Progress on yellowfin tuna age and growth in the WCPO

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Project 82
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Outline

- Objectives
- Background - previous YFT ageing studies in WCPO
- Otoliths available for analysis
- Trial work
- Future work

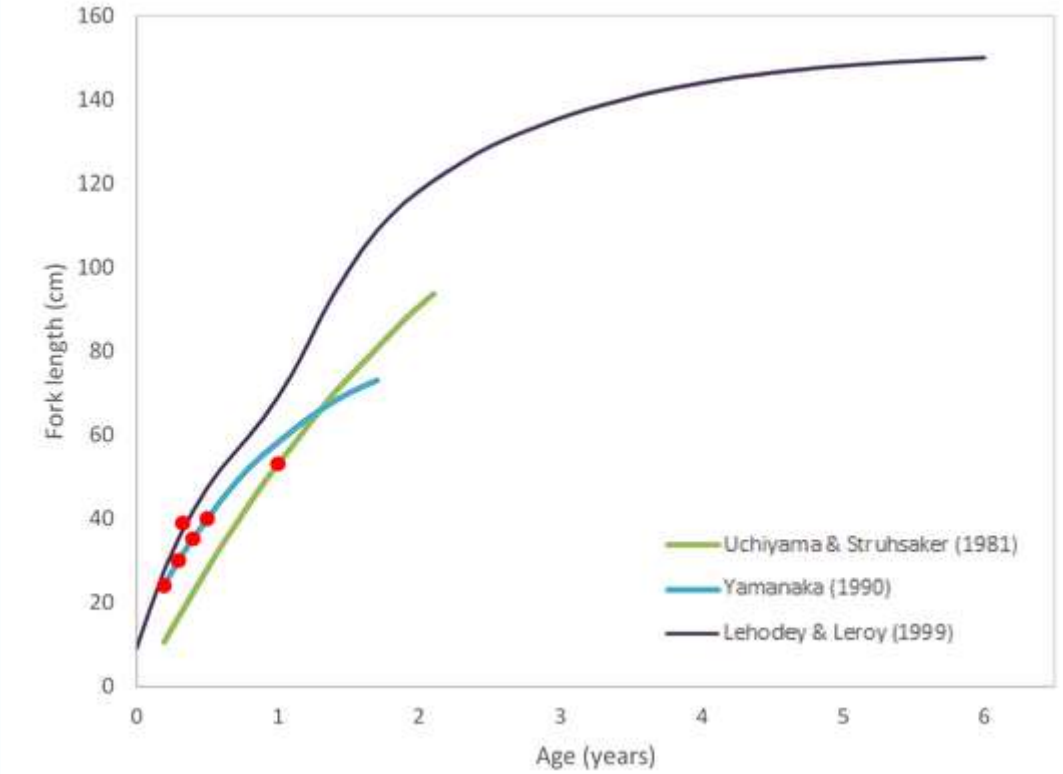
Objectives

- Conduct preliminary analysis on suitability:
  - Otoliths - daily & annual age
  - Fin spines - verify the annual counts in otoliths of small fish
- Develop a reference collection and protocols
- Prepare and read 1500 otoliths – annual ageing
- Prepare and read 150 otoliths – daily ageing
- Undertake age validation work
- Report to WCPFC SC15

