

Supplementary material

Trophic ecology of albacore tuna (*Thunnus alalunga*) in the western tropical Indian Ocean and adjacent waters

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Table S1. Relations and set of rules used for reconstitution of length and weight of digested prey recovered from the stomachs of albacore tuna (*Thunnus alalunga*) in the Western Indian Ocean and adjacent waters.

Reconstituted length is dorsal mantle length (DML) for cephalopods, total length (TL) for crustaceans, and standard length (SL) for fish. Reconstituted weight is total wet weight of undigested animal (RW). Reconstitutions was based on otolith length (OL), dentary bone length (DBL) and standard length for fishes; lower rostral length (LRL) and lower hood length (LHL) for cephalopods; telson length (TLL), length of cephalothorax (CTL) and total length for crustaceans. Length is in mm and weight in g. Some equations were adjusted to measurements in mm and transformed from original format shown in the references to simplify presentation. Equations presented in bold are species-specific, regular font represents equations taken from another species within genus, italic are genus-specific equations. ‘Not estimated’ means that no reliable equation was available to the authors for LRL range collected in our study

Order, Class, Phylum, Category, Family, Species and Category	Length reconstitution rules	Weight reconstitution rules	Relationships used for length reconstitution	Relationships used for weight reconstitution	Species substitution	References
Mollusca						
Cephalopoda						
Oegopsidae						
Enoploteuthidae						
<i>Abraliopsis morisii</i>	LRL→DML	LRL→RW	DML = $0.89 + 24.28 \times \text{LRL}$	RW = $0.878095431 \times \text{LRL}^{2.75}$	<i>Abraliopsis gilchristi</i>	Lu and Ickeringill 2002
<i>Abraliopsis gilchristi</i>	LRL→DML	LRL→RW	DML = $0.89 + 24.28 \times \text{LRL}$	RW = $0.878095431 \times \text{LRL}^{2.75}$		Lu and Ickeringill 2002
<i>Abraliopsis</i> spp.	LRL→DML	LRL→RW	DML = $0.89 + 24.28 \times \text{LRL}$	RW = $0.878095431 \times \text{LRL}^{2.75}$	<i>Abraliopsis gilchristi</i>	Lu and Ickeringill 2002
<i>Ancistrocheirus lesueurii</i>	LRL→DML	LRL→RW	DML = $-41.3 + 40.75 \times \text{LRL}$	RW = $0.823657904 \times \text{LRL}^{3.56}$		Clarke 1986
<i>Pterygioteuthis</i> sp.	LRL→DML	LRL→RW	DML = $-4.54 + 35.33 \times \text{LRL}$	RW = $2.435129651 \times \text{LRL}^{2.61}$	<i>Pterygioteuthis gemmata</i>	Lu and Ickeringill 2002
<i>Pyroteuthis margaritifera</i>	LRL→DML	LRL→RW	DML = $-5.26 + 26.73 \times \text{LRL}$	RW = $2.637944459 \times \text{LRL}^{2.7}$		Lu and Ickeringill 2002
Cranchiidae						
<i>Cranchia scabra</i>	LRL→DML	LRL→RW	DML = $35.94 + 35.26 \times \text{LRL}$	RW = $6.889510242 \times \text{LRL}^{1.88}$		Lu and Ickeringill 2002
<i>Taonius</i> sp.	LRL→DML	LRL→RW	DML = $-12.3 + 61.43 \times \text{LRL}$	RW = $2.19460044424291 \times \text{LRL}^{2.19}$		Xavier and Cherel 2009 based on data from Rodhouse <i>et al.</i> 1990
Histioteuthidae						
<i>Stigmatoteuthis dofleini</i>	LRL→DML	LRL→RW	DML = $-62.338 + 35.032 \times \text{LRL}$	RW = $1.37712776433596 \times \text{LRL}^3$		Kubodera 2002
Lycoteuthidae						
<i>Lycoteuthis lorigera</i>	LRL→DML	LRL→RW	DML = $-13.04 + 34.56 \times \text{LRL}$	RW = $1.37712776433596 \times \text{LRL}^3$		Lu and Ickeringill 2002
Octopoteuthidae						
<i>Octopoteuthis rugosa</i>	LRL→DML	LRL→RW	<i>DML = $-1.51 + 18.55 \times \text{LRL}$</i>	<i>RW = $1.25860000992948 \times \text{LRL}^{2.54}$</i>	<i>Octopoteuthis</i> sp.	Lu and Ickeringill 2002
<i>Octopoteuthis</i> sp.	LRL→DML	LRL→RW	<i>DML = $-1.51 + 18.55 \times \text{LRL}$</i>	<i>RW = $1.25860000992948 \times \text{LRL}^{2.54}$</i>		Lu and Ickeringill 2002
<i>Taningia danae</i>	Not estimated	LRL→RW	–	RW = $0.417279090198691 \times \text{LRL}^{3.42}$		Clarke 1986
Ommastrephidae						
<i>Eucleoteuthis luminosa</i>	LRL→DML	LRL→RW	DML = $19.42 + 33.18 \times \text{LRL}$	RW = $3.126768365 \times \text{LRL}^{2.15}$		Lu and Ickeringill 2002
<i>Ommastrephes bartramii</i>	LRL→DML	LRL→RW	DML = $17.736 + 34.141 \times \text{LRL}$	RW = $2.7232 \times \text{LRL}^{2.7538}$		E. V. Romanov, unpubl. data

