GROWTH RATE ESTIMATES OF WCPO YELLOWFIN TUNA FROM TAGGING DATA

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OUTLINE

- Brief run through previous studies
- Latest information

LEHODEY AND LEROY, 1999

- E Atlantic/SW Pacific/W Indian Ocean show ‘classic’ slow juvenile growth, while EPO does not
- Re-examined for WCPO using tagging data from 1989-1992
  - Data screened for reliable dates and release/recapture lengths
  - Data screened for short times at liberty (<30 days)

Table 1. Total and selected returns of tagged yellowfin tuna by time at liberty.

Time at liberty (yr)	Total	Selected
0 to 0.5	2157	441
0.5 to 1.0	732	441
1.0 to 1.5	366	208
1.5 to 2.0	120	55
2.0 to 2.5	43	16
2.5 to 3.0	25	12
3.0 to 3.5	13	7
3.5 to 4.0	7	5
> 4.0	3	2
Unknown	15	
Total	3483	1187

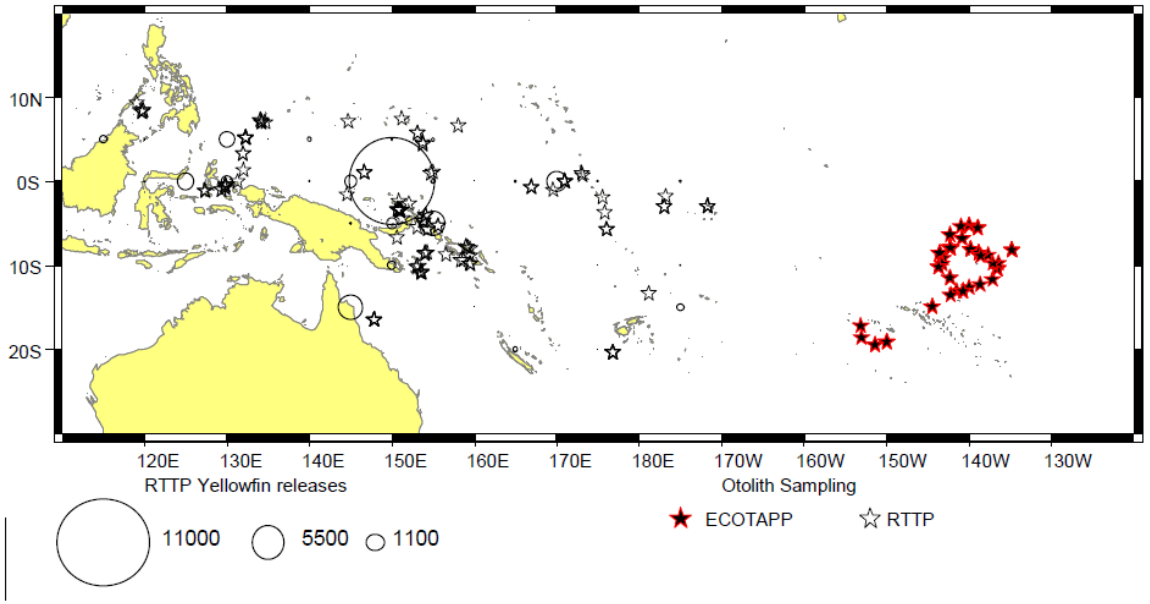


Figure 1. Location of RTTP yellowfin releases and recaptures and geographical distribution of otolith samples

