Supplement A – Non-phytoplankton food sources for copepods

Table A1. List of observed non-phytoplankton food sources for copepods.

Taxa of copepods	Food sources	References
Adults of small species (*Acartia*, *Oithona*, *Paracalanus*), arctic *Calanus* spp., nauplii	Heterogeneous protozooplankton	Turner, 2004 and references therein
Oithonidae	Nauplii, protozooplankton	Turner, 2004
Oithona davisae	Flagellates	Uye, 1994
Oithona similis	Pellets of zooplankton	González and Smetacek, 1994
Limnoithona tetraspina	Microzooplankton	Gould and Kimmerer, 2010
Corycaeus spp.	Nauplii	Turner et al., 1984; Landry et al., 1985
Oncaeidae	Flagellates	Turner, 2004
Oncaea mediterrenea	Marine snow	Alldredge, 1972; Ohtsuka and Kubo, 1991
Pseudocalanus acuspes	Ciliates, flagellates, heterogenous particles, sinking particles	Peters et al., 2006; Renz and Hirche, 2006
Calanus pacificus	Bacteria	Lawrence et al., 1993
Various taxa	Bacteria, ciliates, dinoflagellates, cannibalism	Mauchline, 1998 and references therein

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Supplement B – Information of experimental sites

Table B1. Sampling date and corresponding season and spatial group (4 groups determined from *K*-means clustering according to surface salinity and chlorophyll *a* concentration) of each cruise-station. We use "Sequence" to denote different samples because some stations were sampled more than one time.

Cruise-stations	Sequence	Dates	Season	Group
897_E7	1	May 2009	Spring	A
897_26	2	May 2009	Spring	A
905_16	3	July 2009	Summer	A
905_26	4	July 2009	Summer	A
905_29	5	July 2009	Summer	B
905_30	6	July 2009	Summer	B
924_30	7	April 2010	Spring	C
925_w6	8	May 2010	Spring	A
925_w12	9	May 2010	Spring	A
925_w16	10	May 2010	Spring	A
932_29	11	July 2010	Summer	D
932_30	12	July 2010	Summer	D
966_E6	13	July 2011	Summer	B
966_E9	14	July 2011	Summer	A
966_20	15	July 2011	Summer	C
980_9	16	November 2011	Winter	A
980_19A	17	November 2011	Winter	A
1615_9	18	March 2009	Spring	A
1632_5	19	May 2009	Spring	B
1632_9	20	May 2009	Spring	A
1632_13	21	May 2009	Spring	A
1719_1	22	May 2010	Spring	C
1719_5	23	May 2010	Spring	B
1719_9	24	May 2010	Spring	A
1719_11	25	May 2010	Spring	A
1735_9	26	July 2010	Summer	A
1753_9	27	October 2010	Winter	A
1766_9	28	December 2010	Winter	A
1813_1	29	August 2011	Summer	B
1813_5	30	August 2011	Summer	A
1813_9	31	August 2011	Summer	A

Supplement C – Schematic diagram of artificial cohort incubation experiments.

