The following supplements accompany the article

Growth and shrinkage in Antarctic krill *Euphausia superba* is sex-dependent

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Supplement 1

Sources and cruise details of datasets within KRILLBASE.

Data nationality	Contributed by	Further information	Source	Date range		Latitude range		Longitude range		No. length measurements
				From	To	From	To	From	To	
Australian	So Kawaguchi	BROKE Survey (1996), Australian Antarctic Division	Australian Antarctic Division data for BROKE Survey (1996) sent by So Kawaguchi	30/01/1996	22/03/1996	-66.0219	-62.9897	79.98023	150.0485	9348
Australian	So Kawaguchi	KACTAS Survey (2001, Australian Antarc Division	Australian Antarctic Division data for KACTAS Survey (2001) sent by So Kawaguchi	14/01/2001	11/02/2001	-67.0016	-63.7501	62.71173	105.4892	3564
Australian	So Kawaguchi	KAOS Survey (2003), Australian Antarctic Division	Australian Antarctic Division data for KAOS Survey (2003) sent by So Kawaguchi	16/01/2003	03/03/2003	-67.0002	-66.0802	61.9298	70.3198	4304
Gerrman	Volker Siegel	Sea Fisheries Institute, Hamburg	German data sent by Volker Siegel, Sea Fisheries Institute, Hamburg	16/11/1977	12/02/2001	-77.2502	-51.7669	-90.8335	19.9831	254058
International dataset		Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) program. Data held at British Antarctic Survey	BIOMASS	24/01/1981	08/04/1985	-68.246	-53.5124	-71.4752	93.0106	52365
International dataset			CCAMLR2000	11/01/2000	04/02/2000	-64.005	-51.8252	-65.9355	-23.289	5670
Japanese	Taro Ichii		1991 austral summer Japanese data sent by Taro Ichii (spermatophore notes not entered)	22/12/1990	02/02/1991	-63.5168	-59.3668	-61.8668	-53.7668	6874
Peruvian	Javier Quinones		Peruvian summer 1999/2000 data from Javier Quinones	25/01/2000	28/01/2000	-62.5081	-60.6021	-62.8901	-54.5571	1127
Japanese	Sanae Chiba		1996 Ori net data sent by Sanae Chiba	03/03/1980	02/02/1996	-65.0001	-62.0001	135.0006	145.0058	262
UK		British Antarctic Survey cruise data	Combination of all BAS data in previous sheet	03/03/1980	16/12/2013	-67.767	-49.6463	-70.071	-30.4254	74948
UK		Discovery Investigations, data held at British Antarctic Survey	DISCOVERY	20/12/1926	10/09/1951	-72.9502	-40.7502	-179.333	178.6665	40639
Ukrainian	Boris Trotsenko, E Pakhomov		Ukrainian data (digital photos of net logsheets) sent in 2 batches by Boris Trotsenko, translated	19/01/1983	01/04/1990	-67.4751	-55	32.8634	80.0001	13037

