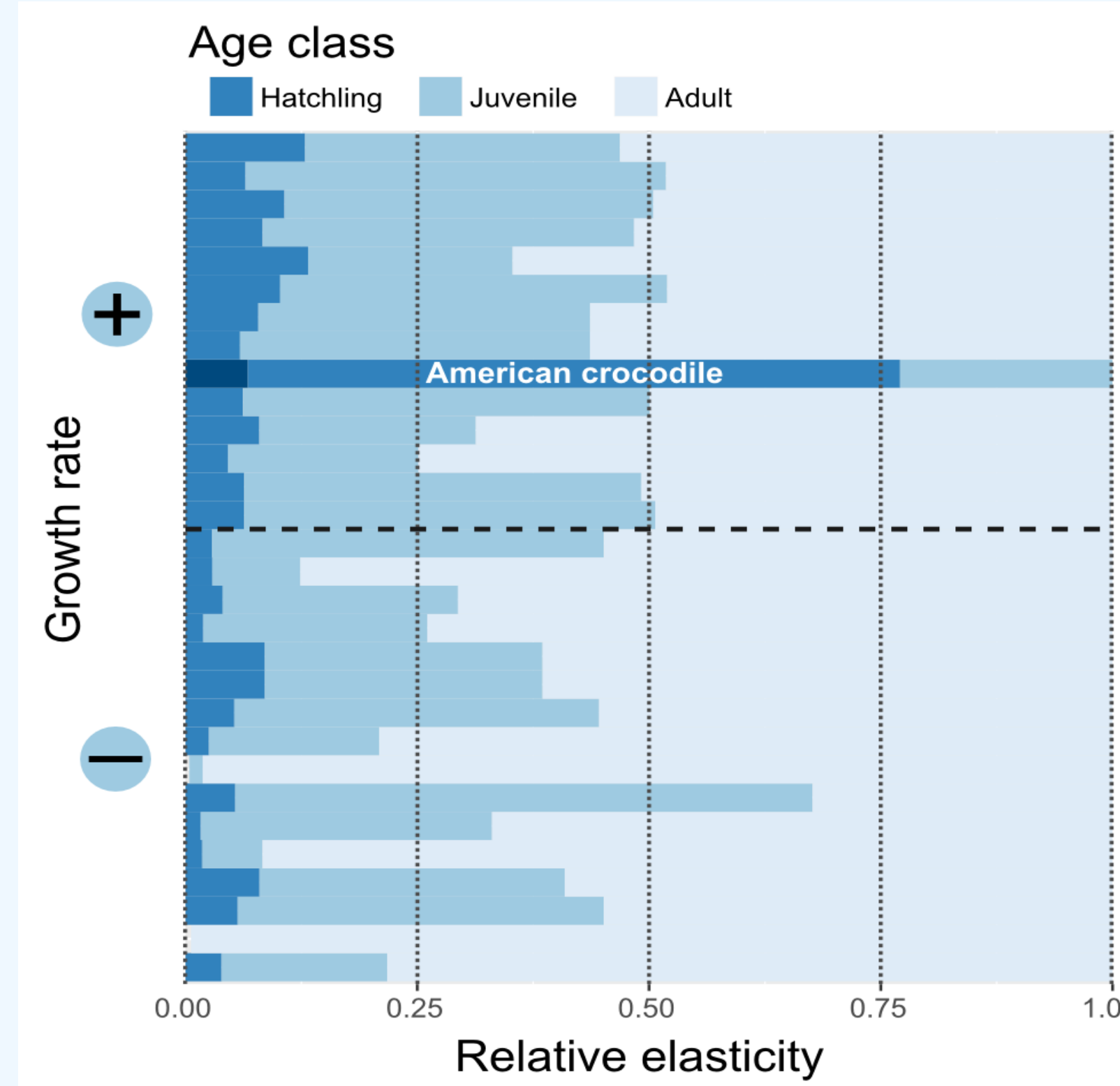
Relative contribution of survival and fecundity to population growth rate. Dashed line represents half of the population and dotted line represents 1%.

## Conclusion

*Crocodylus acutus* can survive to at least 25 years of age in south Florida. Turkey Point population showed a positive increase since 1976. Population growth rate was mostly sensitive to survival rate of crocodiles before they reached adulthood. Juvenile survival, not adult survival, was more critical to population growth rate. A 16% hatchling survival rate vastly exceeds typically low reptile hatchling survival estimates (~1-2%).



Capture-recapture analysis of hatchling, juvenile and adult American crocodile to estimate age-specific survival rates and population growth.



Relative importance of survival rates by age class for long-lived reptiles. Dashed line represent a population growth rate of  $\lambda = 1.0$ .

Compared with other long-lived reptiles, American crocodiles show positive population growth rate and greater contribution of juvenile survival to population growth.

Species with declining populations rely more on adult survival.

Large, long-lived, highly fecund reptiles may need to be redefined along the slow-fast continuum of life-history strategy.

## Acknowledgements

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