

VARIATION IN ORGANISMIC RNA AND DNA CONTENT: ANALYSIS AND
APPLICATION TO THE ASSESSMENT OF LIVING PLANKTONIC BIOMASS

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ABSTRACT

VARIATION IN ORGANISMIC RNA AND DNA CONTENT: ANALYSIS AND APPLICATION TO THE ASSESSMENT OF LIVING PLANKTONIC BIOMASS

by Elizabeth Lam Gagneron

Modern analysis of DNA and RNA nucleic acid sequences has yielded profound changes in our understanding of the genetic biodiversity of planktonic organisms within the microbial food web of aquatic ecosystems. However, the bulk environmental concentrations of DNA and RNA, and their relative ratios, also potentially provide important information on the biomass and metabolic activity of planktonic organisms. Currently, there is a need to quantify the relative living biomass levels of natural water contained in ships' ballast tanks to regulate the spread of aquatic invasive species (AIS) resulting from ballast water discharge practices within the international shipping industry. Ultraviolet (UV) irradiation serves as the most popular form of inactivation treatment through its damaging effects to DNA and thus the reproductive capabilities of aquatic organisms. In this study, the optimization of a fluorometric nucleic acid assay using a handheld fluorometer was investigated. This assay was optimized for use in the field and involved the determination of optimal buffers, extraction time and sample hold times. The RNA, DNA and their ratio measured by this technique were used to assess growth and growth potential in a variety of grow-out experiments. Results showed reductions in nucleic acid concentrations between control and UV-treated samples in both lab and shipboard conditions. This thesis describes the development of a simple method to measure nucleic acids in the field and quantify the effect of UV ballast water treatments.