Data nationality	Contributed by	Further information	Source	Date range		Latitude range		Longitude range		No. length measurements
				From	To	From	To	From	To	
			by Evgeny Pakhomov, transcribed by Mark Jessopp, Catherine Brester, Angus Atkinson then Natalie Ensor							
Ukrainian	E Pakhomov		Pakhomov et al (unpub data) Macroplankton data in the Prydz bay region in 1987-1990 from bongo & Melnikov nets catches	12/01/1988	15/03/1990	-67.5001	-65.26666667	51.68333333	81.05033333	1340
US	Valerie Loeb & Roger Hewitt	US Antarctic Marine Living Resources Program data	Combination of all AMLR data in previous sheet	08/01/1990	25/01/2007	-63.0391	-60.0001	-62.5031	-53.2901	67586
US	Kendra Daly	US expedition data (AMERIEZ, Protea)	Old US expedition data (e.g. AMERIEZ, Protea) sent by Kendra Daly	10/11/1983	13/08/1988	-66.0167	-55.6836	-51.0012	-34.9834	4891
US	Kendra Daly	US SO GLOBEC Progam	Data sent by Kendra Daly on the US SO GLOBEC Program (winter data)	07/05/2001	10/05/2002	-69.7091	-66.029	-71.5411	-67.3131	2270
Published literature			Fevolden & George (1984) J. Crust Biol. 4 (Spec. No 1) 107-122	23/01/1983	12/02/1983	-64.61676667	-62.16676667	-63.1001	-58.38343333	6285
Published literature			Higginbottom & Hosie (1989) MEPS 58 197-203	09/03/1987	09/03/1987	-66.89166667	-66.89166667	70.25833333	70.25833333	732
Published literature			Jazdzewski, K et al (1978) Biological and populational studies on krill near South Shetland Islands, Scotia Sea and South Georgia in the summer 1976. Polskie Archiwum Hydrobiologii 25(3) 607-631	03/02/1976	11/03/1976	-64.77312431	-53.66133875	-67.245406	-27.6001	9684
Published literature			Maklygin (1993) In. Klekowski, RZ & Opalinski, KW (Eds) 2nd Polish-Soviet Antarctic Symposium 151-157	14/02/1989	15/03/1989	-72.0001	-54.0001	-57.6301	-17.5001	4031
Published literature			Nordhausen (1994) MEPS 109 131-142	01/08/1992	01/08/1992	-64.3701	-64.3701	-61.9301	-61.9301	102
Published literature			Terazaki & Wada (1986) Mem. Natl Inst. Polar Res. Spec. Issue 40, 97-109	22/12/1983	20/01/1984	-65.73343333	-64.91676667	117.9165667	149.9499	1225
Published literature			Stepnik, R. (1982) Polish Polar Research 3(1-2) 49-68	15/12/1978	15/03/1980	-58.4793	-58.4793	-62.175	-62.175	11460
Published literature			Williams, R. et al (1986) ADBEX I cruise zooplankton data. ANARE Research Notes 31	19/11/1982	19/12/1982	-68.5601	-59.99666667	62.75166667	89.98833333	4411
Published literature			Witek (1979) Phytoplankton distribution and some aspects of the biology of Antarctic krill (Euphausia superba). ICES CM 1979/L:14	15/01/1979	15/03/1979	-66.8701	-53.8001	-65.4401	-27.9801	5901
Published literature			Hosie et al (1991) ANARE Research Notes 79	07/03/1987	23/03/1987	-68.0101	-61.81666667	62.96833333	87.98333333	4500
Published literature			Ashjian et al (2004) Deep Sea Res II 51, 2073-2098	30/04/2001	26/08/2001	-69.25916667	-66.18	-75.56666667	-68.18033333	1201
Published literature			Kasatkina, S.M. (1997) CCAMLR Science 4, 161-169	15/01/1985	15/01/1985	-60.77166667	-60.73333333	-55.39666667	-55.3251	1586
Published literature			Lancraft et al (2004) Deep Sea Res II 51 2247-2260	01/04/1983	01/04/1983	-64.08333333	-64.08333333	-61.7501	-61.7501	2100
Published literature			Sala et al (2002) Sci Mar. 66(2) 123-133	27/01/2001	27/01/2001	-72.0001	-72.0001	175.0001	175.0001	1585
Published literature			Hosie et al (1987) ANARE Research Notes 57	09/11/1985	09/11/1985	-65.9267	-65.9267	49.8783	49.8783	167
Published			Endo et al (1986) Mem. Natl. Inst. Polar Res.	06/12/1984	15/01/1985	-69.4001	-57.8201	-63.9201	7.5001	7200

Data nationality	Contributed by	Further information	Source	Date range		Latitude range		Longitude range		No. length measurements
				From	To	From	To	From	To	
literature			Spec. Issue 44, 107-117							
Published literature			Kaufmann, R.S. et al (2003) Deep Sea Res II 50 1765-1785	04/03/1999	24/11/2000	-62.9501	-62.9501	-60.6401	-60.6401	3964
Published literature			Wang et al (2000) Chinese J of Oceanology & Limnology 18(2) 110-116	07/01/1990	10/01/1991	-65.0001	-64.0001	65.2001	104.0666667	6331

Supplement 2

Fishery cruises included in CCAMLR dataset, analysed according to the rules published at

