EXHIBIT 3

EXPERT REPORT

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Prepared for Cottonwood Environmental Law Center

In the case of Cottonwood Environmental Law Center vs CH SP Acquisition LLC
d/b/a
Spanish Peaks Mountain Club; Lone Mountain Land Company
2:23-cv-00028-BMM

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This report summarizes the nitrogen and carbon isotope analyses conducted for Cottonwood Environmental Law Center ("Cottonwood") in the Spanish Peaks Mountain Club. The overarching concluding opinion is that this system is highly enriched with nitrogen from wastewater.

1.0 Introduction

For more than a decade, concerns over the increases in algal growth and nitrogen pollution and the relationship between resort development have been expressed in the West Fork region of the Gallatin River. Since the 1970s, in addition to residential development, there has been development of three new ski resorts and golf courses in Big Sky, Montana. As documented by Gardner (2010, Gardner et al. 2011), the public wastewater and sewer receives secondary treated water that is retained in lined sewer retention ponds and stored until midspring when it its released as irrigation water onto the three golf courses in Big Sky.

Gardner et al. (2011) showed the relationship between residential development and annual average nitrate (NO_3^-) concentrations (Fig. 1):

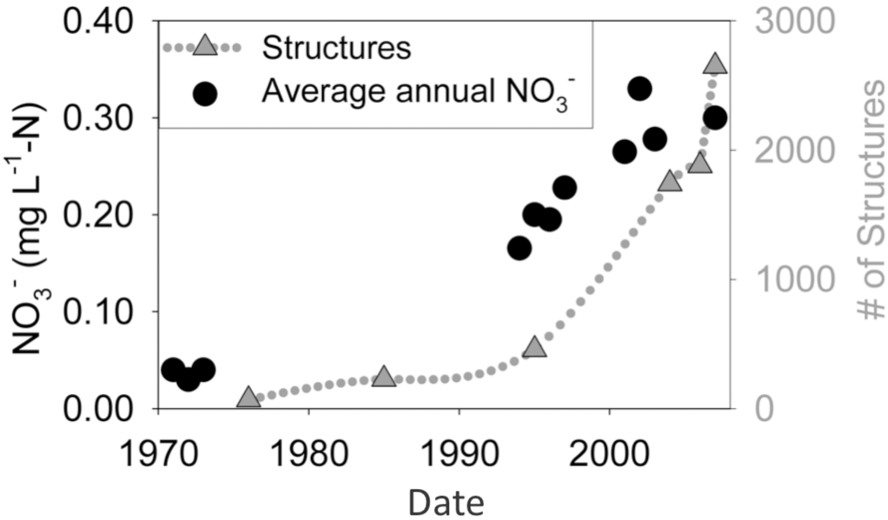

Figure 1. In the West Fork watershed, residential development and annual average stream water NO_3^- concentrations have followed a similar upward trend since resort development. [NSF, 1976; Blue Water Task Force, and Big Sky Water and Sewer District, unpublished data]. Reproduced from Gardner et al. (2011).

The West Fork Gallatin River is included on the Montana Department of Environmental Quality list of impaired waters due to high nitrogen concentrations as well as other factors (DEQ Montana 2020). Higher exports of nitrogen as nitrate (NO_3^-) and as organic forms of nitrogen have been observed in the developed regions of the West Fork watershed compared with undeveloped watersheds (Gardner (2010)). As an impaired water body, the nutrient loads to the West Fork are to be kept below threshold levels set by the DEQ of 0.3 mg N/l as total nitrogen and 0.03 mg/l as total phosphorus from July through September (Allen and Howell 2020). Exceedances of these levels have been previously associated with application of treated municipal water to three golf courses and discharge from the onsite wastewater treatment. Although application of wastewater to the golf courses is not supposed to reach groundwater, it has been estimated that 30% of these applied nutrients enter groundwater (Devitt 2008) and that the greatest reduction in anthropogenic nitrogen load will result from improvement in the Big Sky wastewater reclamation facility. Reductions of 75% in the nutrient concentration of effluent compared to the water quality of the existing treatment plant are required (Allen and Howell 2020).