Order, Class, Phylum, Category, Family, Species and Category	Length reconstitution rules	Weight reconstitution rules	Relationships used for length reconstitution	Relationships used for weight reconstitution	Species substitution	References
<i>Ornithoteuthis volatilis</i>	LRL→DML	LRL→RW	DML = 2.58 + 33.74 × LRL	RW = 1.973877732 × LRL^{2.27}		Lu and Ickeringill 2002 E. V. Romanov, unpubl. data Clarke, 1986; Xavier and Cherel, 2009 ^A
<i>Sthenoteuthis oualaniensis</i>	LRL→DML	LRL→RW	DML = 23.308 + 32.121 × LRL	RW = 2.897 × LRL^{2.7254}		
<i>Todarodes</i> sp.	LRL→DML	LRL→RW	<i>DML = -11.3 + 41.36 × LRL</i>	<i>RW = 2.188026509 × LRL^{2.83}</i>		
Onychoteuthidae						
<i>Onychoteuthis</i> sp2 ' <i>banksii</i> '	LRL→DML	LRL→RW	DML = 2.31 + 32.75 × LRL	RW = 0.960789439 × LRL^{2.8}	<i>Onychoteuthis</i> ' <i>banksii</i> '	Lu and Ickeringill 2002
<i>Walvisteuthis rancureli</i>	LRL→DML	LRL→RW	DML = 2.31 + 32.75 × LRL	RW = 0.960789439 × LRL ^{2.8}	<i>Onychoteuthis</i> ' <i>banksii</i> '	Lu and Ickeringill 2002
Thysanoteuthidae						
<i>Thysanoteuthis rhombus</i>	LRL→DML	Not estimated	DML = 45.5075410449497 × LRL^{1.3889}	–		Arkhipkin 1983
Octopoda						
Alloposidae						
<i>Haliphron atlanticus</i>	LHL→DML	Not estimated	DML = 12.18249396 × LHL^{1.45}	–		Xavier and Cherel 2009
Argonautidae						
<i>Argonauta argo</i>	LHL→DML	LHL→RW	<i>DML = -9.698778987 × LHL^{1.314}</i>	<i>RW = 0.222239422 × LHL^{3.4555}</i>	<i>Argonauta</i> sp.	Staudinger <i>et al.</i> 2013
Ocythoidae						
<i>Ocythoe tuberculata</i>	LHL→DML	LHL→RW	DML = 2.27+5.82 × LHL	RW = 0.349937749 × LHL^{2.51}		Lu and Ickeringill 2002
Tremoctopodidae						
<i>Tremoctopus gracilis</i>	LHL→DML	LHL→RW	DML = -15.342+23.777 × LHL	RW = 0.7975 × LHL^{3.3858}		Authors calculations based on data in appendix table 1 in Smale <i>et al.</i> (1993)
Crustacea						
Amphipoda						
Platyscelidae						
<i>Platyscelus ovoides</i>	CTL→TL	CTL→RW	TL = 0.34 + 2.73 × TLL	RW = 0.000234044 × TLL^{2.53}		Potier <i>et al.</i> 2011
Stomatopoda						
Squillidae						
<i>Natosquilla investigatoris</i>	TLL→TL	TLL→RW	TL = 6.1564 + 5.1521 × TLL	RW = 0.0042 × TLL^{2.7363}		M. Potier, unpubl. data
Decapoda						
Oplophoridae						
<i>Oplophorus typus</i>	Not estimated	CTL→RW	–	RW = 0.000234044 × TLL^{3.4022}		M. Potier, unpubl. data
Penaecidae						
<i>Funchalia taaningi</i>	Not estimated	CTL→RW	–	RW = -4.8143 + 0.608 × TLL		M. Potier, unpubl. data
Pisces						
Clupeiformes						
Engraulidae						
<i>Engraulis capensis</i>	OL→SL	OL→RW	SL = 31.72801359 × OL^{0.9812}	RW = 1.01592548 × OL^{2.8541}		Smale <i>et al.</i> 1995
Perciformes						
Carangidae						
<i>Decapterus macrosoma</i>	OL→SL	OL→RW	SL = -42.451 + 46.589 × OL	RW = 0.226502340676469 × OL^{3.758}		Wang <i>et al.</i> 2003
<i>Decapterus</i> sp.	OL→SL	OL→RW	<i>SL = -19.51 + 45.38 × OL</i>	<i>RW = 0.000001036148588 × OL^{3.54}</i>		Potier <i>et al.</i> 2011
Chiasmodontidae						