www.ccamlr.org/pu/E/pubs/bd/pt11.pdf

Start date	End date	Vessel name	Vessel flag	Observer nationality
28-Jan-00	29-Feb-00	Chiyo Maru No. 5	JPN	USA
16-Dec-00	26-Jan-01	Niitaka Maru	JPN	JPN
25-May-01	03-Jul-01	Top Ocean	USA	UKR
25-Jul-02	31-Jul-02	Top Ocean	USA	GBR
21-Jun-02	20-Jul-02	Chiyo Maru No. 5	JPN	GBR
16-Jun-02	25-Jul-02	Feolent	UKR	GBR
21-Jul-02	05-Aug-02	Foros	DOM	GBR
16-May-02	02-Sep-02	Top Ocean	USA	UKR
06-Jul-03	04-Aug-03	Top Ocean	USA	GBR
10-Aug-03	12-Sep-03	Koyo Maru No. 8	JPN	GBR
19-Jun-03	09-Aug-03	Insung Ho	KOR	GBR
19-Aug-03	21-Sep-03	Chiyo Maru No. 5	JPN	GBR
08-Jul-03	07-Aug-03	Foros	DOM	GBR
11-Aug-03	29-Sep-03	Dongsan Ho	KOR	GBR
21-Feb-04	16-Sep-04	Top Ocean	USA	UKR
20-Jun-04	20-Jul-04	Top Ocean	USA	GBR
23-Jul-04	03-Aug-04	Esperanza	RUS	GBR
10-Aug-04	26-Aug-04	Insung Ho	KOR	GBR
21-May-04	01-Aug-04	Konstruktor Koshkin	UKR	GBR
05-Aug-04	26-Aug-04	Niitaka Maru	JPN	GBR
21-May-04	21-Aug-04	Atlantic Navigator	VUT	GBR
20-Jun-05	09-Jul-05	Foros	DOM	GBR
09-Jul-05	20-Aug-05	Insung Ho	KOR	GBR
03-Mar-05	11-Jun-05	Top Ocean	USA	USA
07-Jun-05	22-Jul-05	Niitaka Maru	JPN	GBR
15-Aug-05	19-Aug-05	Niitaka Maru	JPN	GBR
20-Jan-05	28-Feb-05	Atlantic Navigator	VUT	URY
09-Apr-05	03-Aug-05	Feolent	UKR	UKR
04-Aug-05	14-Sep-05	Foros	DOM	UKR
13-Apr-06	26-May-06	Konstruktor Koshkin	UKR	UKR
26-Jun-06	10-Jul-06	Niitaka Maru	JPN	GBR
08-Jun-06	11-Aug-06	Saga Sea	NOR	GBR
10-Jul-06	29-Jul-06	Niitaka Maru	JPN	GBR
26-Jul-05	15-Aug-05	Atlantic Navigator	VUT	GBR
31-Aug-06	25-Oct-06	Saga Sea	NOR	GBR
10-Dec-06	06-Mar-07	Saga Sea	NOR	GBR
14-Jul-07	13-Aug-07	Saga Sea	NOR	GBR
10-Mar-07	05-Jul-07	Saga Sea	NOR	GBR
10-Jul-07	24-Jul-07	Niitaka Maru	JPN	GBR
12-Aug-07	31-Aug-07	Dalmor II	POL	GBR
14-Aug-07	03-Sep-07	Saga Sea	NOR	GBR
19-Nov-07	20-Jan-08	Saga Sea	NOR	GBR
31-Jan-08	01-Apr-08	Saga Sea	NOR	GBR
04-Apr-08	02-Jul-08	Saga Sea	NOR	GBR
10-Mar-08	10-Jul-08	Konstruktor Koshkin	UKR	UKR
20-Aug-08	18-Sep-08	Juvel	NOR	GBR
02-Aug-08	05-Sep-08	Maksim Starostin	RUS	GBR
02-Jul-08	29-Jul-08	Dalmor II	POL	GBR
04-Jul-08	10-Sep-08	Saga Sea	NOR	GBR

