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METABOLISM AND PHYSIOLOGICAL TRAITS OF THE DEEP SEA AMPHIPOD *EURYTHENES GRYLLUS*

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METABOLIC RATE
OXYGEN CONSUMPTION
LIPID
DEEP SEA
AMPHIPOD
EURYTHENES GRYLLUS

ABSTRACT. – Laboratory experiments were carried out to measure standard (starved animals) and active (animals exposed to food odour) metabolic rates of the deep-sea amphipod *Eurythenes gryllus*. Six individuals could be kept alive and in good condition in the lab for several months and were used for measuring respiration rates. A considerable increase in oxygen consumption was observed following the addition of food odour. Mean specific oxygen consumption rate ranged from 0.11 to 2.05 ml O_2 g^{-1} AFDW h^{-1} for standard animals and 0.45 to 1.51 ml O_2 g^{-1} AFDW h^{-1} for active animals. Amphipods are adapted to a sporadic food source in a food limited environment by having two levels of metabolism: a standard (minimal) rate much like a state of dormancy and an active rate for optimal utilisation of food fall. The active rate was three times higher than the standard rate. Total lipid content (ranging from 22.1 to 37.6 % DW) of individuals collected from the Arctic Fram Strait was measured to calculate food energy stores. Oxygen consumption rates can be combined with lipid content analyses to estimate the energy reserves. We calculated that scavenging amphipods such as *Eurythenes gryllus* have energy storage capabilities for long term sustenance, up to 76 d for an active rate and for up to 203 d at standard rate of metabolism.

INTRODUCTION

One of the most important scavenging amphipods in the deep sea is the cosmopolitan lysianassoid *Eurythenes gryllus* (Lichtenstein 1822), which seems to play an important role in biological processes in the deep-sea ecosystem (Desbruyères *et al*. 1985). As for other benthic or bentho-pelagic scavengers the impact of any large food fall is unpredictable both in space and in time. Food falls in the deep sea represent extremely large local energy enrichment, given mostly low input rates of other organic matter to the deep sea (Smith 1985). When a food fall is available, scavengers must be able to sense its presence almost immediately and locate the food fall directionally and efficiently. Previous studies showed that the scavenging amphipod *E. gryllus* approached a food fall mostly within 30 min and occurred in high numbers (Witte 1999, Janssen *et al*. 2000, Premke *et al*. 2003). Additionally, the marked seasonality of high latitude marine ecosystems implies that the relationship between nutrition and metabolism is of specific significance for many polar organisms, since they must survive long periods without major food supply (e.g. Clarke 1983, Sainte-Marie 1984).

Lipids are important, since they have the capability to store energy in a very efficient way. As a storage fuel lipids are advantageous, because they can be stored in anhydrous form and represent more energy for less bulk (Gurr & Harwood 1991). In the Arctic marine food web lipids play an important role to buffer the seasonality of food availability (Graeve *et al*. 1997, 2001).

The arctic deep-sea scavenging amphipod community is an important energy mediator from carcasses to other organisms of all trophic levels (Jones *et al*. 1998). Therefore, this study focused on the conjunction of deep-sea and high-latitude conditions and its effect on the metabolic rates and energy storage capacities of scavengers. It aims to answer questions related especially to *Eurythenes gryllus* as a main scavenging consumer in the Arctic deep-sea ecosystem; providing additional data to the limited amount of information of the energetics of deep-sea communities.

MATERIAL AND METHODS

Sampling and experimental set-up: The amphipods were collected in summer 2001 in the Fram Strait, off Spitsbergen, (79°21'N, 02°59'E) (Fahrbach 2002) with baited traps fixed on a free falling tripod lander at 1468 m water depth where temperature varied between –0.5 and 1.5°C and salinity was close to 34 ‰. Surface water temperature was cold enough (1.5-2.5°C) to recover animals in good condition.

Generally it is difficult to keep deep-sea organisms in aquaria at surface pressure and temperature. *Eurythenes gryllus* is a very eurybathic but also an extremely stenothermic animal which is difficult to handle (George 1979). Therefore, only six animals could be used for measuring oxygen consumption rates of *Eurythenes gryllus*. Other individuals collected alive died in the aquarium or were not in good condition for measurements. The six animals studied survived up to five months in a cooled circular tank.