Cent. Eur. J. Biol. • 9(1) • 2014 • 19-27
DOI: 10.2478/s11535-013-0177-2

VERSITA

Central European Journal of **Biology**

Compensatory partitioning of carbon budgets by the grass shrimp (*Palaemonetes pugio*) and implications for predator prey relationships

Research Article

Josh Stout[1,*], Gary Taghon[2]

[1]*School of Natural Sciences, Fairleigh Dickinson University, 07666 Teaneck, New Jersey, USA*

[2]*Institute of Marine and Coastal Sciences, Rutgers, The State University of New Jersey, 08901 New Brunswick, New Jersey, USA*

Received 31 May 2012; Accepted 14 March 2013

Abstract: Carbon utilization and allocation were examined between two populations of shrimp (*Palaemonetes pugio*) to determine the possible effects of living in an area of high anthropogenic impact. Carbon assimilation has been studied in *P. pugio*, but no study has looked at how assimilation might be influenced by contaminants. Anthropogenic effects on carbon assimilation in grass shrimp represent a major unmeasured impact on the carbon budget of multi-cellular organisms in estuaries and near shore environments. The influence of anthropogenic contamination on carbon assimilation has implications for predicting the environmental impact of contaminants, for models of estuarine function, and trophic transfer from the dominant macroscopic detritus processor to species of direct economic importance. Shrimp budgets were compared between two populations, one from a highly polluted marsh creek system in Northern New Jersey, and one from a clean reference site in Southern New Jersey. All components of the carbon budgets were measured directly including carbon allocated to reproduction. Carbon lost to respiration was lower in shrimp from the polluted system allowing them to have increased reproductive output. This is examined in the context of previous studies that show lowered predation by a piscine predator at the polluted site, resulting in a trophic cascade and changes in ecosystem function due to anthropogenic impacts.

Keywords: *Shrimp metabolism • Palaemonetes • Toxicology • Carbon • Trophic cascade • Ecotoxicology • Estuary*

1. Introduction

Anthropogenic contaminants such as weathered fuel oil and heavy metals can affect ecosystem function on many levels beyond those studied by the usual lethality studies. In this study, carbon utilization and allocation were examined between two populations of shrimp to determine the possible effects of living in an area of high anthropogenic impact.

The genus *Palaemonetes* is abundant in many fresh water and estuarine systems worldwide. Members of the genus are commonly used for toxicological dosing studies and the results used to build models of ecological risk due to anthropogenic contaminants. Carbon assimilation has been studied in *P. pugio*, but no study has looked at how assimilation might be influenced by contaminants [1]. If there are anthropogenic effects on carbon assimilation in grass shrimp, this would represent a major unmeasured impact on the carbon budget of multi-cellular organisms in estuaries and near shore environments. The influence of anthropogenic contamination on carbon assimilation has implications for predicting the environmental impact of contaminants, for models of estuarine function, and trophic transfer from the dominant macroscopic detritus processor to species of direct economic importance.

Several studies have shown changes in respiratory rates in crustaceans in response to a variety of anthropogenic contaminants. Respiration has been measured as a dose response to fuel oil, coal ash and PAH derivatives [2-4], organochlorides [5-7], and heavy metals [8,9]. However, few studies have

* *E-mail: stoutjs@fdu.edu*