Background

Previous direct ageing studies

Growth curves – daily ageing

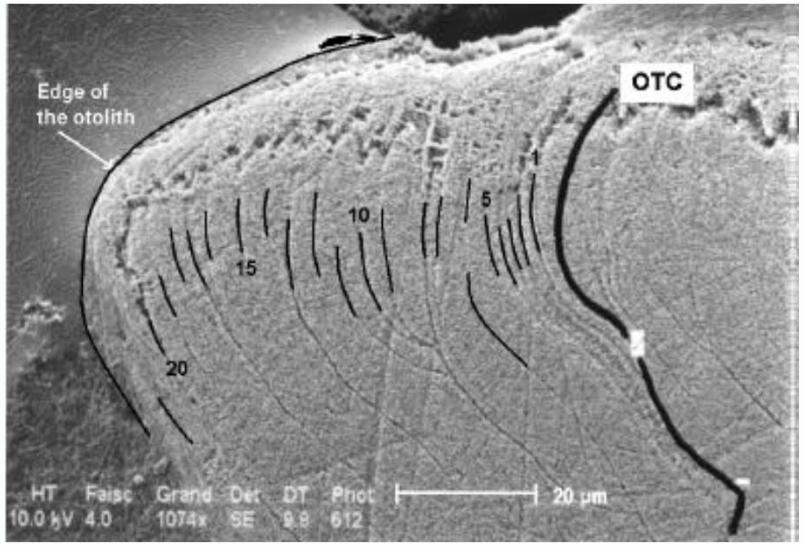


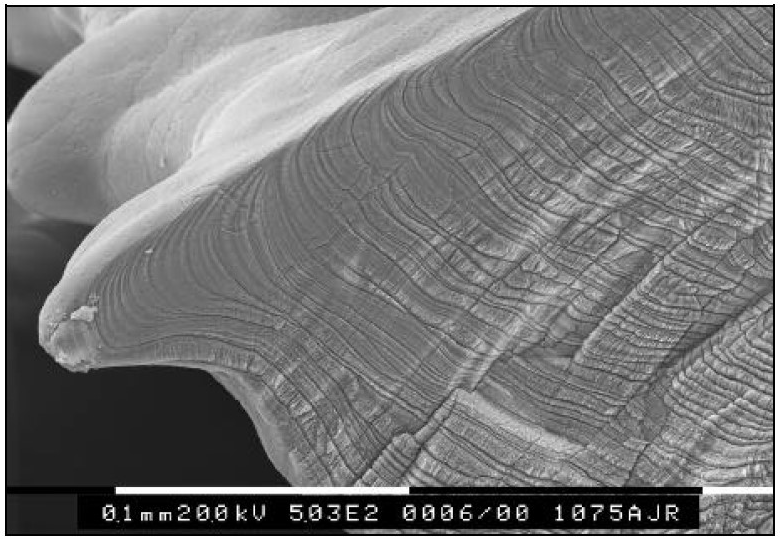
Daily ageing only

Reference	Type	Size range	N	Reading method	Validation method	Days at liberty or captivity	Age validation successful
Uchiyama and Struhsaker 1981	Age validation	52	2	Whole otolith	Captive experiments	24-30	Yes
	Ageing	7-93	14	Whole otolith			
Yamanaka 1990	Age validation	25-40	12	Whole otolith light microscope	Captive experiments	2-39	Yes
	Ageing	15-28	68	Whole otolith light microscope			
	Ageing	16-79	139	Frontal section light microscope			
Lehodey and Leroy 1999	Age validation[1]	39-90	3	Transverse section SEM	OTC mark-recapture	21-175	Yes
	Age validation[1]	39	1	Transverse section light microscope	OTC mark-recapture	21	Yes
	Age validation[1]	43, 90	2	Transverse section light microscope	OTC mark-recapture	49, 175	No
	Ageing	20-145	180	Transverse section light microscope			

Age validation

Sample	FL (cm) release	FL (cm) recapture	Days at liberty	Count (1) (mean number) Light microscopy	% difference	Count (2) SEM	% difference
T00105	42	43	49	44.4	-9.4	50	2.0
T00138	35	39	21	21.3	1.4	21	0.0
T00159	62	90.5	175	157	-10.3	175	0.0





From Lehodey & Leroy (1999)

