

# Tag-recapture oxytetracycline-marking experiments to investigate daily increment deposition rate in bigeye otoliths

**Daniel Fuller and Kurt Schaefer**  
**Inter-American Tropical Tuna Commission**



Bigeye and Yellowfin Tuna Age and Growth Workshop, La Jolla, California USA, 23-25 January 2019

# Introduction

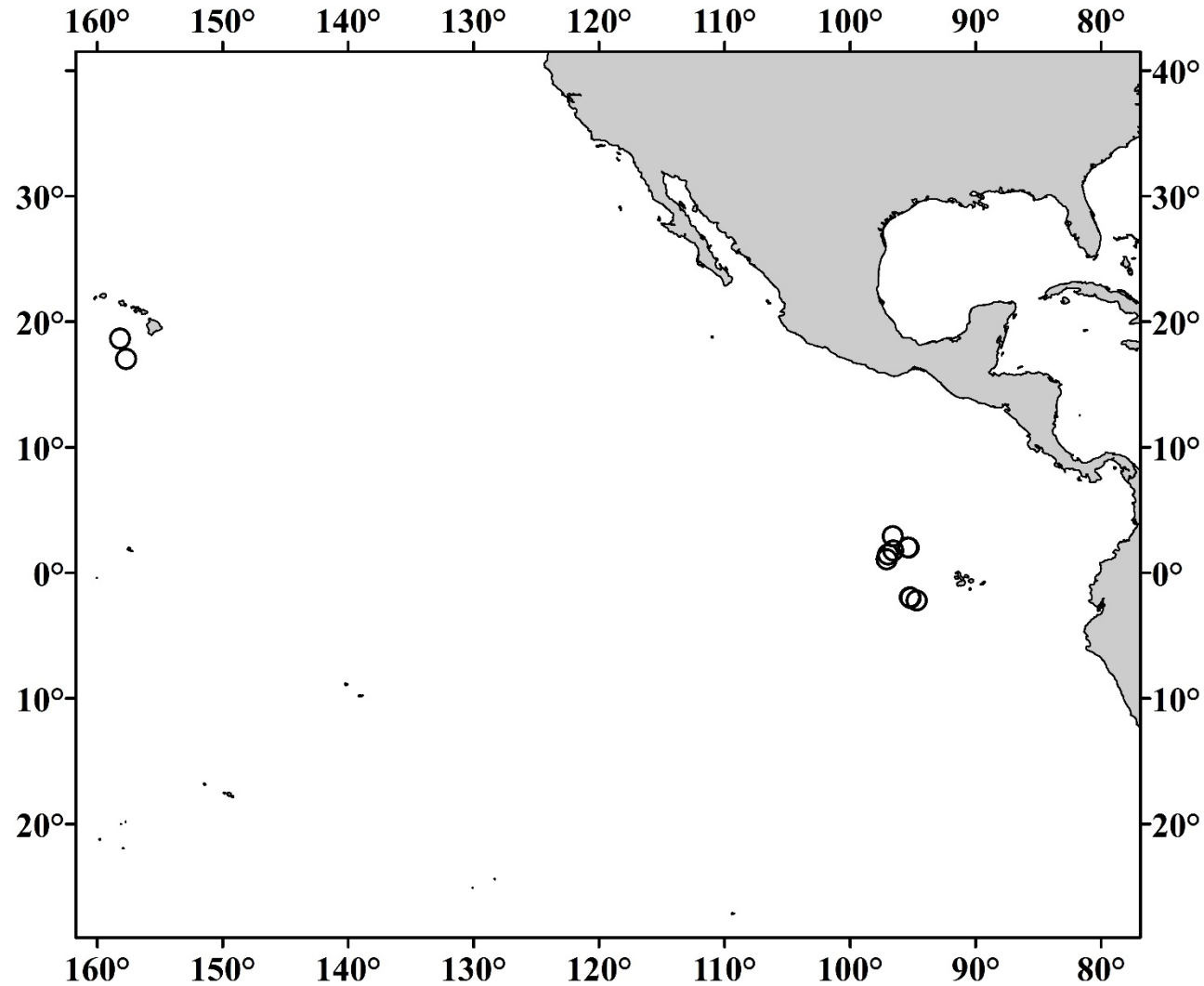
- An investigation of the daily increment deposition rate for yellowfin by Wild and Foreman (1980) indicated that the relationship between increment count and time were considerably less from the fluorescent mark to the ventral edge than for the fluorescent mark to the post-rostral tip
- An investigation of daily increment deposition rate was conducted on bigeye tuna otoliths in the WPO, however this work utilized transverse sections and increment counts on these otoliths, marked with strontium chloride, underestimated the days at liberty
- Increment deposition rates for bigeye tuna in the EPO had not previously been conducted
- In this study, daily increment deposition rates were evaluated in frontal sections (primordium-post-rostral tip) of bigeye tuna sagittal otoliths utilizing OTC marked and recaptured fish

# Materials and Methods

- During 1995 and 1996 1,043 bigeye tuna 36 -105 cm were captured, injected with OTC, tagged, and released in waters southwest of Hawaii. 46 otolith pairs were recovered from 101 recaptures.
- During 2000 and 2002 to 2004 1,094 bigeye tuna 46 -139 cm were captured, injected with OTC, tagged, and released equatorial waters of the eastern Pacific. Eighty one otolith pairs were recovered from 424 recaptures.

