UNIVERSITY OF CALIFORNIA

Santa Barbara

Enzymatic activities, metabolic rates and chemical compositions of midwater chaetognaths, medusae and certain nemertean and polychaete worms in relation to habitat depth off California

A dissertation submitted in partial satisfaction
of the requirements for the degree of

Doctor of Philosophy
in
Biology
by

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March 1992

ABSTRACT

Enzymatic activities, metabolic rates and chemical compositions of midwater chaetognaths, medusae and certain nemertean and polychaete worms in relation to habitat depth off California

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Metabolic potentials of fourteen species of chaetognaths, were estimated by measuring the activities of citrate synthase (CS) and pyruvate kinase (PK) and correlating these activities with oxygen consumption rates measured on the same individuals. Neither lactate dehydrogenase (LDH) nor any of several -opine dehydrogenases could be detected. CS activities were generally higher than PK activities suggesting that chaetognaths are aerobically poised in their metabolism.

Oxygen consumption rates were measured on 13 species of hydromedusae and 5 species of bathypelagic coronate scyphomedusae. Analysis of all individuals of all species of medusae showed the familiar pattern of decreasing oxygen consumption rate with respect to increasing wet weight of animals. Malate dehydrogenase, CS, LDH, and PK activities were measured on thirty species of medusae. The common allometric scaling phenomenon of decreasing activity in larger size individuals were observed in krebs cycle enzyme activities.

LDH activities on-the-other-hand were observed to increase with increasing wet weight.

Lipid, carbohydrate, protein, water, carbon and nitrogen contents were measured and energy contents were estimated on over thirty species of medusae. Protein and lipid rarely accounted for more than one percent of the wet weight. Carbohydrate content was very low in California medusae accounting for less than 0.01% of the wet weight fraction.

Investigations of metabolic rate, enzyme activity and chemical composition were undertaken on two abundant deep-sea pelagic worms: *Nectonemertes mirabilis* (Nemertinea; Hoplonemertinea) and *Poeobius meseres* (Annelida; Polychaeta). Six other species of worms were captured in smaller numbers and used for comparison in the physiological and biochemical measurements.

Polychaete worms had the highest oxygen consumption rates, and along with N. mirabilis displayed significant size effects on metabolic rate. *Poeobius meseres* had the lowest rates of oxygen consumption. , and there was no significant relationship of oxygen consumption rate to wet weight. It appears that as a group polychaete worms may be the animals with the highest metabolic rates in the bathypelagic zones of the world's oceans. No significant effect of size on the enzymatic activity of CS, LDH or PK was observed in *P. meseres* or *N. mirabilis*. Lipid was higher than protein for all the worms in this

study. Carbohydrate was of little significance in these worms and was usually less than 0.01% if the total wet weight.

CS activities of pelagic worms showed excellent correlation with metabolic rates. Correlations between CS and oxygen consumption were also good for chaetognaths, however such correlations were poor for medusae.

Neither an apparent decline in metabolic rate nor in metabolic potential as determined by enzymatic activities can be ascribed to depth of occurrence for pelagic chaetognaths, medusae or worms. This is in contrast to the rapid declines in metabolic rate and metabolic potential with depth that have been observed for pelagic fishes and crustaceans.

My wife Evelia supported me beyond belief while doing a dissertation herself. Jeremías and Iris have given me much laughter and joy. They have made my work both more difficult and more enjoyable. I love all three of them and extend to them my deepest gratitude.

I was supported in part by NSF grant OCE-9115551 to JJC and a California Sea Grant Fellowship through NOAA, National Sea Grant College Program, Department of Commerce, under grant number NA89AA–D–SG138, project number USDC EG-10-8B, through the California Sea Grant College, and in part by the California State Resources Agency.