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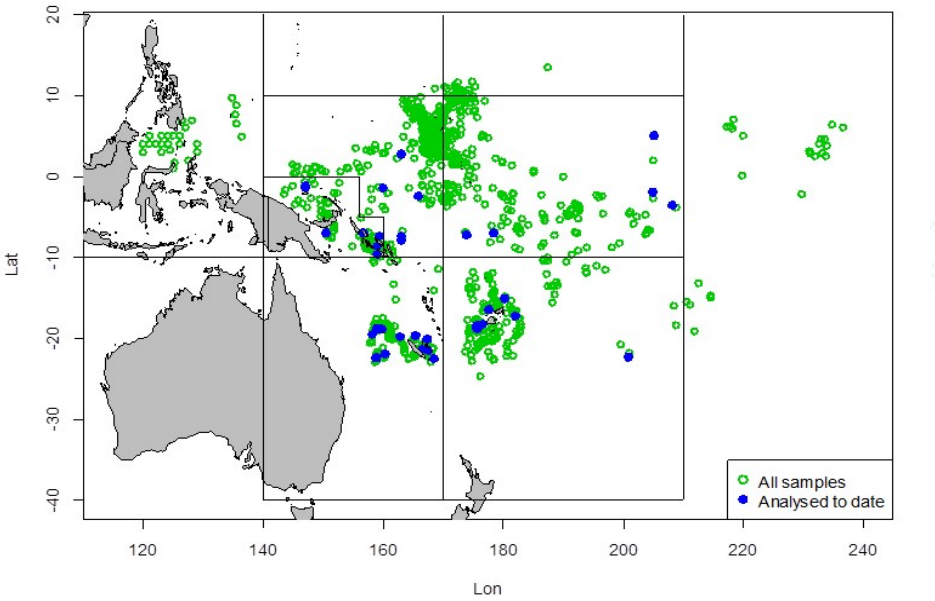
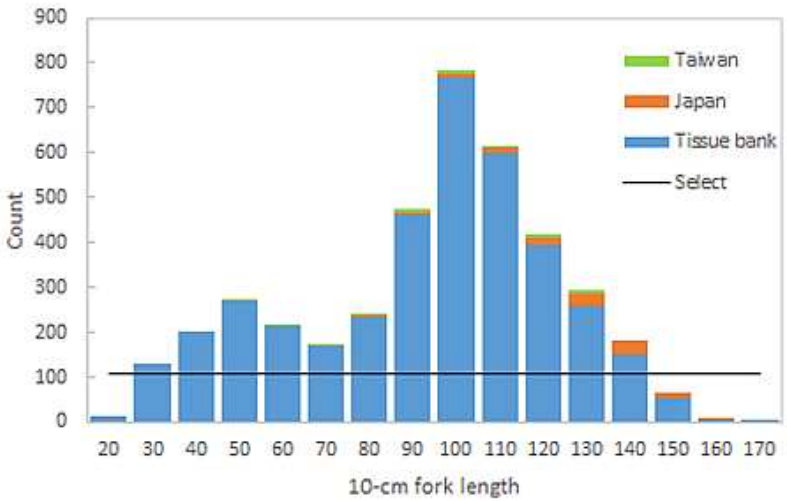
Otoliths available

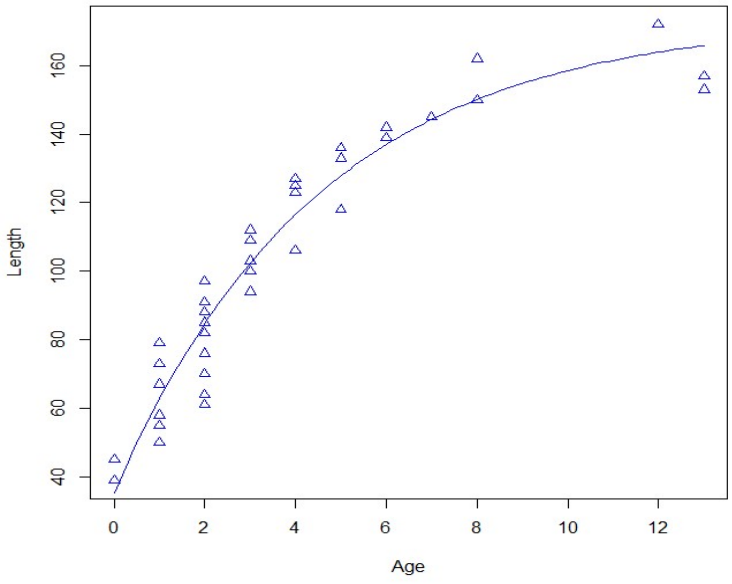




- Over 4,000 available from tissue bank since 2009
- Nearly 3,000 since 2014
- Additional otoliths from Japan & Taiwan
- Selected 40 for trial work

Trial work – annual ageing

- 40 otoliths and 40 spines – annual ageing
- 30-172 cm FL
- FAS prepared and read otoliths
- FAS prepared spines, CSIRO examined