# Materials and Methods

## Sampling Area

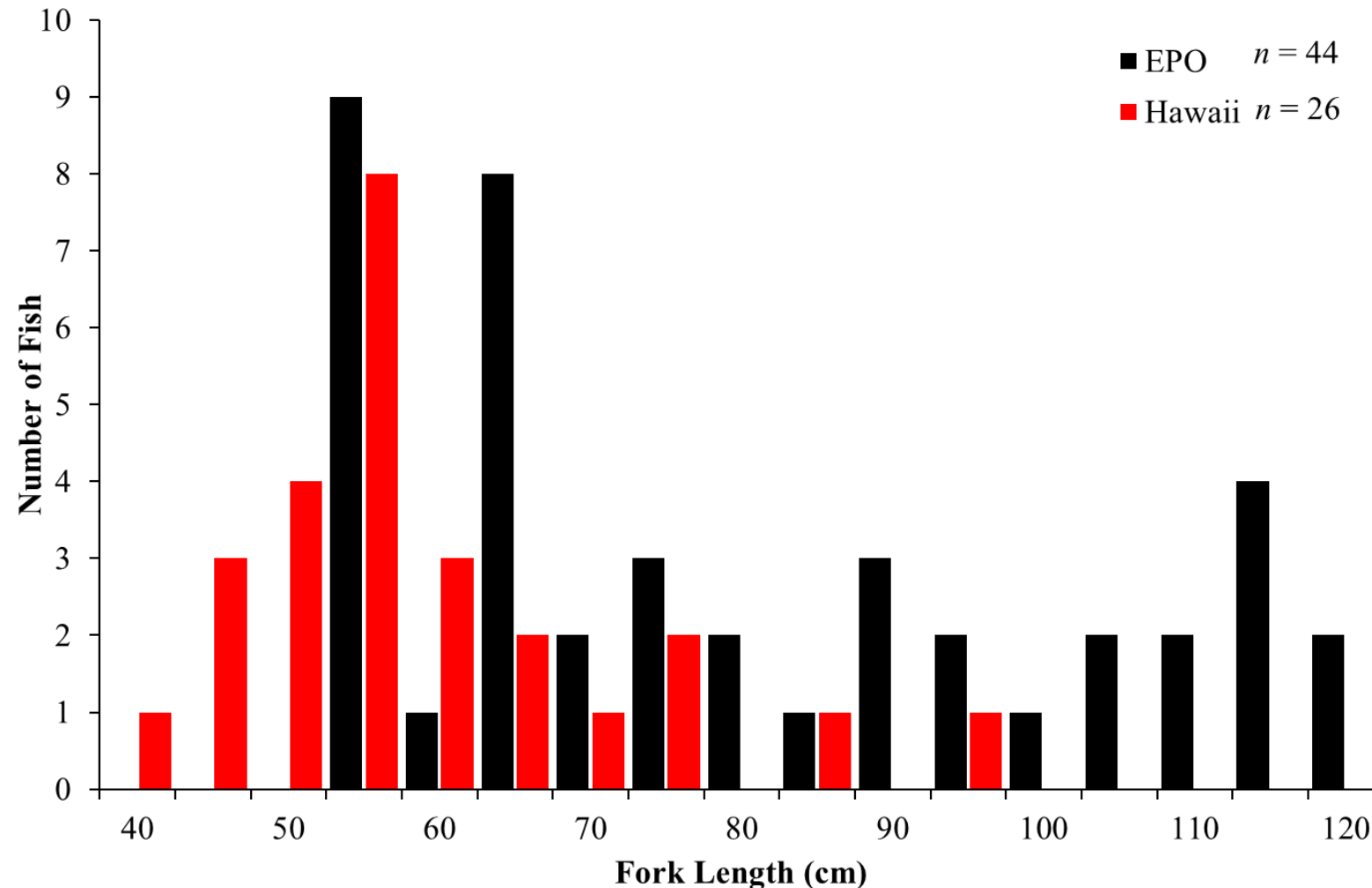


# Materials and Methods

- During 1995 and 1996 1,043 bigeye tuna 36 -105 cm were captured, injected with OTC, tagged, and released in waters southwest of Hawaii. 46 otolith pairs were recovered from 101 recaptures.
- During 2000 and 2002 to 2004 1,094 bigeye tuna 46 -139 cm were captured, injected with OTC, tagged, and released equatorial waters of the eastern Pacific. Eighty one otolith pairs were recovered from 424 recaptures.
- 70 total otoliths (release lengths: 38 - 119 cm, recapture lengths: 44 – 135 cm) were read to evaluate increment deposition rate

# Materials and Methods - Sampling

Length at release of the 70 bigeye tuna from which otoliths were collected and utilized in deposition rate study