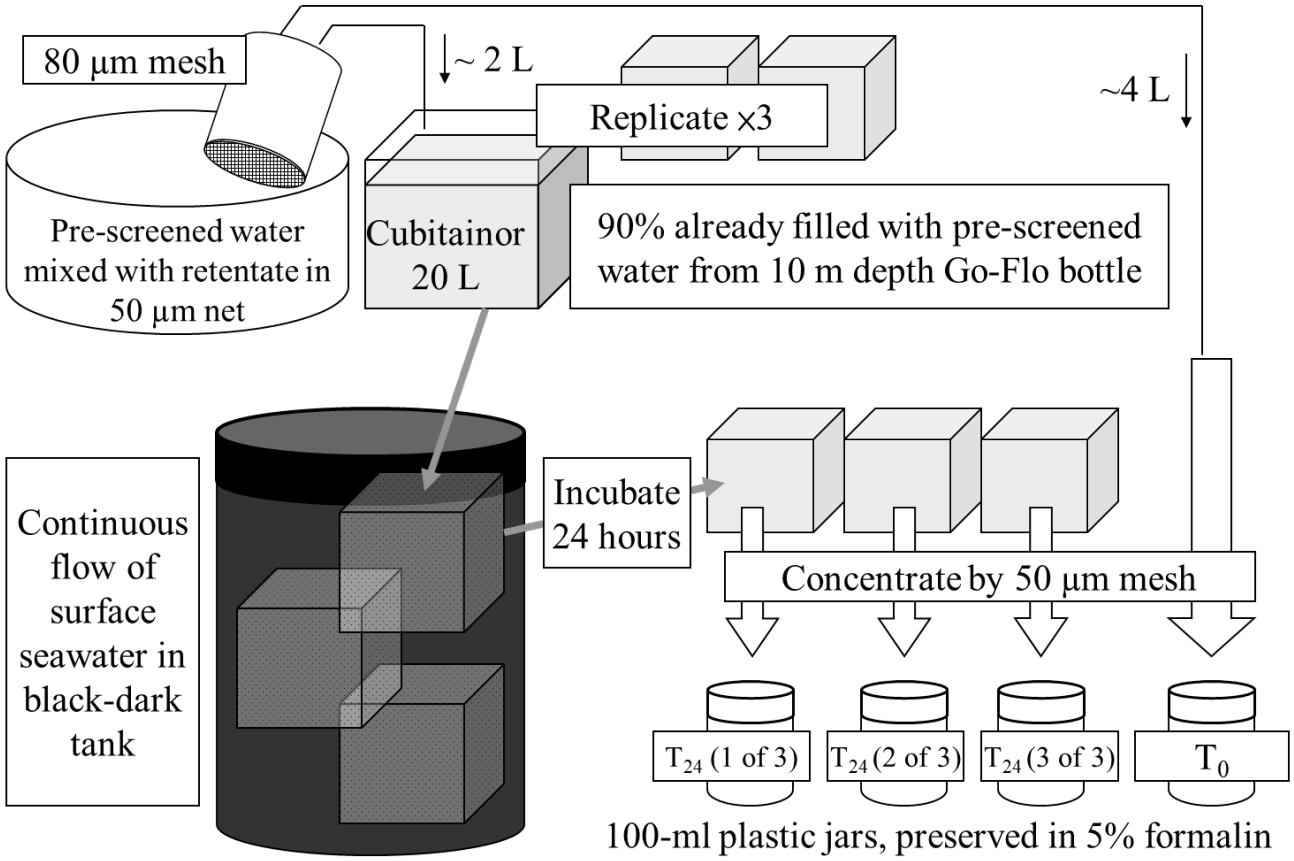

Fig. C1. Schematic diagram illustrating incubation experiments for the 50-80 µm size fraction. Animals from the retentate were limited to the 50-80 µm size range by using a 50 µm plankton net and 80 µm mesh. Three replicates were carried out, incubated in the tank for 24 hours, and preserved in 5% formalin (T_{24}). An additional sample, T_0 was also preserved at the beginning of incubation and served as the reference relative to each T_{24} replicate.

Supplement D – Multiple-peak consideration in determining community carbon biomass before and after incubation for growth rate estimates.

Traditionally, the average biomass at the start (W_0) and end (W_T) of incubations are used to calculate growth rate with the artificial cohort method (e.g. Kimmerer et al., 2007; Kobari et al., 2007; McKinnon and Duggan, 2003). However, this simple approach may not be appropriate when the method is used to measure community-level growth rates. Since copepod communities in our subtropical environment are complex and diverse (e.g. Lo et al., 2004; Tseng et al., 2008), the biomass spectra of the copepod assemblages always consisted of multiple peaks (occurrence: 95.5%) despite our efforts to create single cohorts (peak) by the artificial cohort technique. Under these circumstances, growth rates calculated with simple mean biomass values may be biased by the frequency difference between the assemblages before and after incubation. Specifically, if the assemblage before an incubation has two peaks and the larger peak is associated with high biomass (i.e. highly skewed) and the corresponding assemblage after incubation also has two peaks but the larger peak is now associated with low biomass (as shown in Fig. E1), the estimated growth rate will be inevitably under-estimated (vice versa).

