

POPULATION PARAMETERS: KAWAKAWA (*EUTHYNNUS AFFINIS*)

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The Eastern little tuna or kawakawa, *Euthynnus affinis* (Cantor 1849), is a medium-sized epipelagic, migratory neritic tuna is widely distributed across the Indo-West Pacific region in open waters close to the shoreline (Figure 1). It has a maximum fork length of 100 cm (Froese & Pauly 2015) and generally forms multispecies schools by size with other scombrid species comprising 100 – 5,000 individuals or more (Collette & Nauen 1983). It is a highly opportunistic predator feeding indiscriminately on small fishes, including clupeoids and atherinids as well as squids, crustaceans, molluscs and zooplankton (Collette 2001; Gupta et al. 2014) . The species supports substantial commercial and artisanal fisheries in many countries bordering the Indian Ocean, including Indonesia, India, Iran, Pakistan and Sri Lanka (Pierre et al. 2014). Most research has been focussed in these areas where there are important fisheries for the species, with the most common methods used to estimate growth being through length-frequency studies. Estimates of the K parameter of the von Bertalanffy equation range from 0.42 (James et al. 1993) to 1 (Sulistyaningsih et al. 2014) with all studies indicate that *E. affinis* is a fast growing species, attaining a fork length of 30-49 cm in the first year. A summary of the results of studies which have investigated the age and growth of this species is provided in Table 1 and Figure 2. Estimates of mortality parameters and length-weight relationship are provided in Table 2.

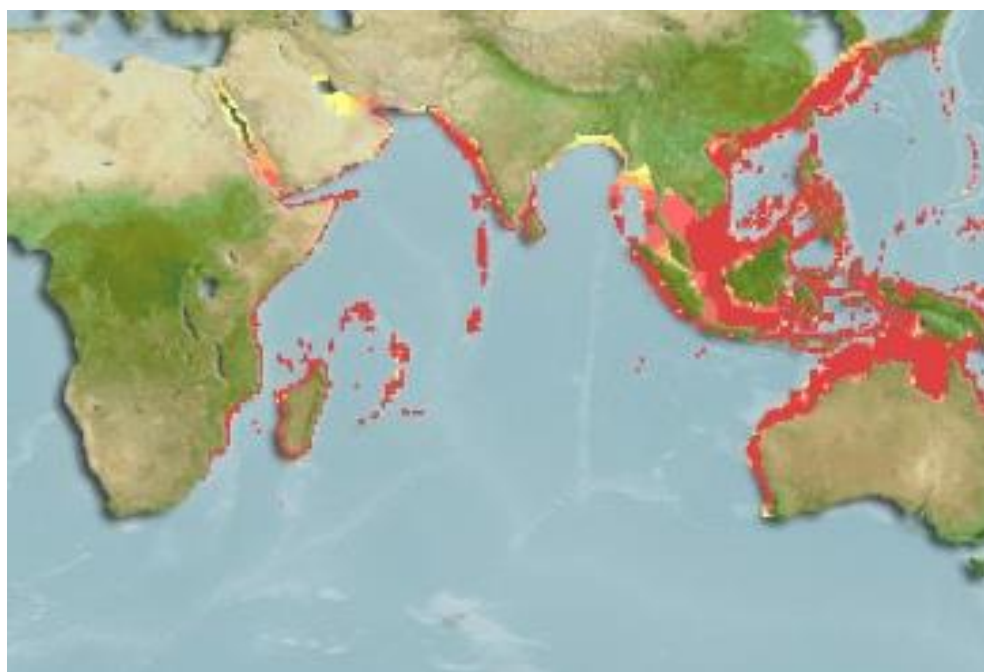


Figure 1. Distribution of *E. affinis* in the Indian Ocean²

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² Reviewed distribution maps for *Euthynnus affinis* (Kawakawa), with modelled year 2100 native range map based on IPCC A2 emissions scenario. www.aquamaps.org, version of Aug. 2013. Web. Accessed 23 Mar. 2015.



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Table 1. Estimated growth parameters for *E. affinis* with details of the type of analysis from which they have been determined and the region. LF – length frequency studies and ELEFAN: Electronic Length Frequency Analysis.