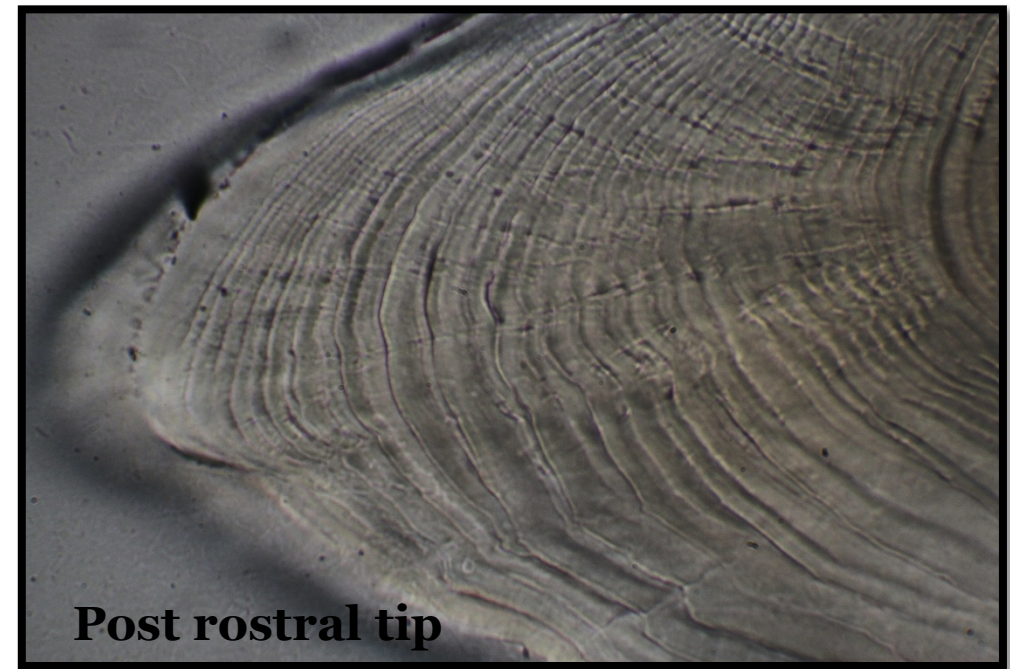
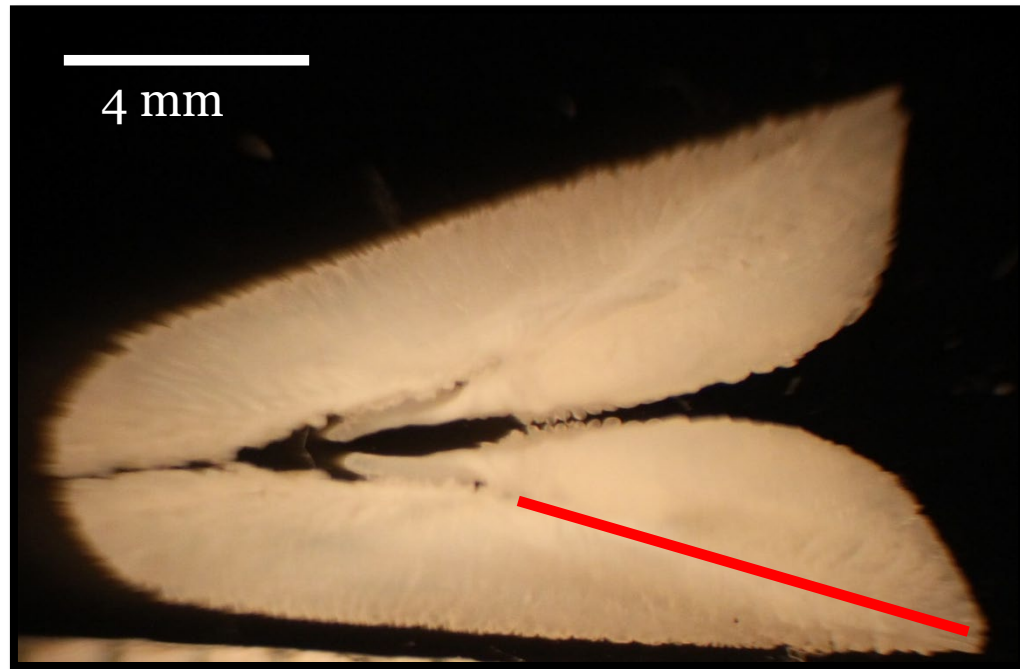


# Materials and Methods

- During 1995 and 1996 1,043 bigeye tuna 36 -105 cm were captured, injected with OTC, tagged, and released in waters southwest of Hawaii. 46 otolith pairs were recovered from 101 recaptures.
- During 2000 and 2002 to 2004 1,094 bigeye tuna 46 -139 cm were captured, injected with OTC, tagged, and released equatorial waters of the eastern Pacific. Eighty one otolith pairs were recovered from 424 recaptures.
- 70 total otoliths (release lengths: 38 - 119 cm) were read to evaluate increment deposition rate
- Otoliths were mounted in epoxy resin and allowed to cure
- Sections were cut in the primordium – postrostral axis and hand polished

