We thank the reviewer for their comments, and agree entirely that by combining the information shown in Figs. 3(b) and 5(b) yields unrealistically high C:Chl ratios. We believe these high values originate from three sources:

i. The choice of carbon per cell values that were likely unrealistic for our study site
ii. The high degree of uncertainty associated with both phytoplankton carbon estimates and C:Chl calculations
iii. The fact that Chl is decoupled from increases in biomass during the summer period

We examined our calculations of phytoplankton carbon very carefully, paying particular attention to the values used for the amount of carbon per cell. These were calculated by taking an average of literature values for organisms that could reasonably be expected to occur at our study site. Upon inspection, we found that our estimates of gC $cell^{-1}$ for the collective size class designated 'phyto' (= picophytoplankton + nanophytoplankton) was approximately twice that found by Li et al. (2006) – our estimate was ~20 pg C $cell^{-1}$ but an average of all the data points shown in Fig. 6 of Li et al. (2006) yields a value of ~9 pg C $cell^{-1}$. This value was derived from flow cytometer estimates of the average biovolume of the 'phyto' size class, which was then converted to carbon using the relationships given by Verity et al. (1992) (see Li and Dickie (2001) for a full description of methodology). We feel that this method yields a more reliable estimate of phytoplankton carbon than the average of literature values used previously.

In addition, we also looked carefully at the values used to calculate diatom carbon per cell, and decided to omit two values that were more than one order of magnitude higher than the other organisms. Unlike the smaller size classes that were sized using flow cytometry, we do not have accurate size information for this component of the phytoplankton assemblage, and must rely on reasonable assumptions about cell sizes. Given the high C:Chl ratios pointed out by the reviewer, we felt that this step is likely justified. However, both methods of converting cell counts to carbon are associated with a degree of uncertainty, and we have now included an estimate of uncertainty in all phytoplankton carbon calculations.

Absolute uncertainty (σ; gC m^{-3}), was calculated for each phytoplankton component (dinoflagellates, diatoms, pico + nano) and combined to obtain the uncertainty in total phytoplankton carbon using standard propagation of error techniques. We used an error of 24% for carbon per cell estimates for all size components based on the mean value of the uncertainties reported in Menden Deuer and Lessard (2000). We based the error in cell counts on an uncertainty of 10% reported by Veldhuis and Kraay (2000). We have re-plotted Figs. 5(a) and (b) using the new estimates of phytoplankton carbon. For an illustration of the uncertainty in carbon estimates, we show Fig. 5(a) with error bars, and also tabulate the NCP_p (Fig. 5(b)) values along with their uncertainties for clarity (Table 1).

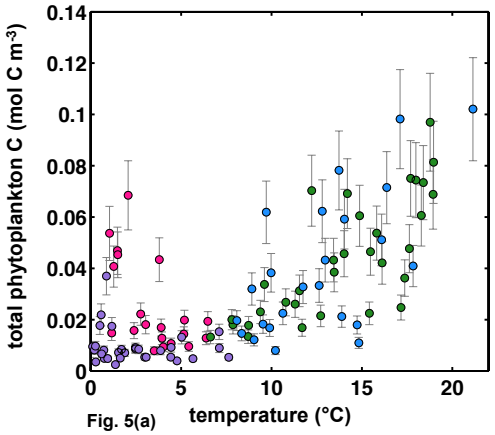

Fig. 5(a)

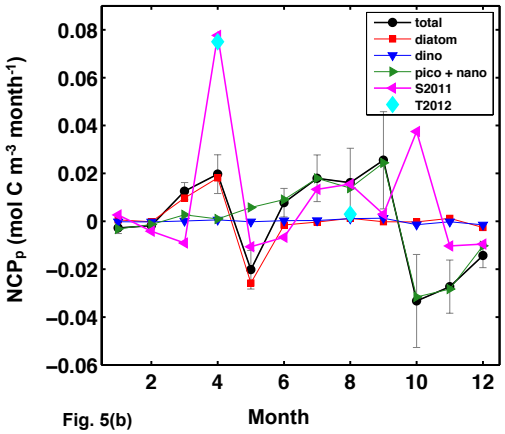

Fig. 5(b)

Table 1. NCP_p ± uncertainty from Fig. 5(b) above. Values were calculated using the new carbon per cell values. Shadwick et al. (2011) and Thomas et al. (2012) pCO_2-derived *NCP* values are shown for comparison.

