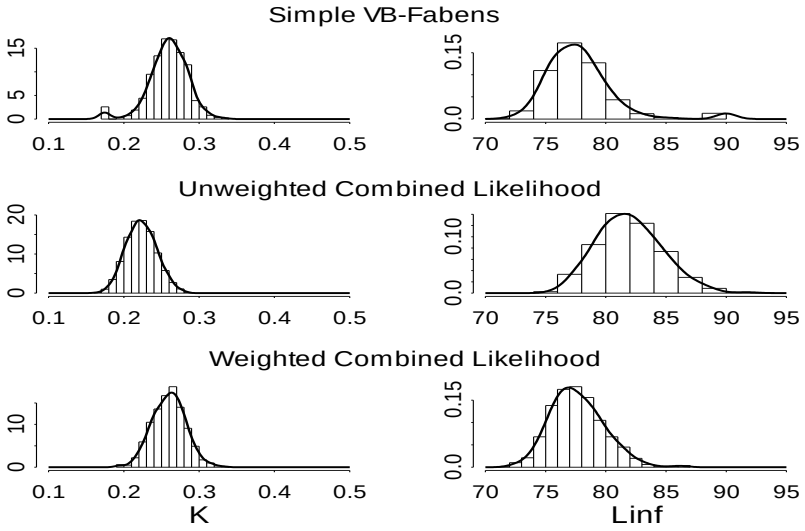
Skipjack growth analysis with tagging data

(D. Gaertner).

Growth of skipjack was analyzed with the aid of tagging data collected during the RTTP-IOTC program. The results from the conventional Fabens' method are confronted with a new method. (Gaertner et al, in press) which combine the tagging data and parameters of growth of skipjack from isolated studies in the World Ocean. The main advantage of this approach is to account for the form of the relationship between the historic growth parameters and to express L_∞ as a bioenergetic function of K. The influence of the penalties in the partial objective functions of the Log-likelihood were compared between an unweighted combined likelihood and a sample size weighted likelihood. The estimates of the growth parameters for the different models are in the following table and figure.

Summary of bootstrapped statistics for the von Bertalanffy-Fabens model and for the integrated likelihood approaches (unweighted and size sample weighted) combining the Indian Ocean tagging data (1512 observations) and the meta-analysis on existing studies on growth parameters of skipjack in the world's oceans (31 observations). $\Delta L = \left(\left(C\ K^{-h}\right) - L_t\right)\left(1 - e^{-K\Delta t}\right)$. * = estimated *a posteriori* based on the *C* and *h* estimates of the bioenergetic function relating L_∞ at *K*; NA = non estimable. Only fish with date at recapture known exactly were considered.

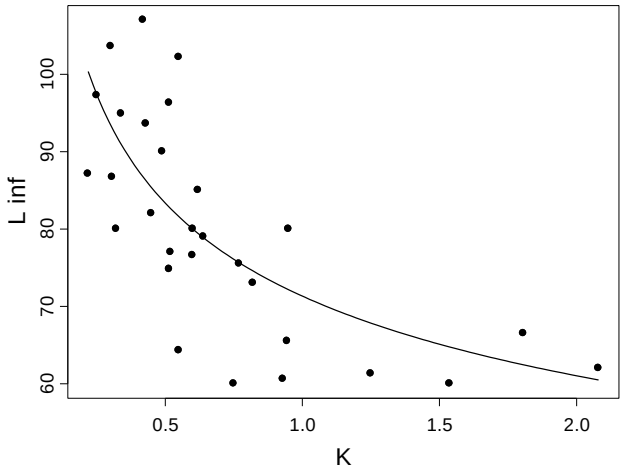
Method	Estimate	*K*	L_∞	*C*	*h*
Fabens	mean	0.26	77.84	NA	NA
	median	0.26	77.48	NA	NA
	C.I.	0.18-0.31	73.70-90.00	NA	NA
Unweighted combined Likelihood	mean	0.22	81.96*	68.33	0.12
	median	0.22	81.82*	68.42	0.12
	C.I.	0.19-0.26	77.21-87.55	62.19-73.86	0.05-0.19
Weighted combined Likelihood	mean	0.26	77.66*	64.64	0.14
	median	0.26	77.44*	64.84	0.13
	C.I.	0.22-0.30	73.91-82.84	57.99-70.69	0.05-0.22



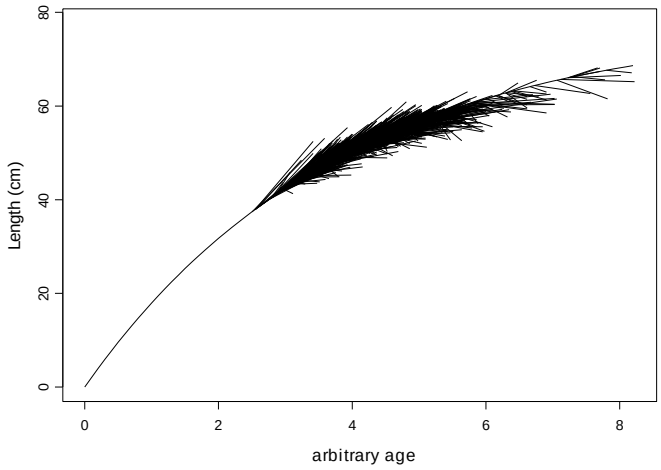
Growth parameter estimates for the Indian Ocean Skipjack

The following table represents the estimates of growth parameters from isolated studies for skipjack in the world's oceans used for modelling the bioenergetic function expressing L_∞ as a function of K used into the integrated approach.