Region	Von Bertalanffy growth parameters					Length at age (cm)				Longevity (years)	n	Ageing method	Analysis type	Reference
	L _{m50} (cm)	L _{max} (cm)	L _∞ (cm)	K(year ⁻¹)	t ₀ (years)	Yr 1	Yr 2	Yr 3	Yr 4					
Seychelles		61.5	90 (FL)	0.45	-0.27									Fishbase.org ³
South Africa		100	82 (FL)	0.51						6.4				Fishbase.org
Northwest Sumatra		61.5	64.58 (FL)	1	-0.129						4225	LF	ELEFAN	(Sulistyaningsih et al. 2014)
Persian Gulf & Sea of Oman		88	95.06(FL)	0.67	-	49	69	79	85		-	LF	ELEFAN	(Kaymaram & Darvishi 2012)
Tanzania		85	89 (TL) (80 FL)	0.78	-						-	LF		(Johnson & Tamatamah 2013)
Persian Gulf & Sea of Oman		-	87.66(FL)	0.51	-0.23	40.3	58.9	70.2	77.1		9988	LF	ELEFAN	(Taghavi-Motlagh et al. 2010)
India		73	81.7 (FL)	0.79	-0.023	44.6	64.9	77.4	-		-	LF	ELEFAN	(Khan 2004)
Iran		86	87 (TL) (78 FL)	0.52	-0.46						-	LF	ELEFAN	(Reza et al. 2008)

³ Parameter values used in 2014 assessments

Region	Von Bertalanffy growth parameters					Length at age (cm)				Longevity (years)	n	Ageing method	Analysis type	Reference
	L _{m50} (cm)	L _{max} (cm)	L _∞ (cm)	K(year ⁻¹)	t ₀ (years)	Yr 1	Yr 2	Yr 3	Yr 4					
Indonesia		60	63.53(FL)	0.63	-0.21						1325	LF	ELEFAN	(Jatmiko et al. 2013)
Pakistan	37.7	80	81.92(FL)	0.56	-0.0317	42.7	59.5	-	-	9.03	278	LF	ELEFAN	(Ahmed et al. 2014)
India	37.7	80	81.92(FL)	0.56	-0.0317	42.7	59.5	69.1	-			LF	ELEFAN	(Rohit et al. 2012; Abdussamad et al. 2012)
Gulf of Thailand	-	-	79(FL)	0.96	-	47	65	72	-			LF	Modal progression	(Yesaki 1989)
Java Sea, Indonesia	-	-	59.63(FL)	0.91	0.178							LF	ELEFAN	(Chodrijah et al. 2013)
Sri Lanka	-	63	63 (FL)	0.61	0	38.8	44.4	52.9	-			LF	ELEFAN	(Joseph et al. 1986)
India	-		81	0.366	-0.344	31.43	46.6	57.14	64.44			LF	ELEFAN	(Silas 1985)
India	44	75	83.5 (TL) (75 FL)	0.42	-0.044	29.6	48.1	60.2	68.2			LF	ELEFAN	(James et al. 1993)
Veraval, India	-	70	72.5 (FL)	0.56	0.033	31.84	49.27	29.23	64.92		1680	LF	ELEFAN	(Ghosh et al. 2010)

Table 2. Mortality parameters and length-weight relationships

Region	M (year ⁻¹)	Z (year ⁻¹)	Length-weight relationship		Units	Reference
			a	b		
South Africa	0.68		0.02	2.9	cm - g	Fishbase⁴
Seychelles	1.44	6.47				(Sulistyaningsih et al. 2014)
Persian Gulf and Sea of Oman	0.76	2.58	1.86E-05	2.87	cm - kg	(Kaymaram & Darvishi 2012)
Tanzania	1.09	1.78				(Johnson & Tamatamah 2013)
Persian Gulf and Sea of Oman	0.65	2.37				(Taghavi-Motlagh et al. 2010)
India	0.928	2.24	0.239	2.786	cm - g	(Khan 2004)
Iran	0.64 – 0.67	1.78 - 2.62				(Reza et al. 2008)
Indonesia	1.07	2.4				(Jatmiko et al. 2013)
Pakistan			0.0254	2.89	cm - g	(Ahmed et al. 2014)
India	0.93	1.68	0.0254	2.89	cm - g	(Rohit et al. 2012; Abdussamad et al. 2012)
Java Sea, Indonesia	1.13	2.64	0.00001	3.13	cm - kg	(Chodrijah et al. 2013)
India	0.76	2.57	0.019	2.95	cm - g	(James et al. 1993)
Veraval, India	0.94	1.69	0.145	3.056	cm - g	(Ghosh et al. 2010)