	NCP_p (mol C m^{-3} month^{-1})		
Month	This study	Shadwick et al. (2011)	Thomas et al. (2012)
1	-0.033 ± 0.146	-0.033	-
2	-0.022 ± 0.091	-0.011	-
3	0.151 ± 0.250	0.050	-
4	0.237 ± 1.476	0.059	0.075
5	-0.243 ± 1.115	-0.049	-
6	0.093 ± 0.447	0.016	-
7	0.216 ± 0.851	0.031	0.003
8	0.194 ± 1.400	0.024	-
9	0.306 ± 2.401	0.034	-
10	-0.400 ± 1.957	-0.040	-
11	-0.328 ± 0.975	-0.030	-
12	-0.172 ± 0.384	-0.014	-

Below, we use the phytoplankton carbon uncertainties along with a conservative estimate of the uncertainty in fluorometric chlorophyll a measurements of ±15% (Van Heukelem et al., 2002) to calculate spring and summer C:Chl ratios using the new phytoplankton carbon values (Tables 2 and 3). Representative data points and their corresponding standard deviation were selected from each season from Fig. 5(a).

Spring

Table 2: Spring phytoplankton carbon estimated using the updated carbon per cell values. σ is the associated uncertainty.

Temperature	1.277 °C
Carbon	0.041 mol C m^{-3}
σ	0.008 mol C m^{-3}
C ± σ	0.041 ± 0.008 mol C m^{-3} = **0.195 fractional error** = 492.4 ± 96.1 mg C m^{-3}
Chlorophyll	3.7 mg m^{-3}
C:Chl	492.4/3.7 ≈ 133

The fractional error in C:Chl ratio is given by:

$$\frac{\partial Q}{|Q|} = \sqrt{\left(\frac{\partial Chl}{Chl}\right)^2 + \left(\frac{\partial C}{C}\right)^2}$$
$$= \sqrt{0.150^2 + 0.195^2}$$
$$= 0.246$$

i.e. the error in C:Chl ratio is 0.246 times C:Chl ratio: 0.246 × 133 ≈ 33

Spring C:Chl = 133 ± 33

This is within the range of values commonly reported in the literature. It is important to remember that during this period of the year, Chl is very strongly related to the dominant (by weight) component of the phytoplankton assemblage, i.e. diatoms (Fig. 3(d)).

Summer

Table 3: Spring phytoplankton carbon estimated using the updated carbon per cell values. σ is the associated uncertainty.

Temperature	18.282 °C
Carbon	0.061 mol C m^{-3}
σ	0.012 mol C m^{-3}
C ± σ	0.061 ± 0.012 mol C m^{-3} = **0.197 fractional error** = 732.6 ± 144.1 mg C m^{-3}
Chlorophyll	0.8 mg m^{-3}
C:Chl	732.6/0.8 ≈ 916

The fractional error in C:Chl ratio is given by:

$$\frac{\partial Q}{|Q|} = \sqrt{\left(\frac{\partial Chl}{Chl}\right)^2 + \left(\frac{\partial C}{C}\right)^2}$$
$$= \sqrt{0.150^2 + 0.197^2}$$
$$= 0.248$$

i.e. the error in C:Chl ratio is 0.248 times C:Chl ratio. $0.248 \times 916 \approx 227$

Summer C:Chl = 916 ± 227

It is evident that, even when uncertainty is accounted for, summer C:Chl ratios are high compared to accepted values (~50-200). However, the point that we emphasise in the manuscript is that Chl does not accurately represent biomass during this summer period. We have compelling evidence in the form of the increasing cell counts and the persistent drawdown of pCO_2 attributable to biology that biomass continues to increase in this period. Yet, the biomass increase is essentially completely uncoupled from Chl concentration as evidenced in Fig. 3c, and likely caused by the very low intracellular Chl concentration possessed by the small cells that dominate the assemblage during this period. The reviewer points to the C:Chl ratio reported by Li et al. (2006) for Bedford Basin of ~100. However, Bedford Basin consistently has summer Chl concentrations of ~one order of magnitude higher than the Scotian Shelf study site (see Li et al. (2006), Fig. 6b and also Craig et al. (2012), Fig. 2), which results in lower C:Chl ratios. It is evident that the C:Chl ratio during the summer at this site provides a misleading metric of the biological system, and we will endeavour to explain this important point clearly in the next revision. We are very grateful to the reviewer for bringing our attention to this fact.

