BIOCHEMICAL AND PHYSIOLOGICAL STUDIES ON THE EFFECTS OF CONTAMINATED SEDIMENT EXPOSURE ON THE PELECYPOD MOLLUSK ARGOPECTEN IRRADIANS (LAMARCK)

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ABSTRACT

Bay scallops (Argopecten irradians L.) were held in a flow-through bioassay system adapted for sediment exposure studies. The experiment featured three treatments: an experimental group held over contaminated sediments from Black Rock Harbor in Bridgeport, CT (BRH), a reference group held over silica sand (REF) and a control group that was maintained sediment-free (CTRL).

Mortality rates were not an important experimental endpoint in this study. However, general growth and body condition indices revealed interesting biological effects. Scallops exposed to contaminated sediments initially exhibited hormetic responses including accelerated growth (shell height, whole body weight) and soft tissue proliferation (gill, mantle, shell). As the BRH specimens' physical conditioned declined, contemporaneously sampled CTRL and REF scallops superseded them for most growth indicators. Behavioral signals varied directly with physical condition.

Examination of physiological and biochemical data revealed significant sublethal responses that merited further consideration. Specifically, declining $\underline{V}O_2$ and $\underline{V}CO_2$ were directly correlated with gill fragmentation in the BRH treatment. Anaerobic metabolism apparently sustained limited growth among BRH specimens as their physiological condition began to decline. While anaerobic compensation appeared effective in the early

stages of physical decline, this compensatory mechanism failed after the sixth week of exposure. Biochemical measurements corroborated the metabolic substrate storage and utilization patterns predicted by both the mean RQ (CO_2:O_2) and O:N molar ratios.

Although the hypothesis is not fully tested, bay scallops appear to be promising "surrogate" test species candidates for estuarine sediment toxicity studies because they are responsive to habitat quality and are easily manipulated in a laboratory setting. While their apparent resilience appeared to surrender lethal dose (LD) or lethal concentration (LC) data as an evaluative tool in this situation, this loss was more than compensated by the many sublethal stress indicators revealed by biochemical and physiological testing. The importance of significant, sublethal responses should not be ignored in the sediment quality evaluation process. However, further testing is needed to confirm this hypothesis. Subsequent work should focus on using sediments over a gradient of contamination and perhaps expand the work to include field exposures.