⁴ used in 2014 assessment

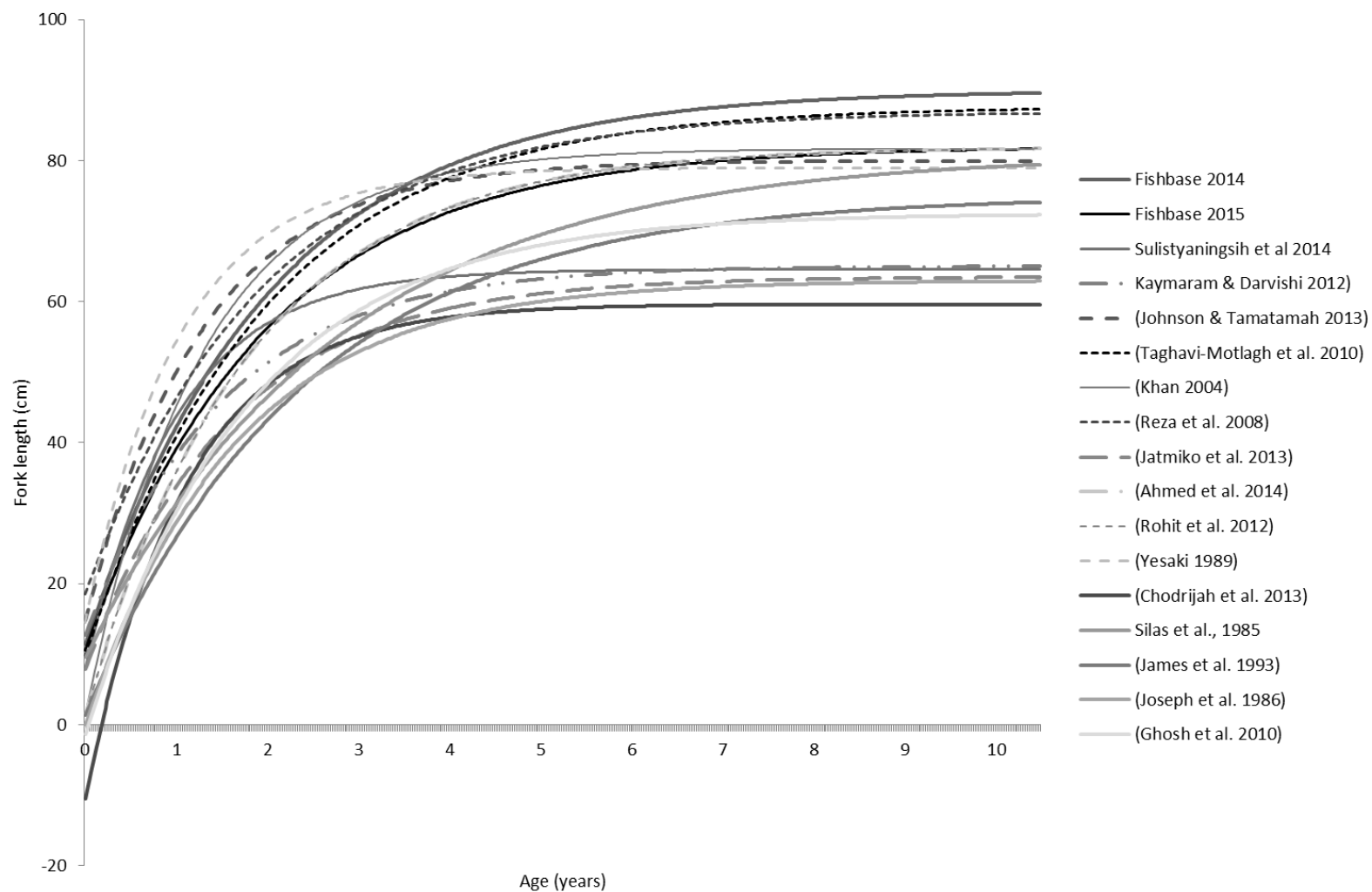


Figure 2. Length-at-age curves derived from ageing studies of kawakawa (*Euthynnus affinis*)

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