Fig. 5(b) has also been re-plotted (above) and the carbon inventory, NCP_p' (i.e consideration of the mixed layer) re-calculated. Below we tabulate the new carbon inventory characteristics along with the original values to illustrate the difference made by the new carbon per cell values to the overall patterns.

Table 4: Comparison of carbon inventory characteristics for original and new carbon per cell values.

Carbon Inventory Characteristics	New	Original
Spring bloom $NCP_p{}'_{,spr}$ (May)	0.67 mol C m^{-2} $month^{-1}$	48.32 mol C m^{-2} $month^{-1}$
Average summer $NCP_p{}', = \overline{NCP_p} = 1/4 \sum_{Jun}^{Sep} NCP_p'$	0.16 mol C m^{-2} $month^{-1}$	3.81 mol C m^{-2} $month^{-1}$
Integrated summer $NCP_p{}', = \int_{Jun}^{Sep} NCP_p' \, dt$	0.63 mol C m^{-2}	15.26 mol C m^{-2}
Annual +ve $NCP_p = \sum +NCP_p'$	1.72 mol C m^{-2}	90.47 mol C m^{-2}
$\overline{NCP_p'} \Big/ NCP_{p,spr}$	24%	8%
$\int_{Jun}^{Sep} NCP_p' \Big/ NCP_{p,spr}'$	94%	32%
$\int_{Jun}^{Sep} NCP_p' \Big/ \sum +NCP_p'$	37%	17%

Using the new carbon per cell values for diatoms and 'phyto' results in an increase in the proportion of annual uptake of carbon represented by the summer assemblage from 17% to 37%, and also increases the ratios of average summer and integrated summer $NCP_p{}'$ to spring $NCP_p{}'$. The overall message is essentially the same, i.e. that summertime assemblages represent a significant proportion of carbon uptake, despite the change to the absolute values. These re-analyses emphasise importance of the choice of carbon per cell values and that uncertainty in the values must be considered.

We propose to adopt the changes detailed here throughout the whole manuscript, and to carefully explain the uncertainties involved in the carbon estimates and to reiterate the decoupling of biomass and Chl during the summer period and its implications for C:Chl estimates.

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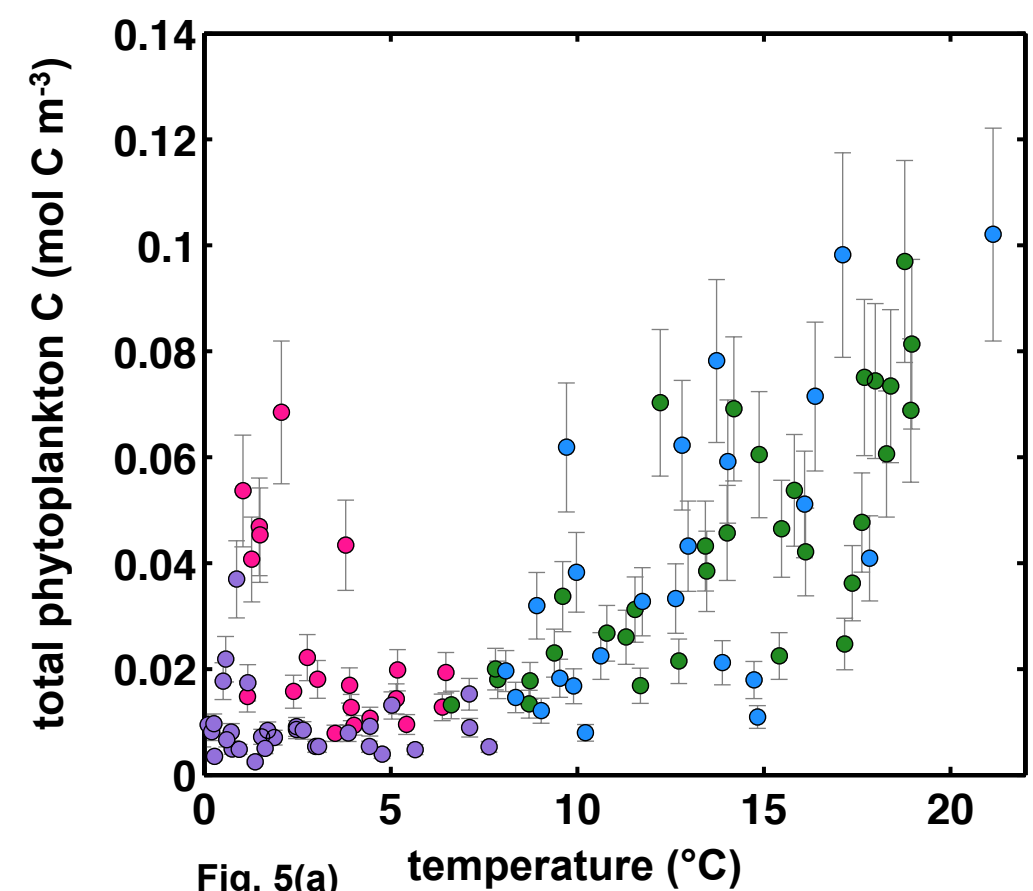
total phytoplankton C (mol C m-3)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
temperature (°C)

