Abstract:
Juvenile growth and development rates of Metridia pacifica, one of the dominant large copepods in the subarctic Pacific, were investigated March through October of 2001-2004 in the northern Gulf of Alaska. Stage duration of copepodite C1 to C5 were between 8 and 15 days under optimal conditions. Seasonally, growth rates increased from March to October, and reached up to 0.28 d⁻¹. After standardization to 5°C (using a Q10 of 2.7), growth rates, averaged 0.083±0.005 d⁻¹ (mean ± S.E.), and were significantly correlated to chlorophyll a, with saturated growth rates of 0.19 d⁻¹ for C1-3 and 0.10 d⁻¹ for C4-5. A comparison of our rates to those predicted by global models of copepod growth rate suggested further refinement of these models is required.

Introduction:
In the subarctic Pacific, Metridia pacifica is a major player in the seasonal zooplankton cycle, generally ranking behind Neocalanus species within the zooplankton community biomass in spring and early summer, but ranking first during the late summer through winter seasons after the departure of large grazing copepods (Neocalanus spp.; Eucalanus spp.) from the upper mixed layer. Although we have an overall picture of the life cycles of the large-bodied copepods in the Northern Pacific, the details are largely inferred. Despite the presumed importance of Metridia pacifica, there are only few field estimates of development rate, two for egg production rate and one for somatic growth in copepodites. Here, we present seasonally rates on growth and development of M. pacifica in the northern Gulf of Alaska with field experimental results from the 2001-2004, explore the functional relationships between growth and food resource, temperature and body size, and compare estimated somatic growth rate to predicted values from global models.

Method:
Six cruises were conducted annually in 2001-2003 plus three more cruise in 2004. Field experiments were set up along the Seward line at stations OA1, 4, 9, 13 and Prince William Sound (PWS) (Fig.1). Copepods were collected from the upper 50 m and sorted into “artificial cohorts” by serial passage through mesh sizes from 800 µm to 200 µm. Half of each fraction was preserved immediately as the time zero, and the remainder equally divided among several 2L carboys. After 4-5 days of incubation, carboys were screened and preserved. In the lab, copepods were identified to species, staged, and the prosome lengths (PL-µm) were measured. The progression of the cohort was determined by changes in the mean size. The dry weights (DWg-µg) were predicted from the relationship: log10DWg-3.29log10PL-8.75 (r²=0.98, n=83). The calculation of in situ weight-specific growth rate was based on the g-1 dW/dV, n/dV d⁻¹. When necessary, growth rates were standardized to 5°C using Q10 of 2.70 for food-saturated broadcast-spawning copepods (Hirst and Bunker, 2003).

Results:
A. Seasonally, growth and development tend to be faster through March to October, and the overall mean growth rate of four years was 0.114 ± 0.0073 SE d⁻¹.
B. After removing temperature effects, growth and development rates decline with increasing copepodite stage, and the overall mean standardized growth rate was 0.083 ± 0.005 d⁻¹.
C. Growth rates of Metridia pacifica were significantly related with temperature, chlorophyll a, body size, and stage by multiple regression analysis. Standardizing for temperature, chlorophyll a concentration explained 28.2% - 44.7% of variance in growth rate, while the inclusion of body size produced a single model with more exploratory power.
D. Comparison of growth rate predicted by models with measured rates in this study showed that some caution should be taken for the widespread use of these models, especially in the cold waters.
E. Growth rates and development time for Metridia pacifica in this study are consistent with other calanid copepods in this area.

Conclusions:

References:

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