To overcome this difficulty, we have developed a new procedure which accounts for multiple biomass peaks in artificial cohort experiments. For each copepod assemblage before ($T = 0$) and after (three replicates of $T = 24/48$) incubation, the representative biomass (W_0 and W_T) was determined by the following procedures. First, we calculated the probability density estimate (PDE) using the ln(carbon biomass) values of all copepod individuals by the kernel smoothing technique (see Fig. D1 for illustration) for each assemblage of each taxon. Only the assemblages with ≥ 30 individual copepods were used here (average number for each taxon: ~160, range from 30 to 1182). The estimation was based on a normal kernel function (Bowmen and Azzalini, 1997), and the bandwidth of kernel-smoothing window was 0.1. Secondly, the local maximal values (peaks) of PDE were singled out. To avoid any bias caused by outliers, we excluded the minor peaks that have a probability density (peak height) lower than one-third height of the largest peak. Thirdly, unrealistic values (i.e. negative growth, which might arise from contamination or experimental failure) were removed. The criteria for removal were as follows: for any peak-biomass at $T = 0$ that is higher than all the peak-biomass at $T = 24/48$, that peak at $T = 0$ was eliminated. Similarly, for any peak-biomass at $T = 24/48$ that is lower than all the peak-biomass at $T = 0$, that peak at $T = 24/48$ was eliminated. Following this criteria, only one or two (rarely three) peaks ever remained for each assemblage. Unbalanced numbers of peaks between $T = 0$ and $T = 24/48$ were permitted in growth rate calculations because copepod growth patterns can vary as a consequence of the complex composition of a diverse copepod assemblage (as discussed above). The average value (or single value if only one peak was identified) of the remaining peak-biomass was then the representative biomass value for the assemblage. Note

that we have only one $T = 0$ sample and three $T = 24/48$ replicates. Thus, a total of three pairs of [W_0-W_T] for one incubation for each taxon were calculated. Each pair of [W_0-W_T] was used to calculate growth rate values as $g = \ln\left(\frac{W_T}{W_0}\right)/T$. Finally, the growth rate estimates represent the average of the three values from the replicates.

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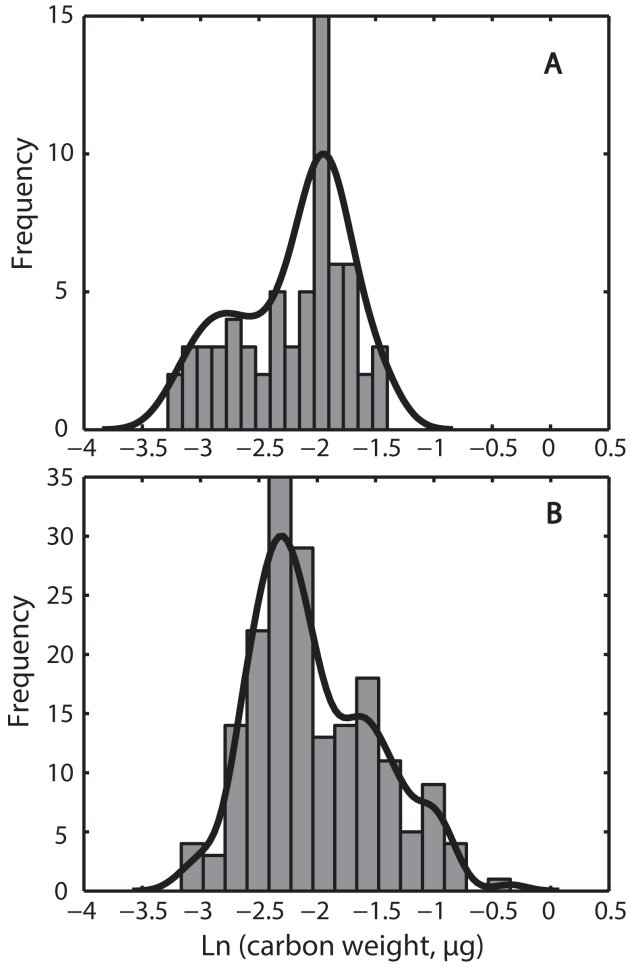

Fig. D1. Examples illustrating carbon biomass frequency (bar) and probability density estimate (bold line) of copepod assemblages at (A) $T = 0$ and (B) $T = 24$. Note that the Y-axis of probability density was rescaled for illustration.

