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Net primary production, respiration, and gross primary production methods and rate calculations

Light and Dark Bottle Oxygen Assay Method to Measure Primary Production and Respiration

For each sample collected, three transparent (light) glass bottles and three dark glass bottles were filled directly from the ship's Niskin bottle array (see methods in Murrell and Lehrter, 2011). Oxygen concentrations and temperature were measured with a probe (YSI or Hach). Initial (T0) and final (TF) oxygen concentrations were measured and times recorded. Salinity values for each sample were obtained from the ship's CTD. Light bottle treatments were incubated in an outdoor incubator with screening that reduced ambient light by 50%. Dark bottle treatments were also placed in the outdoor incubator but were kept dark by their black liners and caps.

Net Primary Production (NPP) rate

NPP calculated based on mean values of triplicate sets of bottles

TF = time final and T0 = time initial

$$\mathrm{NPP} = \frac{\mathrm{DO\_Light\_TF} - \mathrm{DO\_Light\_T0}}{\mathrm{TF} - \mathrm{T0}}$$

Net primary production rate is the dissolved oxygen measurement of the Light bottle at the final time point minus the dissolved oxygen measurement of the Light bottle at the initial time point divided by the difference in the final and initial times.

Respiration (R) rate

R calculated based on mean values of triplicate sets of bottles

TF = time final and T0 = time initial

$$\mathrm{R} = \frac{\mathrm{DO\_Dark\_TF} - \mathrm{DO\_Dark\_T0}}{\mathrm{TF} - \mathrm{T0}}$$

Respiration rate is the dissolved oxygen measurement of the Dark bottle at the final time point minus the dissolved oxygen measurement of the Dark bottle at the initial time point divided by the difference in the final and initial times.

Gross Primary Production (GPP) rate

$$\mathrm{GPP} = \mathrm{NPP} - \mathrm{R}$$

Gross primary production rate is the difference between the net primary production rate and the respiration rate

Temperature adjusted net primary production rate

Uses the Arrhenius equation to adjust rate to initial temperature (T_{T0}) from final temperature (T_{TF}) for cases when temperatures changed during the course of the incubation.

$$\mathrm{NPP}_{\mathrm{T(adj)}} = \mathrm{NPP} * 2^{\frac{(\mathrm{T_{T0}} - \mathrm{T_{TF}})}{10}}$$

Temperature adjusted respiration rate

Uses the Arrhenius equation to adjust rate to initial temperature (T_{T0}) from final temperature (T_{TF}) for cases when temperatures changed during the course of the incubation.

$$\mathrm{R}_{\mathrm{T(adj)}} = \mathrm{R} * 2^{\frac{(\mathrm{T_{T0}} - \mathrm{T_{TF}})}{10}}$$

Temperature adjusted gross primary production rate

Uses the Arrhenius equation to adjust rate to initial temperature (T_{T0}) from final temperature (T_{TF}) for cases when temperatures changed during the course of the incubation.

$$\mathrm{GPP}_{\mathrm{T(adj)}} = \mathrm{GPP} * 2^{\frac{(\mathrm{T_{T0}} - \mathrm{T_{TF}})}{10}}$$