#20 172 cm
Count = 12

Fin spines

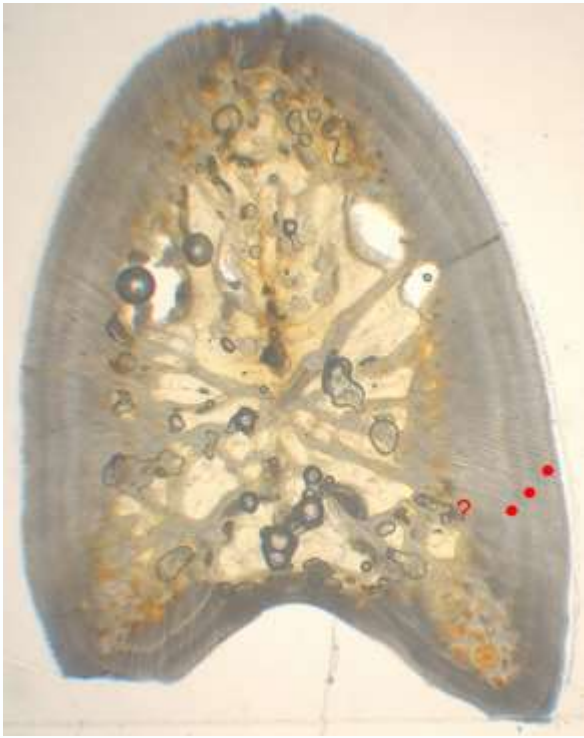
- Spines - bony skeleton
- Vascularised structure, i.e. connected to the circulatory and nervous systems (unlike otoliths)
- Subject to resorption and vascularisation as the fish grows, leading to “loss “ of early increments
- Spines useful to verify otolith 1-3 increments