Supplement E – Illustration of "food-limited" growth

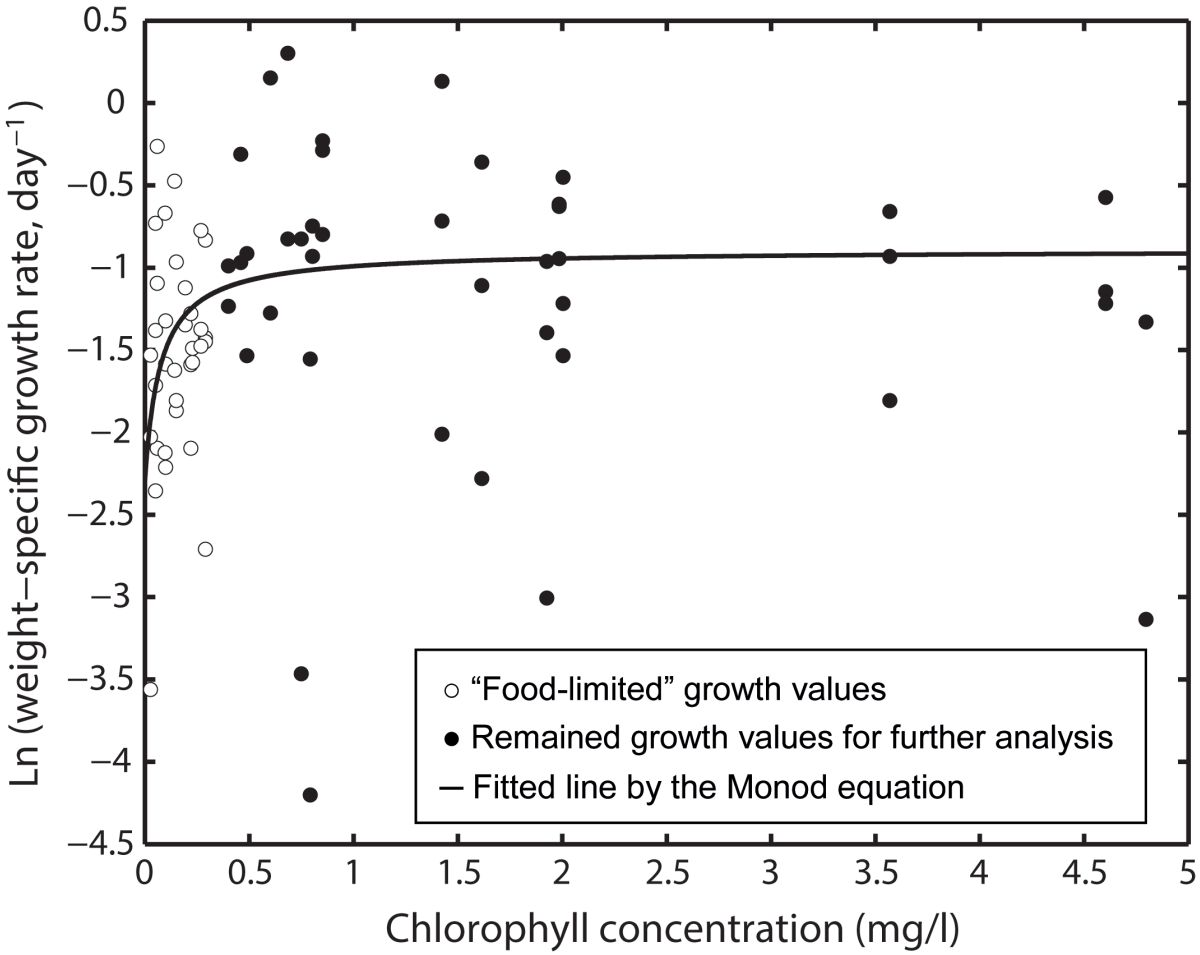

Fig. E1. Relationship between the ln(weight-specific growth rate) and chlorophyll *a* concentration for the broadcaster group. The definition of "food-limited" was evaluated as follows. We consider the log-transformed Monod equation: $\ln(g) = \frac{g_{max}[Chl]}{K_m+[Chl]}$, where g is the measured weight-specific growth rate; g_{max} is maximum rate; $[Chl]$ is the chlorophyll *a* concentration; K_m is the chlorophyll *a* concentration at which g equals $g_{max}/2$. The growth rates measured at chlorophyll *a* concentration below $4\times K_m$ (0.30 mg) were defined as "food-limited" (open circles).