Order, Class, Phylum, Category, Family, Species and Category	Length reconstitution rules	Weight reconstitution rules	Relationships used for length reconstitution	Relationships used for weight reconstitution	Species substitution	References
<i>Chiasmodon niger</i>	OL→SL	OL→RW	SL = 6.53 + 22.7 × OL	RW = 0.269820056384687 × OL^{2.55}		Potier <i>et al.</i> 2011
<i>Pseudoscopelus</i> sp.	OL→SL	OL→RW	SL = 6.53 + 22.7 × OL	RW = 0.269820056384687 × OL ^{2.55}	<i>Chiasmodon niger</i>	Potier <i>et al.</i> 2011
Gempylidae						
<i>Lepidocybium flavobrunneum</i>	FL→SL	Not estimated	SL = -0.4849+0.9241 × FL	–		E. V. Romanov, unpubl. data
<i>Nealotus tripes</i>	OL→SL	OL→RW	SL = -14.91 + 36.78 × OL	RW = 0.042 × OL^{3.81}		Ohshimo <i>et al.</i> , 2018 (Equation for RW corrected by E. V. Romanov) ^B
Mugilidae						
<i>Liza</i> sp.	OL→SL	OL→RW	SL = 14.00900028 × OL ^{1.3355}	RW = 0.163654136802704 × OL ^{2.88}	<i>Chelon richardsonii</i>	Smale <i>et al.</i> 1995
Nomeidae						
<i>Cubiceps pauciradiatus</i>	OL→SL	OL→RW	SL = 0.163654136802704 × OL^{1.3395}	RW = 0.163654136802704 × OL^{2.88}		Potier <i>et al.</i> 2011
Tetraodontiformes						
Molidae						
<i>Ranzania laevis</i>	TL→SL	TL→RW	SL = 4.2120 + 0.9186 × TL	RW = 0.0007 × TL^{2.5071}		Smith <i>et al.</i> 2010 (RW); E. V. Romanov unpubl. data (SL)
Aulopiformes						
Alepisauridae						
<i>Alepisaurus ferox</i>	DBL→SL	SL→RW	SL = -28.6199 + 6.7346 × DBL	RW = 0.000006718595889 × SL^{2.8381}		E. V. Romanov, unpubl. data
Omosudidae						
<i>Omosudis lowii</i>	DBL→SL	DBL→RW	SL = -9.03 + 4.73 × DBL	RW = 0.003661069 × DBL^{2.37}		Potier <i>et al.</i> 2011
Paralepididae						
<i>Lestidiops similis</i>	OL→SL	OL→RW	SL = 30.198 + 46.589 × OL	RW = 0.0000003 × OL ^{3.371}	Lestidiops sphyrenoides	Battaglia <i>et al.</i> 2015
<i>Magnisudis atlantica</i>	OL→SL	OL→RW	SL = -130.46 + 85.73 × OL	RW = 0.0024 × OL^{6.52}		Ohshimo <i>et al.</i> 2018
<i>Paralepis</i> sp.	OL→SL	OL→RW	SL = -1.88 + 50.12 × OL	RW = 0.1916478626 × OL ^{3.4096}		E. V. Romanov, unpubl. data
Beryciformes						
Berycidae						
<i>Beryx splendens</i>	OL→SL	SL→RW	SL = 1.5943+16.238 × OL	RW = 0.000040209736245 × SL^{2.98}		Al-Mamry <i>et al.</i> 2010 (SL); Ivanin and Rebik 2012 (RW)
Diretmidae						
<i>Diretmus argenteus</i>	OL→SL	OL→RW	SL = 7.557194323 × OL^{1.1861}	RW = 0.044811073 × OL^{3.1983}		Smale <i>et al.</i> 1995
Gadiformes						
Moridae						
<i>Antimora rostrata</i>	OL→SL	OL→RW	SL = 6.132484686 × OL^{1.5416}	RW = 0.000148177 × OL^{5.6461}		Smale <i>et al.</i> 1995
Merlucciidae						
<i>Merluccius</i> spp.	OL→TL, TL→SL	TL→RW	TL = 6.997 × (OL+2.170) ^{1.362} SL = -0.58 + 0.93 × TL	RW = 0.0076 × (0.1 × TL) ^{2.9739}	<i>Merluccius capensis</i>	Wilhelm <i>et al.</i> 2013 (OL-TL), Moutopoulos and Stergiou 2002 (TL-SL), Brinkman 2007 (TL-RW)
Myctophiformes						
Myctophidae						
<i>Diaphus perspicillatus</i>	OL→SL	OL→RW	SL = -7.14 + 18.73 × OL	RW = 0.000004 × OL^{3.195}		Potier <i>et al.</i> 2011