CALCULATED ‘MONTHLY’ GROWTH RATE

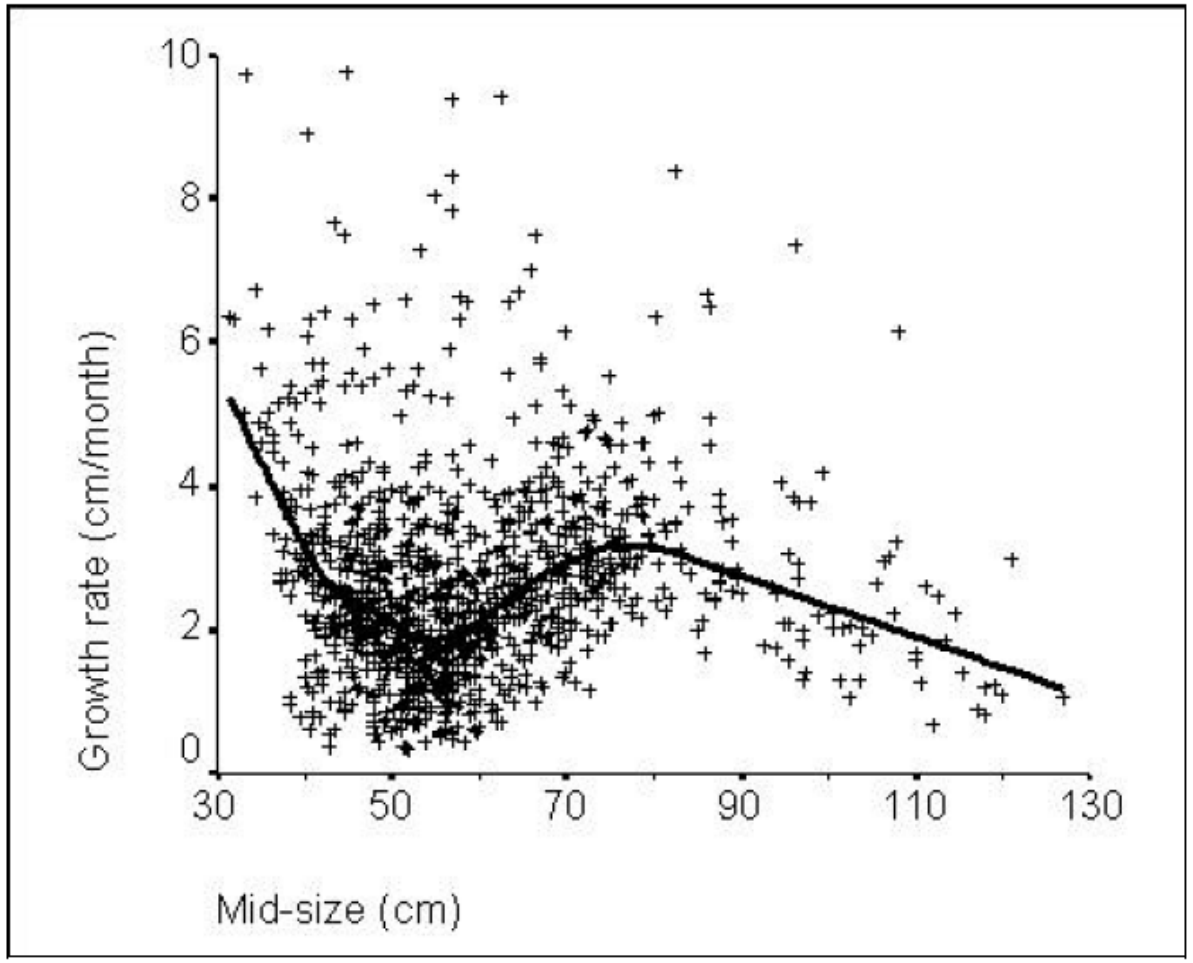


Figure 4. Growth rates of yellowfin tuna of the western and central Pacific based on tag returns from the RTTP. Mid-size is the average length between release and recapture. (a lowess function is used to show the trend of the growth rate as the size increases)

Table 3. WCPO yellowfin growth parameters estimates (standard errors between brackets) according to the Von Bertalanffy growth model with K fixed and K varying in relation to a normal distribution

	Von Bertalanffy K fixed		Von Bertalanffy K = K - N(t)	
L_∞	199.6	(15.6)	151.7	(10.7)
t_0	-0.177	(0.035)	-0.085	(0.037)
K	0.390	(0.052)	0.728	(0.153)
t_m	-		0.936	(0.052)
σ	-		0.380	(0.116)
a	-		0.164	(0.125)
R^2	0.95		0.96	

