Response to Anonymous Referee #1

General comments

The Ms on "Riverine inputs and phytoplankton community composition control nitrate cycling in a coastal lagoon" by M. Zilius is a well written manuscript. It is presented in a concise manner, solid methods & results, and appropriate discussion and conclusion. I have some minor remarks in the text (attached pdf file) and two questions for the discussion.
The study focusses on the spring and summer situation. But what is known or is expected to happen during the rest of the year?

What are exchange processes to the Baltic Sea? Where is the connecting channel in Figure 1? and in relation to the river discharge how much water is leaving or entering the lagoon, and what would this mean for N-export ...?

Answer: Thank you for the positive comments.

This study builds on our earlier work documenting nutrient mass balances in the Curonian Lagoon (Vybernaite-Lubiene et al., 2017, 2022; Zilius et al., 2018) by quantifying specific pathways of N transformation. We acknowledge that some additional background information about our prior work needs to be included for readers to understand why we chose specific seasons and sampling locations for the present work. We are also in agreement with the reviewer that more background information should be provided regarding N transport into the lagoon and exchange processes with the Baltic Sea. To address these issues we have: (1) added a new paragraph (preceding the last section of the Introduction) that describes the results of the previous mass balance work, including seasonal patterns, and (2) added information to the Site Description describing the hydrology of the lagoon and dominant exchange processes. Text added to Introduction:

"A recent study examining input-output fluxes of the Curonian Lagoon (SE Baltic Sea), showed that NO_3^- concentrations in outflowing water were significantly lower relative to riverine inputs (Vybernaite-Lubiene et al., 2017). Attenuation of NO_3^- in estuarine systems is typically attributed to phytoplankton or bacteria assimilation. Following the conversion of dissolved inorganic nitrogen (DIN) to particulate organic nitrogen (PON), there are two potential pathways for assimilated N: (1) enhanced export of PON (resulting in minimal net N retention), or (2) sedimentation of PON (resulting in net N retention via storage or denitrification). Our prior work on the Curonian Lagoon suggests that sedimentation is the dominant fate of assimilated N in the spring, whereas remineralization and export of PON was the dominant pathway in summer. We hypothesized that seasonal differences in N pathways were dependent on the composition of the phytoplankton community, which can lead to deposition in sediments (in the presence of heavier diatoms) or PON export and remineralization (in the presence of buoyant cyanobacteria). The aim of our further work was to quantify these pathways during diatom vs. cyanobacteria dominated conditions."

Text added to Study site description:

"*The Curonian Lagoon is a large (1584 km^2), shallow (mean depth 3.8 m) waterbody located along the southeast coast of the Baltic Sea (Fig. 1). The lagoon is mainly freshwater (mean salinity = 0.2 PSU) due to large riverine inputs and limited exchange with the Baltic Sea through a narrow channel (Zemlys et al., 2013). The lagoon is vertically well-mixed owing to the shallow depth and weak salinity gradients (Zilius et al., 2014, 2020). The Nemunas River is the principal tributary (16 km^3 yr^{-1}, Vybernaite-Lubiene et al., 2018) accounting for 96% of total water inputs and the main source of nutrients (Jakimavičius and Kriaučiūnienė, 2013; Vybernaite-Lubiene et al., 2022). On average, riverine inputs (46.2×10^6 m^3 d^{-1}) are ~10% lower than lagoon outflow (50.6×10^6 m^3 d^{-1}) due to prior seawater inflow to the lagoon (Vybernaite-Lubiene et al., 2022).*"

The lagoon discharges to the Baltic Sea through a narrow strait (see below corrected Figure 1) and it occasionally receives inputs from the Baltic during periods of wind-driven tidal forcing (Zemlys et al. 2013). These events are typically of short duration and result in small increases in salinity (typically by 1–2, maximum = 7) in the northern portion of the lagoon.

Line 95 There are no red / blue circles visible…. Could you also indicate the Connection to the Baltic Sea?

Answer: The reviewer is right; we have correct figure captions. Following the reviewer's comment, we added an additional panel indicating lagoon outflow and the exchange site with the sea.

Figure 1 Captions. Satellite image by OLI/Landsat-8 (18/09/2014) showing summer blooms in the Curonian Lagoon with the sampling sites (stars) representing the northern and south-central regions and monitoring site at the Nemunas River (black circle). The black line indicates a state border between two countries. The outflow is at the northern end of the lagoon near Klaipeda.