YFT_25. 76 cm FL. Count = 1 opaque with 2nd forming on edge

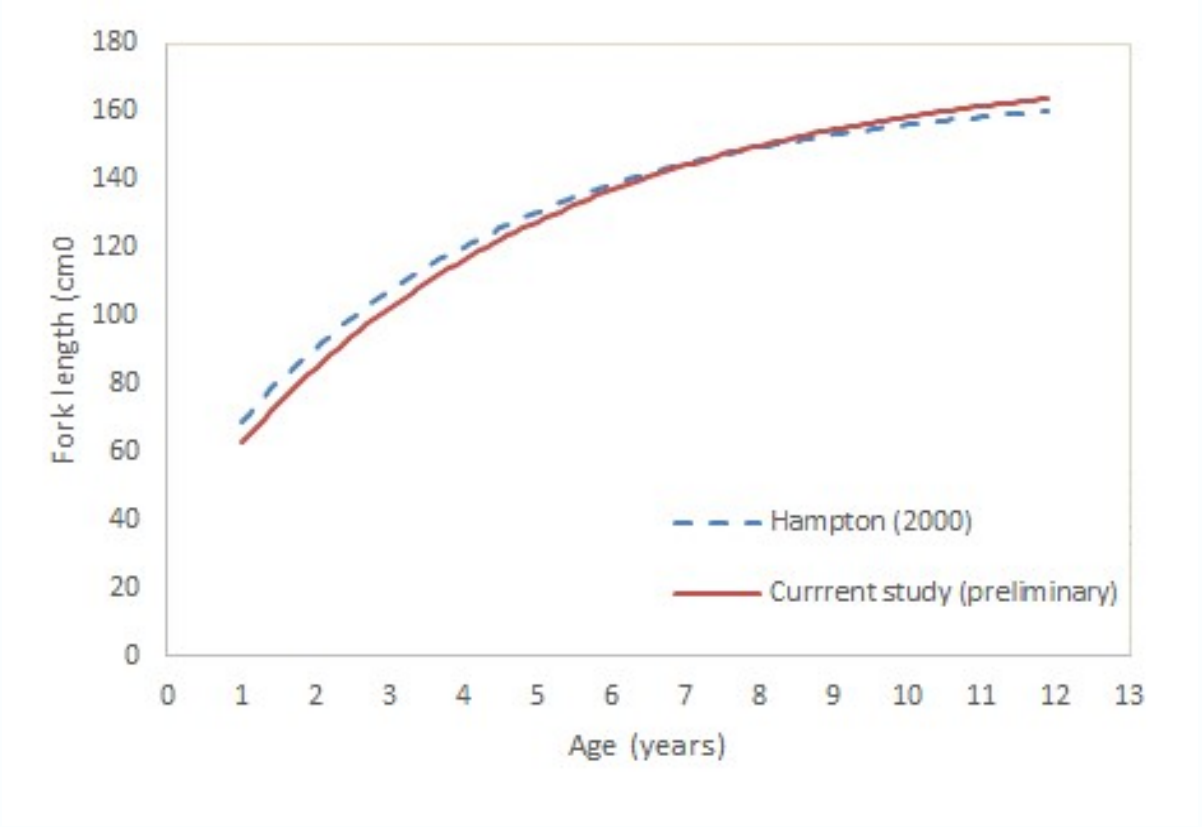
Otolith – spine comparison

YFT_1, 109 cm FL, count = 3

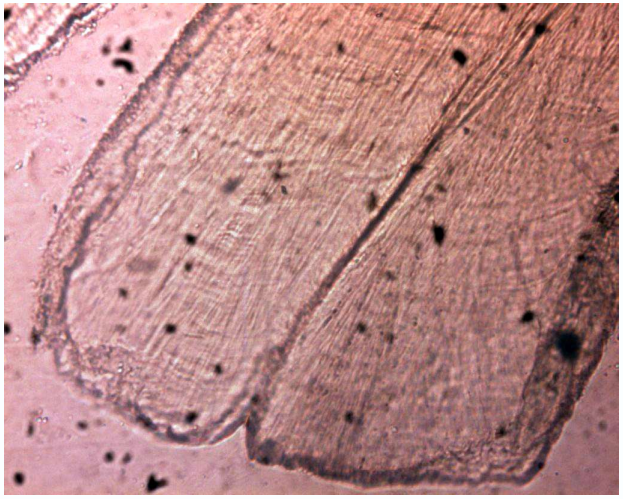
YFT_34, 139 cm FL, count = 6



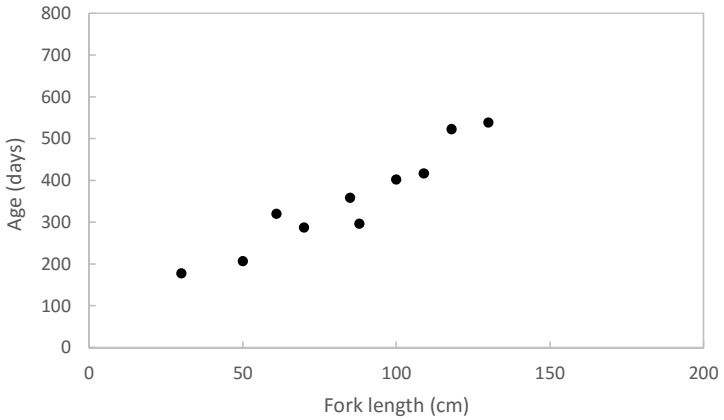
VB curves - otolith and tagging data

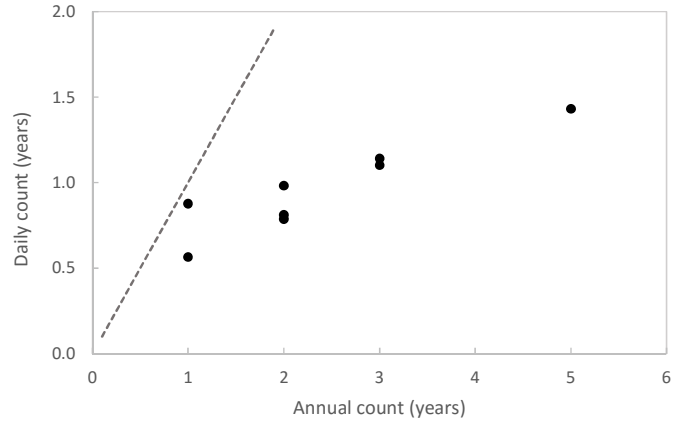


Daily ageing



- 10 otoliths – transverse section
  - Locate annual zones (365 days = age 1 yr)
  - Age that divergence occurred with annual age
- Clear increments close to primordium
- Interruption at 150-180 increments
- 1st & 2nd opaque zones occurred before the 365th increment





Future work

- Inter-laboratory daily-annual age workshop
- Age validation & corroboration
  - 2 x strontium chloride marked otoliths
  - 2 x tagged (non marked) otoliths
  - Edge type & marginal increments analysis
  - Spine analysis to corroborate
- Complete annual ageing work (n=1500)
  - Select otoliths by length and region
- Complete daily ageing work (n=150)
- Develop growth curves
- Use GAMs to investigate spatial variation in age & otolith weight