Max age ~3.5yrs

replacing K by K-$N(t)$

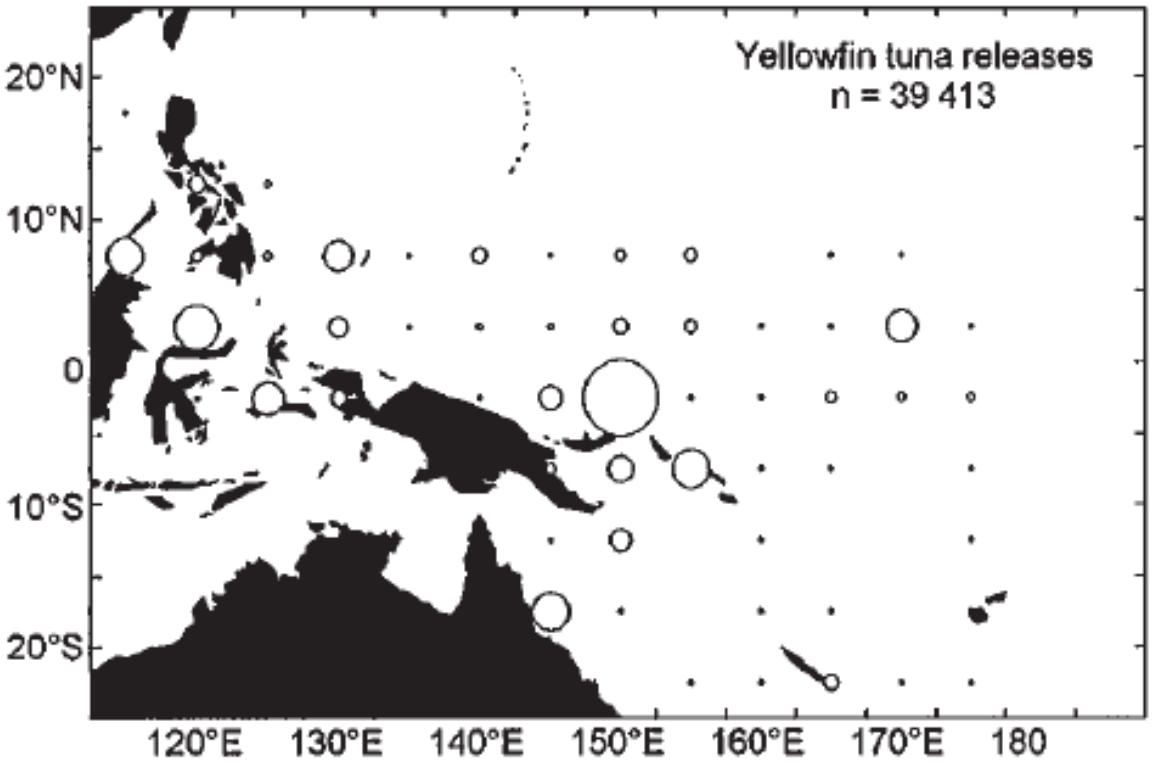
with $N(t)$ the normal distribution

$$N(t) = \frac{a}{\sigma\sqrt{2\pi}} \exp\left[-(t - t_m)^2 / (2\sigma^2)\right]$$

where t_m is the mean age (year) in the yellowfin population when the deficit in growth occurs, σ is the standard deviation and a is a parameter proportional to the maximum decrease of K reached for $t = t_m$.

HAMPTON, 2000

- Part of work focussed on estimating M in SKJ, YFT and BET
- As part of this, growth model used to predict size at each time at liberty interval