Line 140 how was assured that the O_2 level remained within these borders? measured or estimated?

Answer: We have long-term experience studying benthic metabolism in this system (Zilius et al. 2012, 2014 2015; Politi et al. 2021, 2022; Bartoli et al. 2023). In addition, two randomly selected cores were equipped with optode sensor spots to monitor O_2 (FireSting-O2, PyroScience GmbH) continuously. This allowed oxygen to be kept within the targeted range. We have added these details to the main text of the manuscript.

Line 231 – 234 (Figure 3). Is the load given per month?

Answer: Yes, we present here a monthly load of dissolved inorganic nitrogen, and following the review comment, we have corrected the figure caption:
Figure 3. Daily discharge of the Nemunas River and monthly riverine loads of dissolved inorganic nitrogen (DIN) to the Curonian Lagoon during 2021. Data range (whiskers), upper and lower quartiles (edges), the median (horizontal line), and the outliers (grey circle) are represented (n=28–31).

Line 271: what does the "white" column stand for?

Answer: The white column represents total denitrification, consisting of denitrification fueled by water column NO_3^- (D_w) coupled with nitrification (D_n). The same is valid for DNRA. This is a quite common way to present denitrification rates. We added a legend, which was missing, to make the figure more explicit (see figure below).

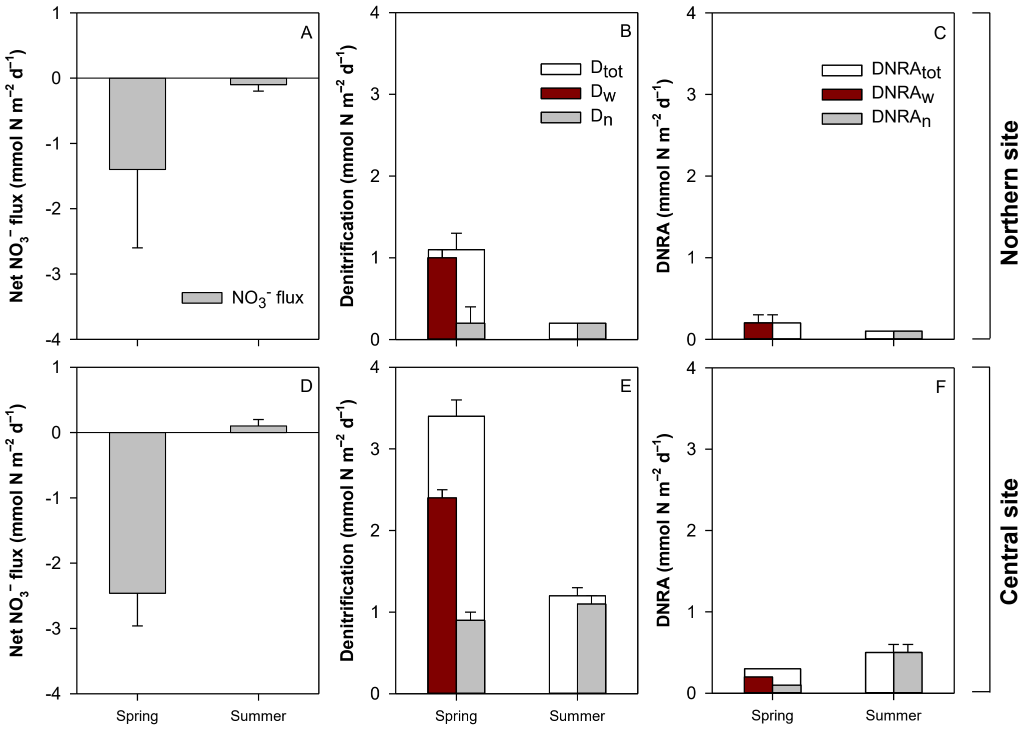

Figure 6. Net daily NO_3^- fluxes (A,D), total denitrification (D_{tot}; B,E), denitrification fueled by water column NO_3^- (D_w) and coupled to nitrification (D_n), and total dissimilative nitrate reduction to ammonium ($DNRA_{tot}$; C,F), DNRA fueled by water column NO_3^- ($DNRA_w$) and coupled to nitrification ($DNRA_n$) measured at the two sites in the Curonian Lagoon in spring (May) and summer (August) 2021. The positive and negative values of NO_3^- fluxes indicate the release and uptake of nutrients, respectively. Data shown are mean values and standard errors (n=5).