Two types of samples were analyzed here. All samples were collected in the Spanish Peaks Mountain Club region by Cottonwood and its contractors. First, water samples were collected in September 2022 to determine ambient nitrogen concentrations. Second, samples were collected on September 19, 2023, to determine whether a signal related to nitrogen pollution could be detected in benthic algae because of activities related to the club. The change in nitrogen and carbon isotope content of collected algal samples was used as the analytical technique.

2.0 Sampling

2.1. Water sampling for nutrient analyses

Water samples were collected from two streams by a Cottonwood employee on September 22, 2022 to collect background information. Exhibit 1. The water samples were analyzed for nutrient concentrations by Bridger Analytical Lab. Information regarding the two site locations and sampling is as follows:

Site 1: 45.26450, -111.38157 Site 1 is a stream that is located below a ski run where industrial grade snow guns were blowing treated sewage near a sign that warns people not to drink the water because it is reclaimed wastewater (Fig. 2). The stream is 4 feet wide, 6-8 inches deep, and drains into the West Fork of the Gallatin River.

Site 2: 45.26979, -111.34093 This stream was not near the ski run where industrial snow guns were spraying treated sewage.

The lab results (Section 7.0 below) reflect what would be expected: the stream located near the industrial snow guns spraying treated sewage towards the stream showed increased concentrations of nitrogen relative to another nearby stream that was not close to the snow guns and had no detectable nitrogen concentrations.

Figure 2. Sign warning people not to drink the wastewater in the stream below the snowguns.

2.2. Benthic algae sampling

Samples of benthic algae (*Cladophora*) were collected by a contractor for Cottonwood (Jack Taylor, Exhibit 1) on September 19, 2023, at two site locations geographically located within Spanish Peaks. Information regarding the two site locations and sampling is as follows:

Site 1: 45.26421, -111.37561

Site 1, the same as described above, is a stream that is located below a ski run where industrial grade snow guns were blowing treated sewage over a sign that warns people not to drink the water because it is reclaimed wastewater. The slope of the ski run where the treated sewage was being blown varied between 20 and 24 degrees. Exhibit 1 (Taylor Declaration) The stream is 4 feet wide, 6-8 inches deep, and drains into the West Fork of the Gallatin River.

Site 2: 45.25491, -111.36371

Site 2 is a stream that is located near the golf course. The stream is 2 feet wide and 4 inches deep and is believed to drain in the West Fork of the Gallatin River.

The lab results (Section 7.0 below) reflect what would be expected: the isotopic composition of the algae reflect the influence of sewage.

3.0 Isotope analysis preparations

Samples were hand collected, placed in Ziploc bags, and shipped to the University of Maryland Center for Environmental Science laboratory overnight. Samples were cooled with a "blue ice" pack. Once samples were received at the receiving office, the package was immediately retrieved, unpacked, and refrigerated. Samples were identified as "1" and "2" with no further identifying markings. Within 48 hours, samples were removed from the refrigerator and dried in a laboratory drying oven. This drying step took 2-3 days.

Dried samples were transferred to a desiccator, and within 48 hours, subsamples of the algal material were transferred to tin capsules required for analysis. Each sample provided by Cottonwood gave enough material to subsample 4 aliquots or replicates of each sample for analysis. Once all subsamples were prepared for analysis, they were shipped to the University of California Davis Stable Isotope Facility for analysis. It is of note that UC Davis does not accept any samples for analysis until they confirm that the samples have been properly prepared.

4.0 Data reporting and analysis

All samples were analyzed using an Elementar vario MICRO cube elemental analyzer (Elementar Analysensysteme GmbH, Langenselbold, Germany) interfaced to a Sercon Europa 20-20 isotope ratio mass spectrometer (Sercon Ltd., Cheshire, United Kingdom).