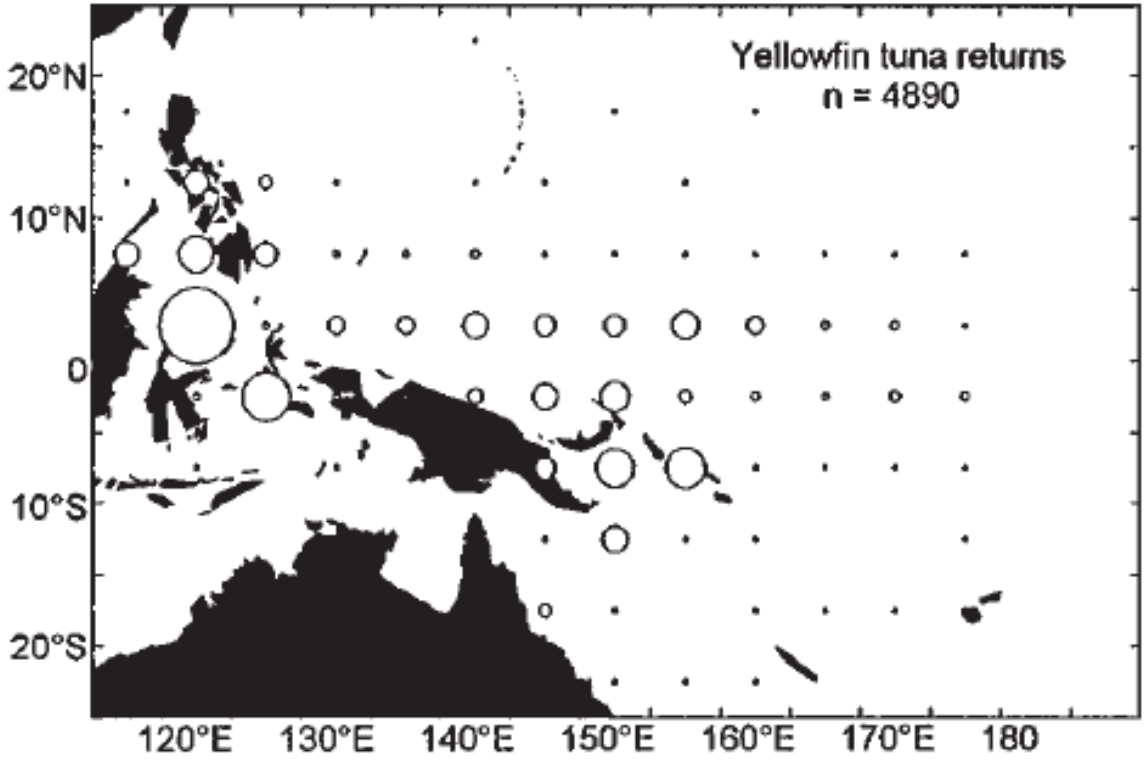


Table 1. Tag releases and returns of skipjack, yellowfin, and bigeye tuna used in the analysis of size-specific mortality rates.

	Skipjack tuna	Yellowfin tuna	Bigeye tuna
Tag releases	97 852	39 413	7906
Tag returns	12 328	4 890	979
Tag returns with accurate recapture FL measurement	4 242	1 629	307

$$(3) \qquad \hat{L}_j = [\overline{L}_\infty - l_i][1 - \exp(-Kt_j)] + l_i$$

where $\hat{L}_j$ is the predicted size at time t_j, the middle of the jth period after release, and $\overline{L}_\infty$ and K are the von Bertalanffy growth parameters mean maximum length and growth coefficient. The $\overline{L}_\infty$ and K were estimated by maximum likelihood from tag-return records in which accurate measurements of FL at recapture were available. The estimation model incorporated individual variation in L_∞ as well as observation error (model 3 in Hampton 1991*a*).