# Materials and Methods

**Sectioning methodology for counting increments from the OTC-mark to the PR tip**



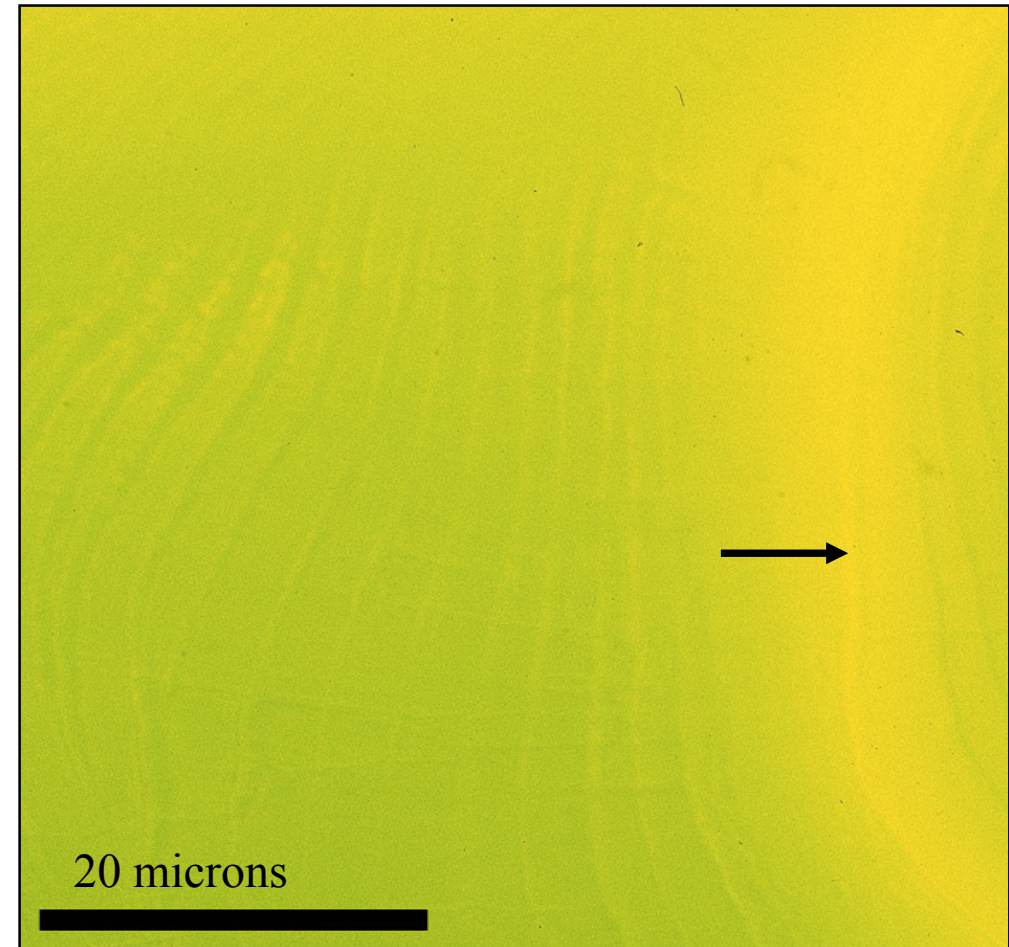
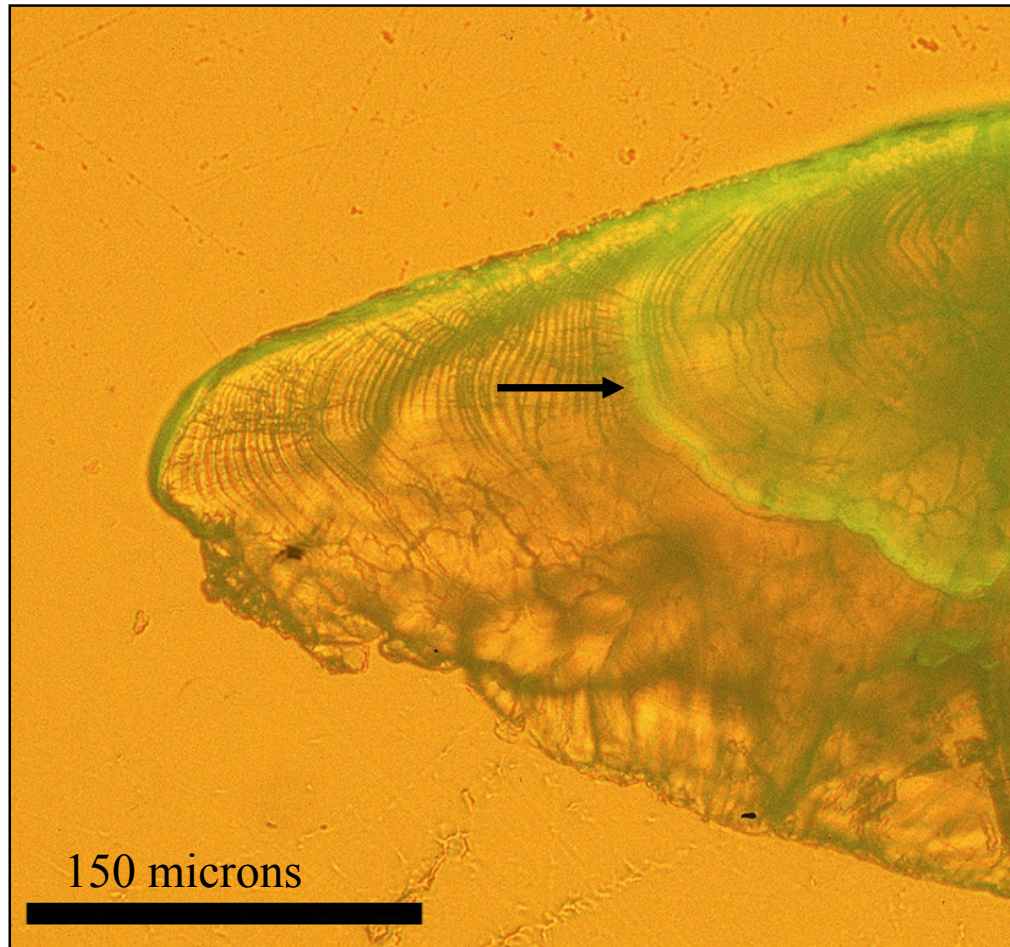