Fig. 5(a)

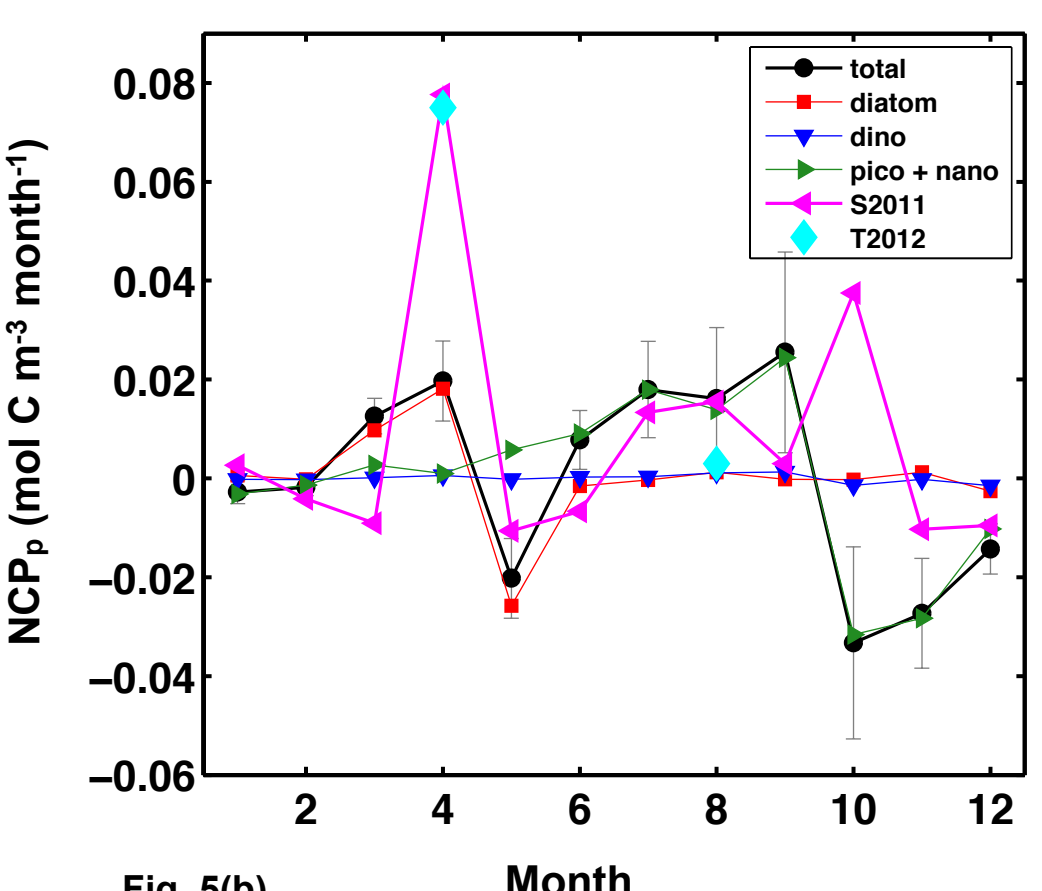
NCPp (mol C m-3 month-1)
0.08
0.06
0.04
0.02
0
−0.02
−0.04
−0.06
2
4
6
8
10
12
Month
total
diatom
dino
pico + nano
S2011
T2012

Fig. 5(b)