Each sample was simultaneously analyzed for carbon (C) and nitrogen (N) total mass and for its isotopic composition. The amount of mass of each sample was originally based on the ideal mass range for sample detection. As long as the amount of mass of material is within range of instrument detection, the absolute amount of mass does not affect the isotopic analysis.

Nitrogen isotopic composition (see background below) is reported using the convention delta notation:

$\delta^{13}C_{sample}$ or $\delta^{15}N_{sample}$ $[(R_{sample}/R_{standard}-1)]$ where R (ratio) = $^{13}C/^{12}C$ or $^{15}N/^{14}N$

$\delta^{13}C_{sample}$ or $\delta^{15}N_{sample}$ are expressed as a per mil deviation ($^{o}/_{oo}$) from international standards. The $R_{standard}$ for $^{13}C/^{12}C$ is international V-PDB (Vienna PeeDee Belemnite) and the $R_{standard}$ for $^{15}N/^{14}N$ is air. Most studies report δ * 1000 to amplify the small differences between samples and standards (e.g., Fry 2006). The unit (parts per thousand, ‰, per mil) may be implied rather than directly stated.

External and internal standards are run with each batch of samples by the UC Davis laboratory. During the isotopic analysis, the isotope laboratory used different certified reference materials for analytical control quality. Analytical uncertainties are given in Table 1:

Table 1.

	$\delta^{13}C$	$\delta^{15}N$
Mean standard deviation reference materials replicates in this project	+/- 0.15 $^{o}/_{oo}$	+/- 0.07 $^{o}/_{oo}$
Mean absolute accuracy for calibrated reference materials	+/- 0.07 $^{o}/_{oo}$	+/- 0.06 $^{o}/_{oo}$

5.0 Background

The use of isotopic composition of nitrogen and carbon to trace the source and fate of these elements in aquatic systems has a long history.

The fundamental concept begins with the molecular weight of each element. The Periodic Table tells us that the molecular weight of carbon is 12.011 and that of nitrogen is 14.07. However, these elements also have isotopes that are atoms with the same chemical properties but which differ in mass. Stable isotopes are those that do not emit radiation. Carbon has an isotope with a molecular weight of 13, and nitrogen has an isotope with a molecular weight of 15. These are natural forms of these elements, but which occur in very tiny amounts of the elements. Isotopes are specified by the name of the element (e.g., C or N), with a superscript indicating their weight. Thus, "normal" carbon is ^{12}C (its atomic weight is 12), but its stable isotope is ^{13}C. For nitrogen, its "normal" isotope is ^{14}N, but its stable isotope is ^{15}N. Isotopes with a higher molecular weight are referred to as "heavy". Heavy carbon, ^{13}C, makes up about 1.1% of all natural carbon. Heavy nitrogen, ^{15}N, makes up about 0.36% of natural nitrogen.

The formation and behavior of isotopes is well known and these principles are used in interpreting differences between sites or between samples taken at different times. The most basic concept is that in any chemical or biological reaction, the tendency is for the "lighter" isotope, that is ^{12}C or ^{14}N, to move through the reaction faster. Thus, in any biological or chemical reaction, if both isotopes of the same element are present (and different isotopes are always present), the lighter isotope will react faster, leaving the heavier isotope behind. With multiple cycles of such a reaction, the product will become lighter with respect to its isotopic composition and the residual left behind will become heavier over time (Fig. 3)