# Materials and Methods

- During 1995 and 1996 1,043 bigeye tuna 36 -105 cm were captured, injected with OTC, tagged, and released in waters southwest of Hawaii. 46 otolith pairs were recovered from 101 recaptures.
- During 2000 and 2002 to 2004 1,094 bigeye tuna 46 -139 cm were captured, injected with OTC, tagged, and released equatorial waters of the eastern Pacific. Eighty one otolith pairs were recovered from 424 recaptures.
- 70 total otoliths (release lengths: 38 - 119 cm) were read to evaluate increment deposition rate
- Otoliths were mounted in epoxy resin and allowed to cure
- Sections were cut in the primordium – postrostral axis and hand polished
- Sections were viewed at 900x (oil immersion) using UV light to illuminate the OTC mark
- Counts were made from the OTC mark to the PR Tip by two independent readers

# Materials and Methods

**OTC mark to the PR-tip and higher magnification showing the OTC mark and the corresponding increment**



# Materials and Methods

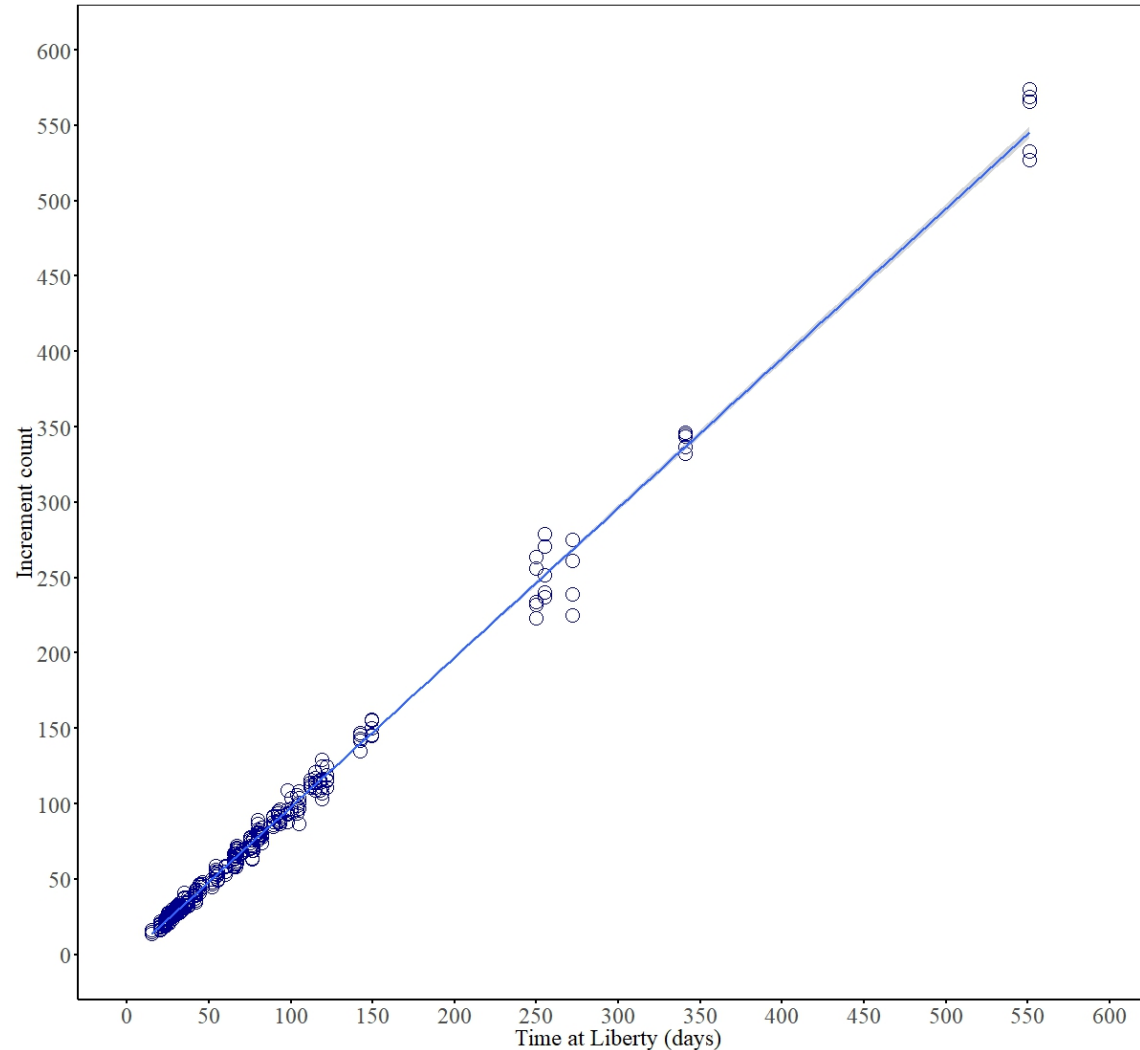
- During 1995 and 1996 1,043 bigeye tuna 36 -105 cm were captured, injected with OTC, tagged, and released in waters southwest of Hawaii. 46 otolith pairs were recovered from 101 recaptures.
- During 2000 and 2002 to 2004 1,094 bigeye tuna 46 -139 cm were captured, injected with OTC, tagged, and released equatorial waters of the eastern Pacific. Eighty one otolith pairs were recovered from 424 recaptures.
- 70 total otoliths (release lengths: 38 - 119 cm) were read to evaluate increment deposition rate
- Otoliths were mounted in epoxy resin and allowed to cure
- Sections were cut in the primordium – postrostral axis and hand polished
- Sections were viewed at 900x (oil immersion) using UV light to illuminate the OTC mark
- Counts were made from the OTC mark to the PR Tip by two independent readers
- Each count was made without knowledge of days at liberty
- Five independent counts were made by each reader
- Grand means were calculated from the mean counts of the two readers