INCREMENT V TIME AT LIBERTY

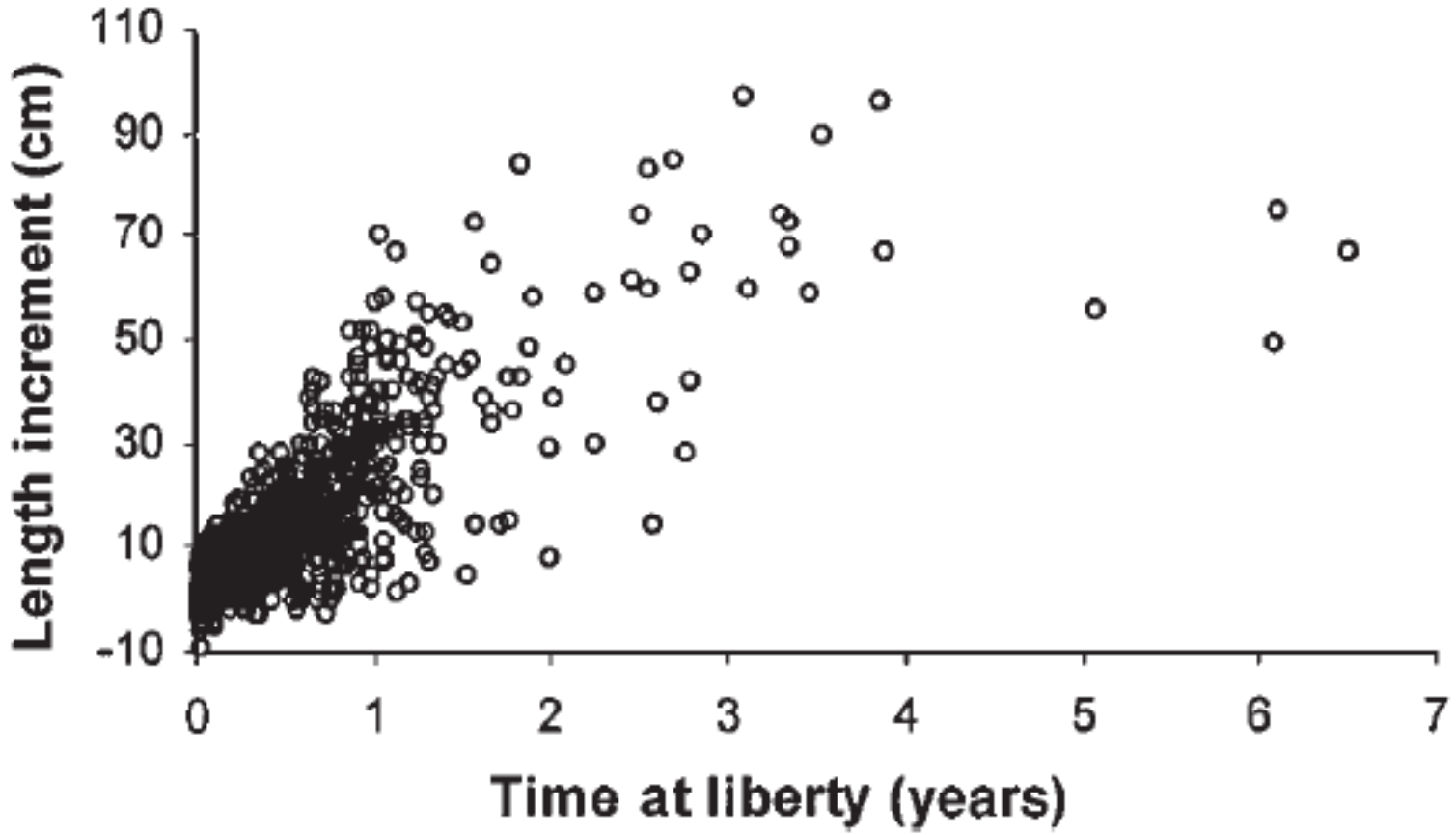


Table 2. Growth parameter estimate mean maximum length ($\overline{L}_\infty$) and growth coefficient (K) for skipjack, yellowfin, and bigeye tuna.

	$\overline{L}_\infty$ (cm)	K (year^{-1})
Skipjack tuna	65.1 (0.58)	1.30 (0.065)
Yellowfin tuna	166.4 (13.5)	0.250 (0.031)
Bigeye tuna	181.7 (6.88)	0.251 (0.028)

Note: The standard deviations of the estimates obtained from 1000 bootstrap replicates are given in parentheses.

AN AREA FOR FURTHER CONSIDERATION?

Pacific Community
Communauté du Pacifique

Table 5: CP, PNGTP and total PTTP tag release numbers, and % of recoveries to date (July 2018) of conventional and archival tags.

Project	Tag Type	Release Numbers				Recapture Percentages			
		SKJ	YFT	BET	Total	SKJ	YFT	BET	Total
CP	Archival	32	257	744	**1,033**	0.0	7.8	19.5	**16.0**
	Conventional	762	2,536	38,539	**41,837**	4.2	14.2	28.8	**27.4**
PNGTP	Archival	0	68	12	**80**	NA	27.9	58.3	**32.5**
	Conventional	80,444	27,065	2,915	**110,424**	20.2	18.6	21.2	**19.8**
Total PTTP	Archival	129	672	932	**1,733**	3.1	12.1	19.3	**15.3**
	Conventional	272,401	109,133	47,891	**429,425**	17.2	16.6	27.2	**18.2**

- Need further consideration of ‘high confidence’ tag data set