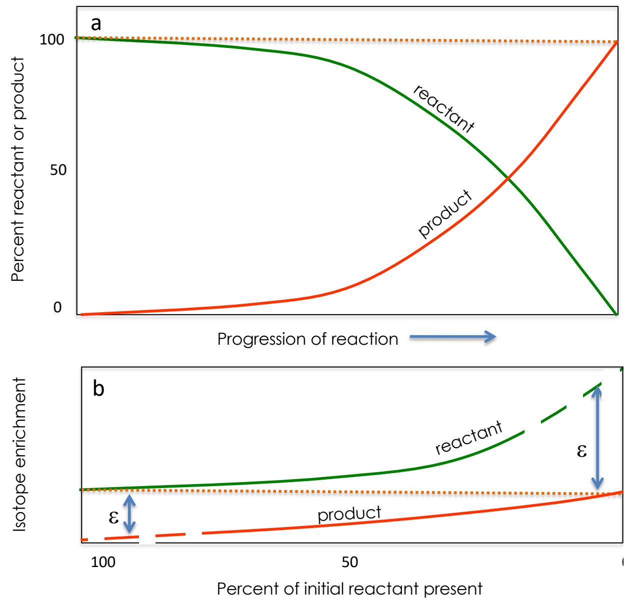

Figure 3. Relationship between isotope fractionation of reactant and product and their consumption, Rayleigh distillation kinetics. The term ε denotes the difference in isotope enrichment between reactant and product. Note that at the initiation of the reaction and near completion of the reaction this value is difficult to determine as there is either virtually no product at the start and if the reaction has gone to completion, no reactant at the end. In the figure, the ends of these curves have dashed lines. Reproduced from Glibert et al. (2019).

An important aspect in interpreting all such isotopic changes over time is that there must be sufficient "reactant" in the system to be reacted upon. Here, the "reactant" is the dissolved nitrogen or carbon in the water. If there is no reactant there can be no chemical or biological reaction, and if there is no reaction, there can be no isotopic change. Also, if a reaction has gone to completion (all reactant has been used up), the isotopic composition of the product will match that of the original reactants.

Differences in δ values between two substances are expressed with an uppercase delta, Δ. Thus:

$$\Delta_{A\text{-}B} = \delta_A - \delta_B \qquad (2)$$

Differences in δ, or Δ, for example $\Delta\delta^{15}$Nor $\Delta\delta^{13}$C, may be between reactant and product, food source and consumer, or any other comparison between a measured value and a baseline, however that is defined. Values of Δ may reflect changes in isotope ratios associated with isolated processes or net effects of multiple factors influencing differences in isotope values between any two pools of interest. Due to the sensitivity of analyses (see above), very small differences in reactant and products can be determined.

6.0 Nitrogen reactions

Nitrogen exists in aquatic systems in many forms and these forms are transformed from one to another by bacterial-mediated reactions or by uptake of nitrogen by aquatic plants (micro- or macroscopic), or by other chemical reactions (Fig. 4).

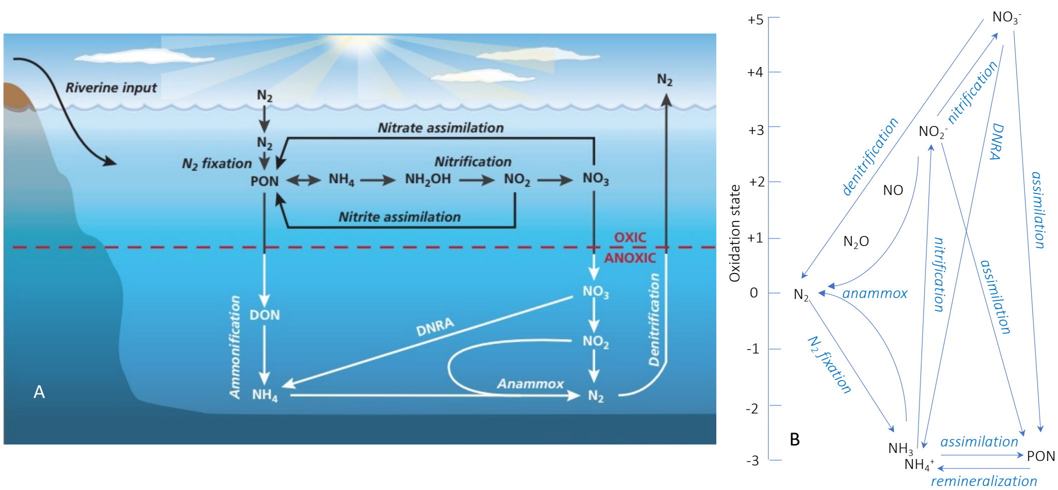

Figure 4. Panel A- The nitrogen cycle, depicting where in the water column the dominant processes occur. Panel B- the processes of the nitrogen cycle and chemical forms of nitrogen relative to their oxidation state. Images modified based on Arrigo (2005) and Hutchins et al. (2009).