# Results

- A paired sample t-test indicated no significant difference between the counts of the two readers ( $t = -0.13$ ,  $DF = 69$ ,  $P > 0.05$ )

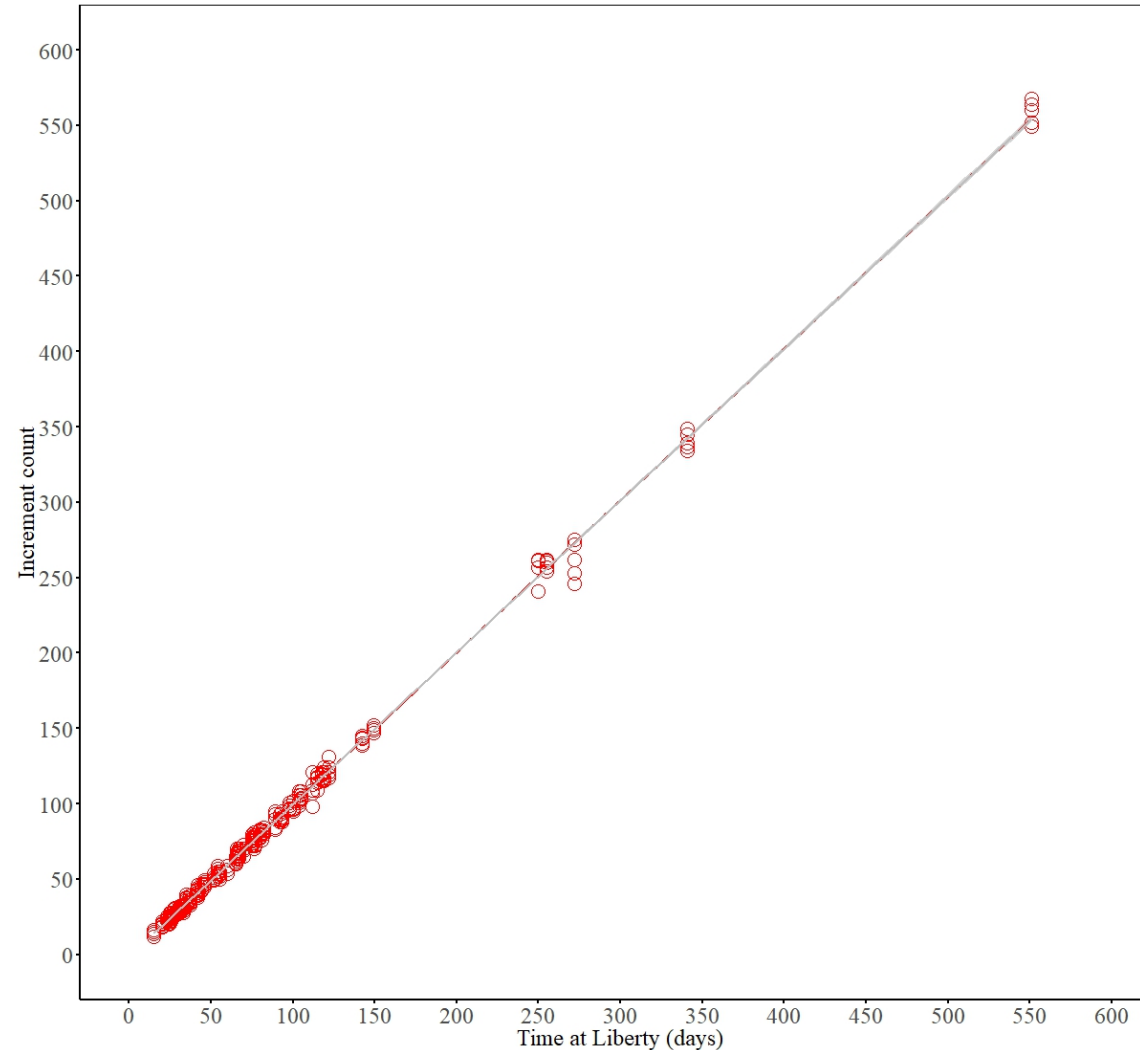
# Results

## Relationship between days at liberty and increment count for 5 independent reads of each otolith by reader 1



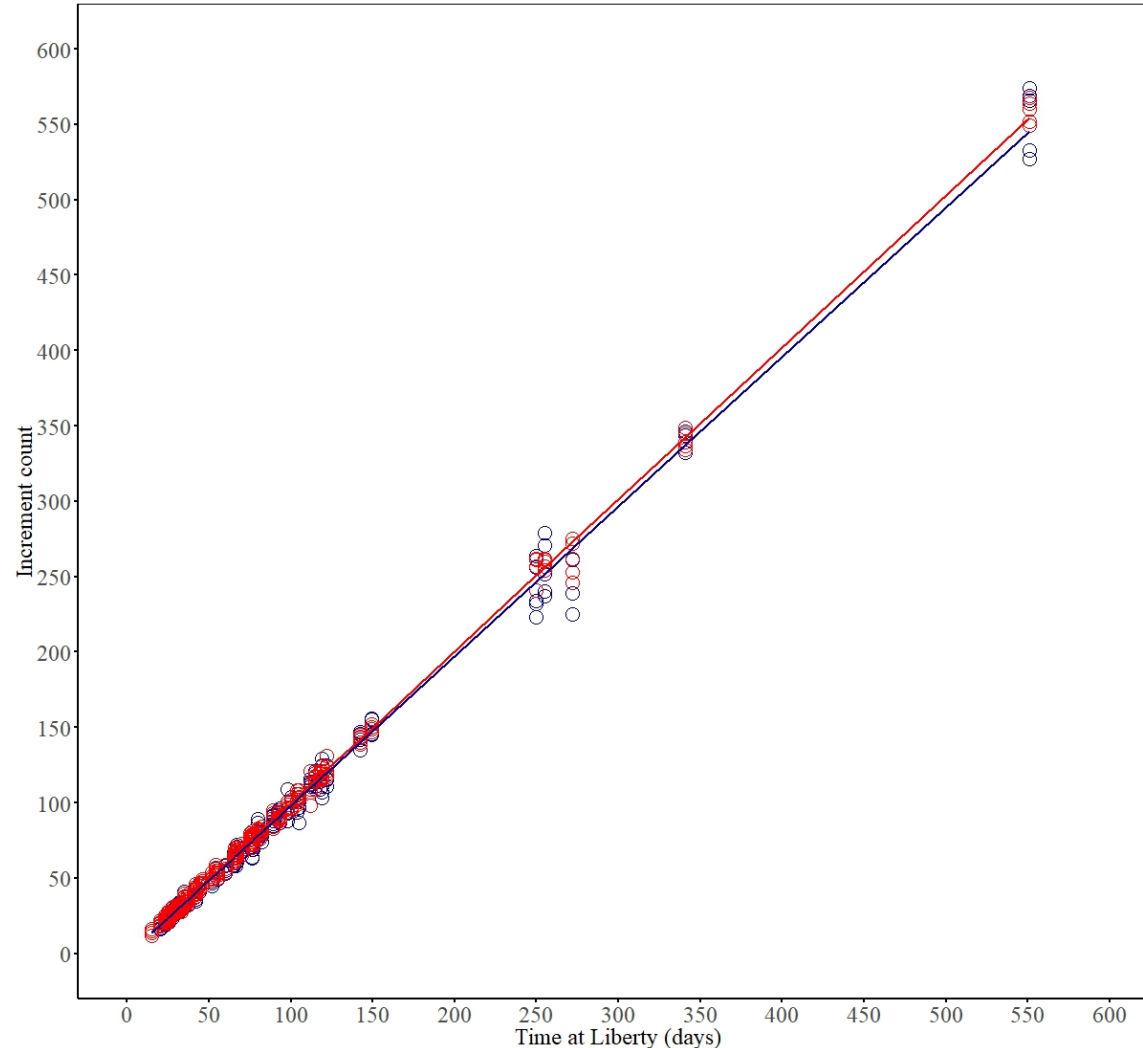
# Results

## Relationship between days at liberty and increment count for 5 independent reads of each otolith by reader 2



# Results

**Relationship between days at liberty and increment counts for 5 independent reads of each otolith by both readers**



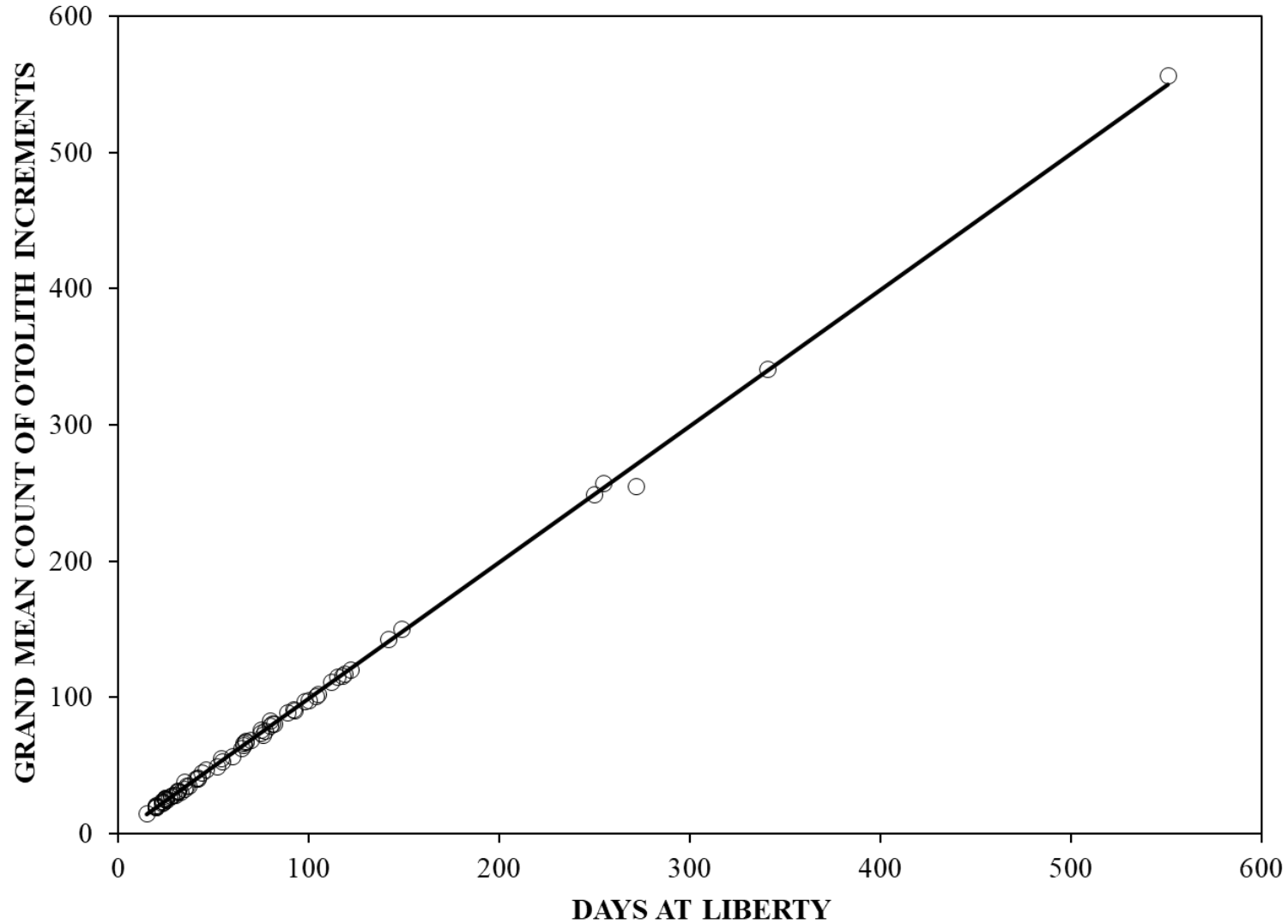