Supplement F – Comparison of growth rates in different *K*-means groups.

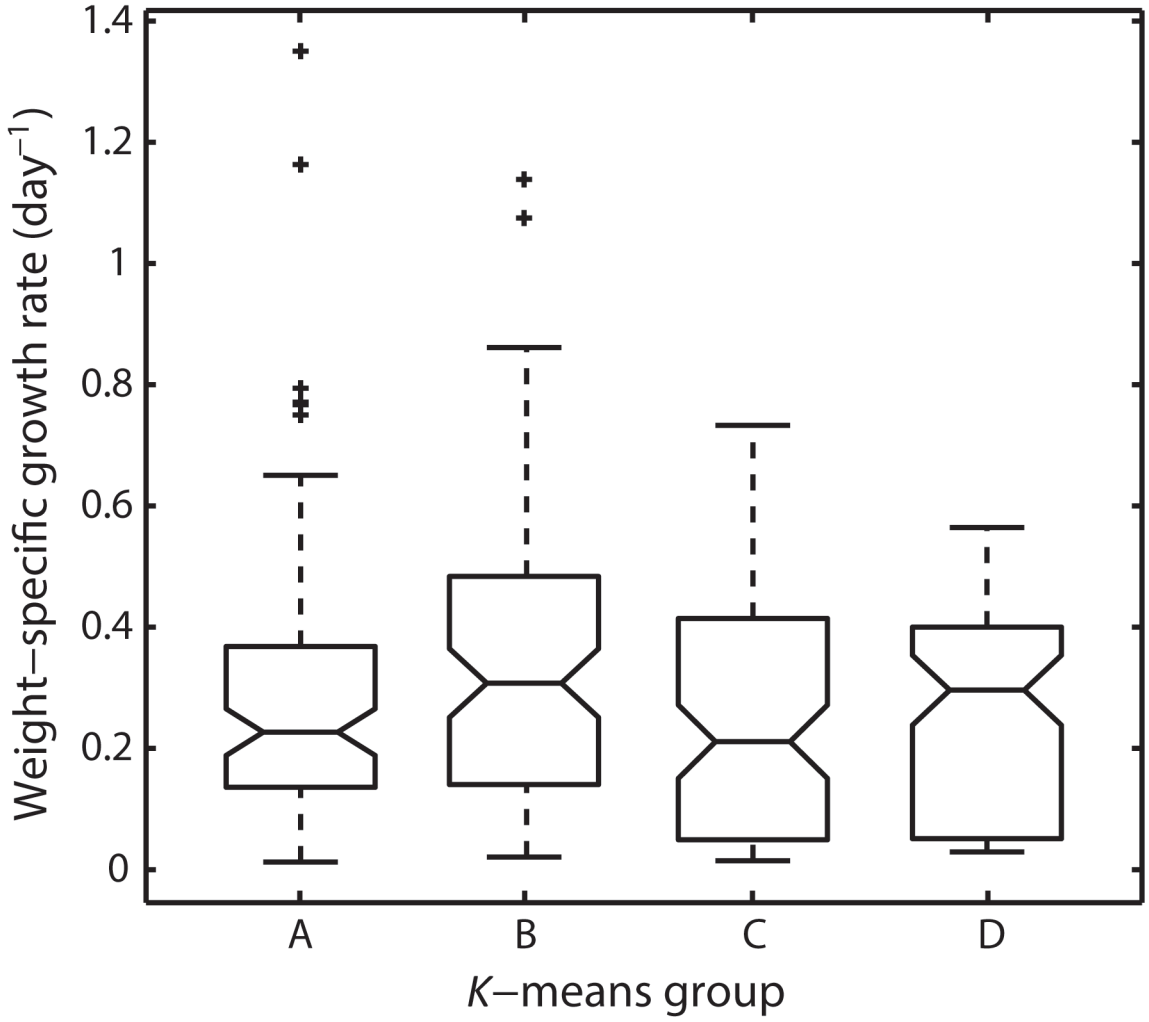

Fig. F1. Weight-specific growth rates in different *K*-means groups. The boxplots for each taxon indicate the values of medians, median intervals (notch ranges), 25th and 75th percentiles (box ranges), 95% confidence intervals (whiskers), and outliers (crosses).