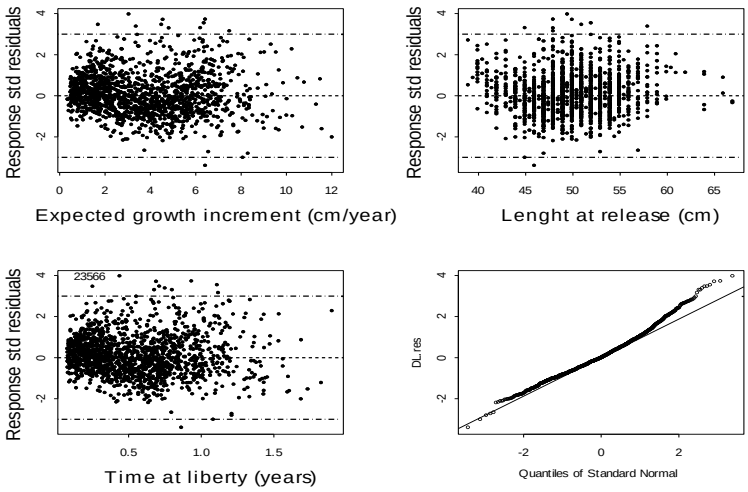
Area	L_∞	K	Method	Reference
E. Atlantic G. of Guinea	80	0.32	Tagging	Bard and Antoine, 1986
E. Atlantic N. trop	80	0.60	Tagging	Bard and Antoine, 1986
E. Atlantic G. of Guinea	86.7	0.31	Spines	Chur and Zharov, 1983
E. Atlantic Senegal	62	2.08	Tagging	Cayré et al, 1986
E. Atlantic Cap Vert	60	1.54	Tagging	Cayré et al, 1986
E. Atlantic Senegal	97.26	0.25	Tagging	Hallier and Gaertner, 2006
W. Atlantic Caribbean sea	94.9	0.34	Length-freq	Pagavino and Gaertner, 1995
W. Atlantic Brasil	87.12	0.22	Spines	Vilela and Costello, 1991
Indian Ocean	60.6	0.93	Length-freq	Marcille and Stequert, 1976
Indian Ocean Maldives	64.3	0.55	Tagging	Adams, 1999
Indian Ocean Maldives	82	0.45	Length-freq	Hafiz, 1987, in Adams 1999
Indian Ocean Sri Lanka	85	0.62	Length-freq	Amarasiri and Joseph, 1987
Indian Ocean Sri Lanka	77	0.52	Length-freq	Sivasubramanium, 1985; in Adams, 1999
Indian Ocean Minicoy	90	0.49	Length-freq	Mohan and Kunhikoya, 1985; in Adams, 1999
E. Pacific	75.5	0.77	Tagging	Sibert et al, 1979
E. Pacific	79	0.64	Tagging	Josse et al, 1979
E. Pacific N	96.3	0.52	Tagging	Bayliff, 1988
E. Pacific S	66.5	1.81	Tagging	Bayliff, 1988
E. Pacific	73	0.82	Tagging	Joseph and Calkins, 1969
E. Pacific	107	0.42	Length-freq	Joseph and Calkins, 1969
W. Pacific	61.3	1.25	Tagging	Sibert et al, 1979
W. Pacific	65.5	0.95	Tagging	Josse et al, 1979
W. Pacific Vanuatu	60	0.75	Length-freq	Brouard et al, 1984
W. Pacific Trop. & Jap.	93.6	0.43	Otolith	Tanabe et al, 2003
W. Pacific Japan	76.6	0.60	Length-freq	Yao, 1981; in Wild and Hampton, 1994
W. Pacific Taiwan	103.6	0.30	Vertebrae	Chi and Yang, 1973; in Wild and Hampton, 1994
Central Pacific	102.2	0.55	Otolith	Uchiyama and Struhsaker, 1981
Central Pacific	80	0.95	Grouped L-freq	Brock, 1954; in Adams, 1999
Central Pacific West	74.8	0.52	Length-freq	Wankowski, 1981



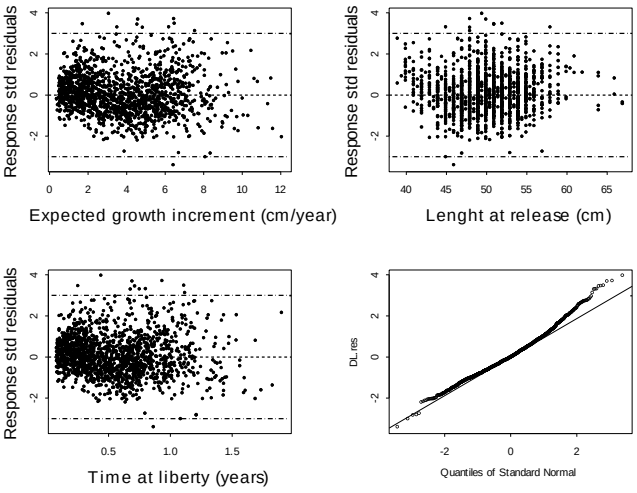
Example of relationship used for modeling the bioenergetic function relating L_∞ and K



Representation of the length increment between the predicted length at release and the observed length at recapture by age at release (arbitrary age)



Residual from the simple VB-Fabens ' growth model



Residual from the Weighted combined likelihood growth model