One of the important reactions is denitrification, defined as the process by which nitrogen in the form of nitrate (NO_3^-) is converted to atmospheric nitrogen, N_2. The overall reaction is:

$$4HNO_3^- + 5\ CH_2O \rightarrow 5CO_2 + 7H_2O + 2N_2\uparrow$$

in which CH_2O represents organic matter. Denitrification is actually a summed series of reactions (Fig. 4), each of which is involves different enzymes and different organisms and different degree of fractionation,

$$NO_3^- \rightarrow NO_2^- \rightarrow NO \rightarrow N_2O \rightarrow N_2\uparrow$$

The end product of denitrification is release of N_2, a harmless gas, to the atmosphere (indicated by the up arrow in the equations above). It is considered a favorable reaction to rid a system of excess nitrogen. It is therefore a reaction that is carried out in sewage treatment plants, and it is also carried out naturally when there is available NO_3^- and associated bacteria. As can be seen from the equations above, the conversion of NO_3^- to N_2 is a multi-step reaction. The steps in this reaction each favor the lighter isotope–and thus the reactant (the nitrogen pool left behind) becomes heavier over time. Denitrification is a process with strong isotopic discrimination, and the NO_3 in the dissolved pool can become substantially enriched with ^{15}N. Isotope discrimination factors are on the order of 20-30 $^{o}/_{oo}$ (Cline and Kaplan 1975, Altabet et al. 1999, Voss et al. 2001). Denitrification depends on availability of NO_3^- and increases under conditions of low oxygen.

Another process that can contribute to isotopic fractionation of nitrogen is ammonia (NH_3) volatilization. This process occurs when the concentration of ammonia in water is high. Again, the lighter isotope moves through the reaction faster, leaving behind NH_3 that would be proportionately heavier. This process has been well studied in soils (where NH_3 is applied as a fertilizer), and also in hot springs, where it is shown that factors such as temperature and pH play important roles in the extent of volatilization and fractionation. As pH increases, so does volatilization. In waste stabilization ponds, ammonia volatilization can be a major removal process, especially in warm periods of the year. Volatilization may increase in spray irrigation.

Nitrification of NH_3 to NO_2^- and then to NO_3^- (Fig. 4B) in oxygenated surface waters is another process that can fractionate nitrogen and leave a residual ammonia pool which would be highly enriched in ^{15}N. Moving downstream, as this NH_3 is further transformed, the remaining pool decreases in concentration and increases in ^{15}N content. Thus, over time and distance, the available nitrogen pool for biological uptake differs in isotopic composition; it gets heavier. In this study (see results below), these different processes in the nitrogen cycle cannot be distinguished but they clearly show that discrimination did occur.

Both nitrate (NO_3^-) and ammonia (NH_3) are important nitrogen sources for primary producers, that is, algae and aquatic plants. Just as fertilizer nitrogen is used to grow agricultural crops, aquatic primary producers also use nitrogen for their metabolism and growth. Nitrogen is a building block of protein and without protein, a cell–any cell–cannot carry out metabolism and ultimately cannot survive. When more nitrogen is available (along with other required elements), growth is faster, and biomass can accumulate. When NO_3^- or NH_3 is taken up by the microscopic or macroscopic algae, its nitrogen isotopic composition reflects its source. The process of uptake of nitrogen by the plant also fractionates nitrogen, but fractionation by macroalgae is slight (0.2 – 1.4 $^{o}/_{oo}$; Umezawa et al. 2002, Lapointe et al. 2018). It is generally thought that the uptake of NO_3^- leads to more discrimination than the uptake of NH_3 due to their different transport mechanisms (Evans 2001).

