*J. Mar. Biol. Ass. U.K.* (2007), **87**, 459–463
Printed in the United Kingdom
doi: 10.1017/S0025315407048710

# Aerobic and anaerobic metabolism of *Paraprionospio pinnata* (Polychaeta: Spionidae) in central Chile

Eduardo Quiroga*‡, Renato A. Quiñones†, Rodrigo R. González†, Victor A. Gallardo† and Gerdhard Jessen†

*Centro de Investigación en Ecosistemas de la Patagonia (CIEP), Bilbao 449, Coyhaique, Chile. †Centro de Investigación Oceanográfica en el Pacífico Sur Oriental (COPAS), Universidad de Concepción, Casilla 160-C, Chile.
‡Corresponding author: e-mail: eduardo.quiroga@ciep.cl

The aerobic and anaerobic metabolism of *Paraprionospio pinnata* were estimated under laboratory conditions. *Paraprionospio pinnata* is a widely distributed, often dominant polychaete inhabiting sublittoral sediments on the continental shelf off central Chile, where there is a pronounced oxygen minimum zone (OMZ). The aerobic respiration rates ranged from 0.25 to 1.28 ml $O_2$ $h^{-1}$ $g^{-1}$ dry weight. *Paraprionospio pinnata* displayed oxyconformity between 30 mm Hg (4 kPa) and 104 mm Hg (14 kPa) of oxygen tension levels ($pO_2$) under laboratory conditions. We found that *P. pinnata* is an aerobic oxygen conformer and is able to endure very low oxygen conditions. High anaerobic activity of alanopine dehydrogenase (5.74 ±1.20 µmol NADH $min^{-1}$ $g^{-1}$ wet weight) and strombine dehydrogenase (8.82 ±4.04 µmol NADH $min^{-1}$ $g^{-1}$ wet weight) were observed. The ratio between the calculated aerobic respiration rates and the electron transfer system activity were 0.28 and 0.12 for normoxic and hypoxic conditions, respectively. Based on the observed respiration rates and the average densities of *P. pinnata* in the study site, we estimated the population carbon flux via aerobic respiration to be about 32 mg C $m^{-2}$ $d^{-1}$ in spring and 80 mg C $m^{-2}$ $d^{-1}$ in winter. *Paraprionospio pinnata* would be using, then, about 8.6% of the total downward flux of organic carbon to the seabed and contributing between 18 and 44% of the total sediment community oxygen consumption.

## INTRODUCTION

The coastal zone off central Chile is an important area of seasonal wind-driven upwelling giving rise to some of the highest primary production rates known worldwide (Daneri et al., 2000). Furthermore, a pronounced oxygen minimum zone (OMZ) associated with the equatorial subsurface water (ESSW) is usually present at depths from 50 to 250 m, where dissolved oxygen concentration decrease to low levels (<0.5 ml $O_2$ $l^{-1}$) covering partially the continental shelf and, when upwelling prevails during summer, can even be found a few meters from the surface within Concepción Bay. The combination of both features results in high fluxes of organic matter to the bottom, and consequently, the benthic system has very high accumulation rates and organic carbon content (Gutiérrez et al., 2000).

The presence of defined and persistent macro- and megafaunal communities together with large mats of the giant bacteria *Thioploca* on the continental shelf off central Chile has been described in numerous field studies (e.g., Gutiérrez et al., 2000). The physiological and metabolic features of these faunal communities are poorly known, particularly their relationship with environmental conditions such as low dissolved oxygen and high food availability. Organisms living in this environment require an adjustment of the functional capacity of oxygen supply mechanisms such as ventilation and circulation. In polychaetes, these mechanisms are facilitated by specialized respiratory surfaces and circulatory systems, combined with the ability to reduce metabolic rates to carry out routine functions under hypoxic conditions. On the other hand, high enzymatic activities of pyruvate oxidoreductases have been reported for polychaetes inhabiting the OMZ off central Chile, which indicates high anaerobic metabolic capacity to cope with functional and environmental hypoxia (González & Quiñones, 2000).

*Paraprionospio pinnata* is a cosmopolitan species inhabiting sublittoral sediments in the Pacific and Atlantic Oceans. In the continental margin off central Chile, *P. pinnata* exhibit high values of standing stock and annual production/biomass ratio (P/B). In addition, the numerical dominance of *P. pinnata* in the community makes it often one of the key species of the benthic system.

Here we measured aerobic respiration rates and enzymatic activity levels of the lactate and opine pathways to estimate the contribution of aerobic and anaerobic metabolism to energy production of the *P. pinnata* population on the continental shelf off central Chile. The relative importance of *P. pinnata* in the benthic metabolism of this ecosystem is assessed.

## MATERIALS AND METHODS

### *Field sampling*

Specimens of *Paraprionospio pinnata* were collected from the muddy bottom of a station located on the mouth of Concepcion Bay (36°36.5'S 73°00.6'W; Figure 1). Samples were taken, at 34 m water depth, during 17 August and 11