Order, Class, Phylum, Category, Family, Species and Category	Length reconstitution rules	Weight reconstitution rules	Relationships used for length reconstitution	Relationships used for weight reconstitution	Species substitution	References
<i>Electrona risso</i>	OL→SL	OL→RW	SL = 11.89835315 × OL^{1.1537}	RW = 0.0227976 × OL^{3.9285}		Smale <i>et al.</i> 1995
<i>Hygophum hygomii</i>	OL→SL	SL→RW	SL = 1.774 + 15.941 × OL	RW = 0.000008 × SL^{3.2189}		Battaglia <i>et al.</i> 2010 (SL); P. Alexander Hulley 2018 pers. comm., Hout Bay, South Africa (RW)
<i>Lampanyctodes hectoris</i>	OL→SL	OL→RW	SL = 18.92152192 × OL^{1.3463}	RW = 0.074967544 × OL^{4.2197}		Smale <i>et al.</i> 1995
<i>Lobianchia gemellarii</i>	OL→SL	SL→RW	SL = 5.270367002 × OL^{1.4879}	RW = 0.00004 × SL^{2.7737}		Smale <i>et al.</i> 1995 (SL); Battaglia <i>et al.</i> 2015 (RW)
<i>Myctophum asperum</i>	OL→SL	OL→RW	SL = 7.03 + 20.76 × OL	RW = 0.244143283153437 × OL^{2.96}		Potier <i>et al.</i> 2011
<i>Symbolophorus barnardi</i>	OL→SL	OL→RW	SL = 26.18534754 × OL^{0.8475}	RW = 0.277065871 × OL^{2.4423}		Smale <i>et al.</i> 1995
Stomiiformes						
Sternoptychidae						
<i>Maurolicus muelleri</i>	OL→SL	OL→RW	SL = 23.46945996 × OL^{0.9618}	RW = 0.159997034 × OL^{3.0971}		Smale <i>et al.</i> 1995

