Abstract

Growth rates of the three most abundant euphausiid species (Thysanoessa inermis, T. spinifera and Euphausia pacifica) in the northern Gulf of Alaska were measured from March through October in 2001, 2002 and 2003. Shipboard experiments were conducted to obtain in situ growth rates using the instantaneous growth rate technique, which involves incubating individual animals at ambient temperature and food, and measuring the change in length of the uropods after molting. The highest mean growth rates (over 5% of length change per moult) were observed during the phytoplankton bloom on the inner shelf in late spring for coastal T. inermis and on the outer shelf in summer for more oceanic T. spinifera and E. pacifica, suggesting tight coupling with food availability. The molting rate appeared to be strongly influenced by temperature ranging from 11 days at 5°C to 6 days at 12°C.

Methods

Euphausiids were collected along the Seward Line and within Prince William Sound in the northern Gulf of Alaska (GOA) during GLOBEC LTOP cruises in 2001-2003. To collect live animals for experiments, location and depth of euphausiid aggregations were identified with an HTI acoustic system operating at 42, 120, 240 and 420 kHz during night-time acoustic survey along the Seward Line. The detected aggregations were fished using MOCNESS with 100 µm mesh nets. Euphausiids were gently removed from the catch and placed in individual 750 ml tissue flasks filled with seawater collected simultaneously at the site. The animals were maintained at the ambient mixed layer water temperature (5°C in March-May, 12°C in July-August and 10°C in October) and the water temperature was adjusted to the temperature of the day. The experiment duration was 48 hours. The length of uropods were measured on all animals and preserved animals using a digitized measuring system (Rott & Hopcroft, 1986).

Results

Seasonal variations in mean water column temperatures in the northern GOA (obtained from IMS GLOBEC website http://www.ims.uaf.edu/GLOBEC/). The temperature is around 5°C throughout the water column from March through May. The upper layer (0-25 m) starts to warm up in summer reaching about 12°C in July-August. By October the surface layer cooled to about 10°C.

1. Growth of euphausiids in the GOA was close to negative in March, but reaching maximum values by May. Growth rates were not induced by temperature, but controlled by other conditions such as food availability.

2. Seasonal growth pattern of coastal T. inermis was different from those of T. spinifera and E. pacifica, and was characterized by a sharp decline in growth rates in late summer and fall, possibly resulted from lack of large diatoms in the coastal area.

3. The molting rate appeared to be affected largely by temperature, rather then other environmental conditions such as food limitation.

4. In contrast, growth expressed as % of uropod length change, did not appeared to be affected by temperature, but controlled by other conditions such as food availability.