Photosynthetic characteristics of phytoplankton in the subarctic North Pacific Ocean during summer

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Abstracts

Geographical variability in the relationship between photosynthesis and irradiance in summer phytoplankton populations was examined in the subarctic North Pacific Ocean in July-August 1997 and July 1999. Photosynthesis versus irradiance (P-E) curves were obtained for seawater that were collected by trace metal clean techniques. Most region sampled during this study was characterized by high nutrient (> 8 . m nitrate) and low chlorophyll (0.2-0.6 $\mu g\ l^{-1}$) except the central western gyre in 1997 where high chlorophyll concentrations of 1.3-3.0 $\mu g\ l^{-1}$. Ambient iron concentration at the surface was consistently subnano molar during both the years (<0.22 nM). Maximum photosynthetic rates (P^B_m) varied between 1.79 and 5.24 mgC (mg chl)$^{-1}$ h^{-1} with no obvious geographical difference between the western and eastern gyres. In contrast however, there were noticeable east-west gradients in the initial slope of the P-E curves (α^B) for surface population during 1997: Station P (50° N, 145° W), located in the eastern gyre had the lowest α^B (0.088 $\pm$ 0.041 mgC (mg chl)$^{-1}$ h^{-1} (μmol m^{-2}s^{-1})$^{-1}$, n=3) that increased westward. During July 1999, no major east-west gradient in α^B was seen which was observed to range between 0.012 and 0.029 mgC (mg chl)$^{-1}$ h^{-1} (μmol m^{-2}s^{-1})$^{-1}$, while a high α^B was observed in the western gyre area. Significant enhancement of both PBm and α^B were observed with 1 - 2 nM iron enrichment signifying the role of iron in controlling the productivity potential of phytoplankton as well as the regional variability in P-E during summer.