Start date	End date	Vessel name	Vessel flag	Observer nationality
20-Dec-08	08-Mar-09	Saga Sea	NOR	GBR
04-Dec-08	09-Mar-09	Maksim Starostin	RUS	RUS
20-Mar-09	05-May-09	Saga Sea	NOR	GBR
23-May-09	16-Jul-09	Dalmor II	POL	UKR
08-Jun-09	18-Jun-09	Maksim Starostin	RUS	GBR
22-Jul-09	28-Jul-09	Insung Ho	KOR	GBR
02-May-09	08-Apr-09	Saga Sea	NOR	GBR
20-Jun-09	16-Aug-09	Juvel	NOR	GBR
24-Jan-10	11-Feb-10	An Xing Hai	CHN	CHN
23-Jan-10	14-Feb-10	Kai Li	CHN	CHN
17-Nov-09	07-Jan-10	Juvel	NOR	GBR
21-Jan-10	31-Mar-10	Thorshovdi	NOR	GBR
11-Feb-10	18-Apr-10	Fukuei Maru	JPN	JPN
11-Feb-10	19-Mar-10	Juvel	NOR	GBR
12-Apr-10	21-May-10	Juvel	NOR	GBR
15-Dec-09	31-May-10	Maksim Starostin	RUS	RUS
31-Dec-09	24-May-10	Saga Sea	NOR	GBR
04-Jun-10	25-Jul-10	Juvel	NOR	GBR
02-Mar-10	18-Jul-10	Dalmor II	POL	UKR
13-Apr-10	13-May-10	Thorshovdi	NOR	ZAF
10-Jun-10	31-Jul-10	Thorshovdi	NOR	ZAF
22-Mar-10	12-May-10	Dongsan Ho	KOR	KOR
13-May-10	27-Sep-10	Saga Sea	NOR	GBR
21-Sep-10	10-Oct-10	Saga Sea	NOR	GBR
14-Aug-10	08-Nov-10	Thorshovdi	NOR	ZAF
09-Feb-11	12-Feb-11	Saga Sea	NOR	GBR
28-Nov-10	26-Jan-11	Juvel	NOR	GBR
12-Dec-10	31-Dec-10	Kai Xin	CHN	CHN
03-Mar-11	22-Apr-11	Kai Xin	CHN	CHN
31-Jan-11	03-Mar-11	An Xing Hai	CHN	CHN
11-Dec-10	20-Jan-11	Kai Li	CHN	CHN
21-Jan-11	11-Feb-11	Kai Shun	CHN	CHN
08-Jan-11	07-Apr-11	Thorshovdi	NOR	GBR
18-Feb-11	24-Mar-11	Saga Sea	NOR	GBR
01-Mar-11	10-Jul-11	Dalmor II	POL	UKR
16-Feb-11	12-Aug-11	Juvel	NOR	GBR
24-Mar-11	23-May-11	Saga Sea	NOR	GBR
15-May-11	29-Jul-11	Saga Sea	NOR	ZAF
14-Apr-11	02-Jul-11	Insung Ho	KOR	RUS
23-Apr-11	05-Jun-11	Juvel	NOR	GBR
24-Jun-11	06-Aug-11	Juvel	NOR	GBR
14-Apr-11	16-Jul-11	Thorshovdi	NOR	GBR
27-May-11	03-Aug-11	Fukuei Maru	JPN	JPN
12-Jul-11	16-Sep-11	Saga Sea	NOR	GBR
11-May-11	05-Sep-11	Dongsan Ho	KOR	KOR
18-Jun-11	12-Aug-11	Betanzos	CHL	CHL
27-Aug-11	09-Sep-11	Betanzos	CHL	CHL
08-Dec-11	06-Feb-12	Saga Sea	NOR	GBR
18-Dec-11	31-Jan-12	Kai Yu	CHN	CHN
02-Feb-12	10-Apr-12	Saga Sea	NOR	GBR
03-Mar-12	31-Mar-12	Lian Xing Hai	CHN	CHN
03-Aug-10	01-Oct-10	Juvel	NOR	GBR
08-Feb-12	22-May-12	Juvel	NOR	GBR
05-Apr-12	18-Jun-12	Saga Sea	NOR	GBR
21-Apr-12	24-Jul-12	Antarctic Sea	NOR	GBR
23-Apr-12	20-Jul-12	Fukuei Maru	JPN	JPN

Start date	End date	Vessel name	Vessel flag	Observer nationality
13-Jul-12	26-Aug-12	Betanzos	CHL	CHL
01-Feb-12	02-Jun-12	Insung Ho	KOR	RUS
22-May-12	23-Jun-12	Kai Li	CHN	CHN
19-Jul-12	24-Sep-12	Antarctic Sea	NOR	GBR
16-Jun-12	28-Sep-12	Saga Sea	NOR	GBR
29-Apr-12	07-Jul-12	Maestro	KOR	KOR
08-Aug-12	14-Oct-12	Adventure	KOR	KOR
02-Jun-12	30-Nov-12	Insung Ho	KOR	RUS
05-Jan-13	09-Apr-13	Antarctic Sea	NOR	GBR
31-Dec-12	06-Apr-13	Saga Sea	NOR	GBR
20-Mar-13	17-Apr-13	Betanzos	CHL	CHL
19-Jan-13	10-May-13	Juvel	NOR	GBR
28-Apr-12	18-Jun-12	Betanzos	CHL	CHL
15-May-13	15-Jul-13	Juvel	NOR	GBR
13-Mar-13	14-Jun-13	Kwang Ja Ho	KOR	RUS
24-Apr-13	14-Jun-13	Betanzos	CHL	CHL
22-Jan-13	16-Jun-13	Adventure	KOR	KOR
17-Feb-13	14-Jun-13	Insung Ho	KOR	RUS
28-Mar-13	08-Jul-13	More Sodruzhestva	UKR	UKR
25-Jun-13	08-Jul-13	More Sodruzhestva	UKR	GBR
24-Mar-13	03-Jun-13	Saga Sea	NOR	GBR
28-May-13	30-Jul-13	Saga Sea	NOR	GBR
25-Jul-13	07-Sep-13	Saga Sea	NOR	GBR
10-Apr-13	13-Aug-13	Antarctic Sea	NOR	GBR
13-Aug-13	04-Sep-13	Antarctic Sea	NOR	GBR
15-Aug-13	18-Sep-13	Betanzos	CHL	CHL
24-Dec-12	17-Apr-13	Kai Xin	CHN	CHN
03-Jan-13	31-Mar-13	Fu Rong Hai	CHN	CHN
10-Apr-13	02-Jul-13	Fu Rong Hai	CHN	CHN
02-Jul-13	03-Sep-13	Fu Rong Hai	CHN	CHN
14-Jun-13	27-Sep-13	Insung Ho	KOR	RUS