# Results

- A paired sample t-test indicated no significant difference between the counts of the two readers ( $t = -0.13$ ,  $DF = 69$ ,  $P > 0.05$ )
- The relationship between the mean number of increments from the OTC mark to the postrostral tip and days at liberty is:  $I = 0.9998D - 1.0353$  ( $r^2 = 0.999$ ,  $n = 70$ )
- The slope is not significantly different from 1 ( $t = 0.06$ ,  $df = 69$ ,  $P > 0.05$ )
- The 95% confidence interval around the regression coefficient for the slope is 0.99-1.01



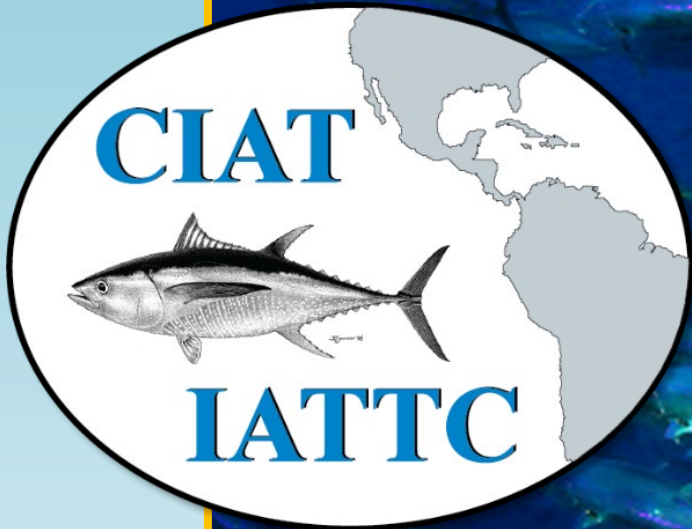
# Results

## Relationship between days at liberty and grand mean increment count



# Conclusions

- Tagging and OTC marking experiments conducted in the central and eastern Pacific Ocean demonstrated that bigeye tuna in the length range of 38 to 135 cm, deposit daily increments in their sagittal otoliths
- Frontal sections, along the primordium to postrostral axis, of sagittal otoliths provided an optimal counting path for resolving daily increments
- Assuming bigeye tuna deposit increments at the same daily rate when less than 38 cm and greater than 135 cm, up to about 150 cm fork length, age estimates from daily increment counts will provide accurate estimates of age at length. This only appears valid for counts along the primordium to the post-rostral tip.



# Questions

