Interactive comment on "Spatial variability of surface-water pCO$_2$ gas exchange in the world's largest semi-enclosed estuarine system: St. Lawrence Estuary (Canada)" *by* Ashley Dinauer and Alfonso Mucci

Ashley Dinauer and Alfonso Mucci

ashley.dinauer@mail.mcgill.ca

We thank the referee for his constructive comments, and time spent to review our manuscript. We are particularly grateful to this referee and his collaborators whose earlier work inspired us to undertake this study. Our response to his comments follow.

Given the physiography (funnel shape) and the large physical dimensions of the maritime portion of the St. Lawrence Estuary, we pursued an analysis of surface-water pCO2 and CO2 flux data in terms of space rather than salinity. With 75% of its total surface area occupied by the Lower Estuary (Tadoussac to Pointe-des-Monts, S > ~21.2),

it is more realistic to integrate/weight the fluxes spatially than to provide average fluxes binned by salinity, in order to obtain a representative whole-estuary flux. Furthermore, as you can appreciate from the appended figure (see Fig. 1), active processes along the estuary are not as clearly defined when the data are plotted as a function of surface salinity. Whereas the plot still shows that the Upper Estuary (S < ∼24.5; surface salinity fluctuations are found around the Upper-Lower Estuary boundary due to tidally-induced upwelling of salty intermediate/bottom waters) is heterotrophic, it fails to highlight the autotrophic character of the Lower Estuary and the neutral character of the Gulf, the latter being substantially larger in surface area than the combined Upper and Lower Estuaries but contributing little to the net CO2 flux.

As noted in lines 643-649, we suggest that biological production is responsible for the observed drawdown of pCO2 in the surface waters of the Lower Estuary as well as the undersaturation observed near the Estuary-Gulf boundary (i.e., along the 300–600 km stretch). We agree with the reviewer's comment that this needs to be explicitly stated in the revised manuscript.

We will identify the red (smoothed temperature data using a moving average filter with a span of 50% of the total number of data points) and dashed (smoothed pCO2(water) data) lines in the Fig. 9 caption, and add the appropriate reference to line 41 in the revised manuscript.
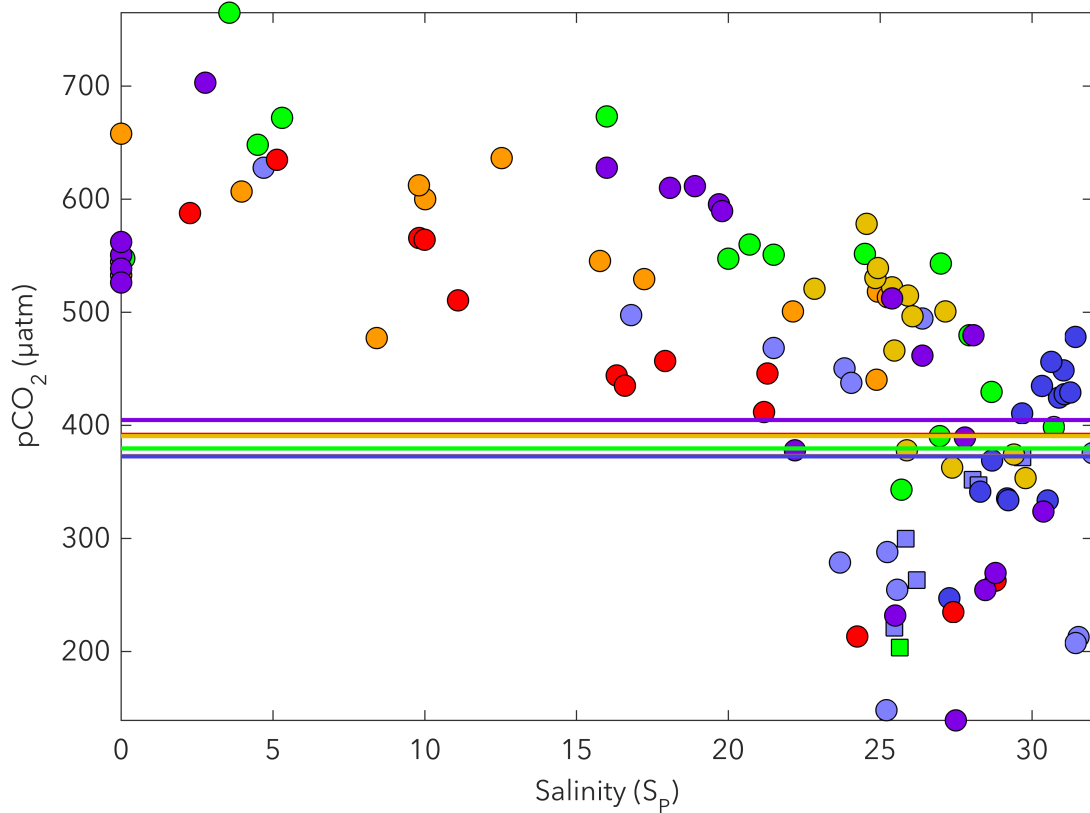
Fig. 1. Spatial distribution of surface-water pCO2 (circles, squares) along the salinity gradient. Horizontal lines show the mean pCO2(air) in the sampling months.