^AClarke (1986) presented equation for *Todarodes sagittatus*, while Xavier and Cherel (2009) presented same equation for *Todarodes* sp.

^BValue 0.42 for parameter ‘a’ in the weight reconstitution equation in Ohshimo *et al.* (2018: Table 1) is apparently a misprint.

Table S2. Name species, taxon groups, clusters tree and biogeographic provinces corresponding to the multivariate classification and regression tree shown at the Fig. 7, see main text of the manuscript

Species code	Species	Taxa	Clusters	Provinces
JUC	Coastal and reef-associated fish juveniles	Fish	1	EAFR-MCM, ISSG
ONY	<i>Walvisteuthis rancureli</i>	Cephalopod		
STO	<i>Sthenoteuthis oualaniensis</i>	Cephalopod		
DIS	<i>Diaphus</i> sp.	Fish		
ONB	<i>Onychoteuthis</i> sp2 'banksii'	Cephalopod		
LEI	<i>Lestrolepis intermedia</i>	Fish		
LYL	<i>Lycoteuthis lorigera</i>	Cephalopod	2	EAFR-SA
MAU	<i>Maurolicus muelleri</i>	Fish		
SYP	<i>Symbolophorus barnardi</i>	Fish		
ENS	<i>Engraulis capensis</i>	Fish		
HES	<i>Heterocarpus</i> sp.	Crustacean		
PHS	<i>Phrosina semilunata</i>	Crustacean		
MAU	<i>Maurolicus muelleri</i>	Fish	3	EAFR-SA
NAN	<i>Nansenia macrolepis</i>	Fish		
ONA	Unidentified Onychoteuthidae	Cephalopod		
BRS	<i>Brachyscelus cruscolum</i>	Crustacean		
JAS	<i>Jasus</i> sp.	Crustacean		
Unk_P	Unidentified fish	Fish		
LAH	<i>Lampanyctodes hectoris</i>	Fish	4	EAFR-SA
MAU	<i>Maurolicus muelleri</i>	Fish		
ORN	<i>Ornithoteuthis volatilis</i>	Cephalopod		
NAN	<i>Nansenia macrolepis</i>	Fish		
LIZ	<i>Liza</i> sp.	Fish		
HOY	<i>Stigmatoteuthis hoylei</i>	Cephalopod		
JUC	Coastal and reef-associated fish juveniles	Fish	5	MONS
NAT	<i>Natosquilla investigatoris</i>	Crustacean		
DES	<i>Decapterus</i> sp.	Fish		
STO	<i>Sthenoteuthis oualaniensis</i>	Cephalopod		
ORN	<i>Ornithoteuthis volatilis</i>	Cephalopod		
LYS	<i>Lysiosquilla tredecimdentata</i>	Crustacean		
CUB	<i>Cubiceps pauciradiatus</i>	Fish	6	MONS
JUC	Coastal and reef-associated fish juveniles	Fish		
DES	<i>Decapterus</i> sp.	Fish		
ARO	<i>Argonauta argo</i>	Cephalopod		
ONA	Unidentified Onychoteuthidae	Cephalopod		
STO	<i>Sthenoteuthis oualaniensis</i>	Cephalopod		

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