Supplement 3

Formulations for fitting of growth trajectories

Seasonally modulated von Bertalanffy functions (sVBFs, Pitcher and Macdonald (1973) J Appl Ecol 10:599-606) were fitted to the modal peaks identified from the component-fitting analyses. Pitcher and Macdonald (1973) developed 2 sVBFs, one in which the population switched between a period of positive growth and a period of zero growth (the switched-growth model) and another where the seasonal change in growth rate occurred more smoothly and allowed for negative growth (the sine-wave growth model). Attempts were made to fit both growth models, with that achieving the lowest mean-square difference to the modal peak data being ultimately selected.

The function for the switched-growth model is as follows:

$$L_t = L_{\inf}(1 - e^{-K(t_g - t_0)}) \qquad \text{(S1)}$$

Where L_t is body length (L, mm) at time t (in weeks from being spawned) and L_{inf} is maximum body length (mm), K is the rate parameter and t_g is the growth time. The relationship between t_g and t is regulated by two further parameters, sw, the time spent growing each year and s, which fixes the times of year at which zero growth begins and ends. A third time-base, t_s, is defined as ($t_r - s$). Growth is switched off when cosine ($t_r - s$) is less than sw. t_g is halted until cosine ($t_r - s$) again becomes larger than sw. This can be defined as follows:

$$\frac{dt_g}{dt_s} = 0 \ when \ \cos\left(\frac{2\pi t_s}{52}\right) < sw \qquad \text{(S2)}$$

The sine-wave growth model has a similar form to Eq. 3:

$$L_t = L_{\inf}(1 - e^{-K}) \qquad \text{(S3)}$$

The principle difference is in the definition of the rate parameter, *K,* as follows:

$$K = C\sin\left(\frac{2\pi(t-s)}{52}\right) + K(t-t_0) \qquad \text{(S4)}$$

This function increases to a maximum through incorporation of a sine function with a wavelength of one year. The magnitude of the oscillation is controlled by an additional constant, *C*, and the timing by a starting point for the sine, *s*.

Before carrying out the fitting procedure, it was necessary to assign a precise date to the respective modal peaks. These dates were 1st November for early productive-season (October to December), 1st February for late productive-season (January to April) and 1st July for overwinter (May to September), reflecting a combination of the mid-points of these seasonal periods and the relative contribution of data within these periods. It was assumed that each modal peak represented the average body length of a distinct year class. *Linf* was set at 65 mm, the maximum size reported within the present databases (the very small number of specimens substantially larger than this size were considered to be outliers due to recording error and excluded from further analysis). The sVBFs were fitted separately to males and females using a distance minimisation algorithm (Microsoft Excel 2007 Solver: Generalized Reduced Gradient (GRG2) nonlinear optimization), where parameters *sw*, t_0, *K* and *s* for the switched-growth model and *C*, t_0, *k* and *s* for the sine-wave growth model were iterated until the R^2 difference between the sVBF simulation and observed modes were minimised. The routine was implemented from a number of different starting conditions to ensure that solutions converged on a global minimum, rather than on any local minimum.

From initial attempts at fitting sVBFs to the observed data, it was evident that a single set of parameter values did not fit both the smaller and larger body-length modes equally well. Therefore, fits were attempted by splitting the observed data set into smaller and larger body lengths and fitting the sVBF to each dataset separately. These split point was made at one of four different points in the life-cycle (1st week in November or July in years 2+ or 3+), representing the points where growth was respectively highest and lowest within the annual cycle. The body length at which the observed dataset was split was varied in different runs of the fitting procedure. The preferred sVBF parameter values and split-points were those that achieved the minimum R^2.