Benthic algae (those that are attached to bottom materials like rocks or shells) are ideal for tracing the changes in isotopic composition (and therefore nitrogen processes) in space or time in aquatic systems. They sit and incorporate the dissolved nitrogen from their environment, and therefore integrate and reflect any changes that occur in that nitrogen (Lapointe et al. 2005, 2018). Thus, if nitrate changes in isotopic composition as it flows from upriver to downstream, and as bacteria denitrify this nitrate, or as ammonia volatilization occurs, the isotopic composition of the nitrogen available to be used changes. The difference in the resulting isotopic composition of the benthic algae informs us that nitrogen processing occurred. As a reminder, such a change only occurs is there is enough reactant or substrate (NO_3^- or NH_3) in the water to undergo such reactions. If there is no substrate, there can be no isotopic change.

Natural abundance stable isotope ratios are widely used to help identify and track biogeochemical sources in the environment (Kendall 1998; Kendall et al. 2008). Stable isotopes are frequently used to track anthropogenic nitrogen in aquatic systems (e.g., Owens 1987; Tucker et al. 1999; Costanzo et al. 2001; Lapointe et al. 2011; Loomer et al. 2014). In particular, increases in $\delta^{15}N$ (relative to a defined baseline or reference site) are often associated with contributions of sewage-derived N (Kendall 1998). Different sources of inorganic nutrients or organic matter often have distinct isotopic signatures, and various biological and/or physical processes alter isotope ratios in expected ways (Kendall et al. 2008; Fig. 5). Fertilizer has a $\delta^{15}N$ around zero, as it is formed using a process that fixed atmospheric nitrogen into ammonia. Atmospheric nitrogen has a $\delta^{15}N$ of zero. The $\delta^{15}N$ of NO_3^- can distinguish a wastewater signal from other sources of nitrogen, including precipitation, fertilizer, and mineral weathering (Kaushal et al. 2006).

The $\delta^{15}N$ of inorganic N derived from manure or sewage is often enriched (>10 $^{o}/_{oo}$) due to isotopic fractionation that occurs at either the sewage treatment facility or downstream thereof. Human septic waste has a $\delta^{15}N$ value around 4-5 (Kreitler 1975). The $\delta^{15}N$ values of N in sewage vary with amount of processing at the facility; processes such as NH_3 volatilization and denitrification drive the $\delta^{15}N$ values of the residual DIN up during treatment and/or processing within the environment. This, in turn, imparts a ^{15}N-enriched signal to primary producers that take up the sewage-derived N (McClelland et al. 1997, McClelland and Valiela 1998, Lapointe et al. 2005). In one classic example, Savage and Elmgren (2004) used $\delta^{15}N$ values in benthic macroalgae to track sewage-derived N in an embayment of the Baltic Sea and quantify effects of reductions in N inputs following implementation of tertiary sewage treatment. They sampled the algae along a 36 km transect and documented a gradient of elevated $\delta^{15}N$ that extended from peak values near the sewage outfall to ~25 km downstream of the outfall. Studies of the isotopic signatures of macroalgae in Florida have been used to distinguish agricultural nitrogen sources from those of sewage (Lapointe and Bedford 2007, Lapointe et al. 2015) and sewage pollution in macroalgae was traced using isotopes in Negril, Jamaica (Lapointe et al. 2011). A variation of this approach for N source tracking is the deployment of specific organisms for a set length of time over which the isotopic signature of their biomass will change, reflecting the local environment. Costanzo et al. (2001) deployed macroalgae in porous containers for several days, during which time their biomass incorporated the $\delta^{15}N$signature of dissolved N and were thus able to map a sewage plume in Moreton Bay, Australia.

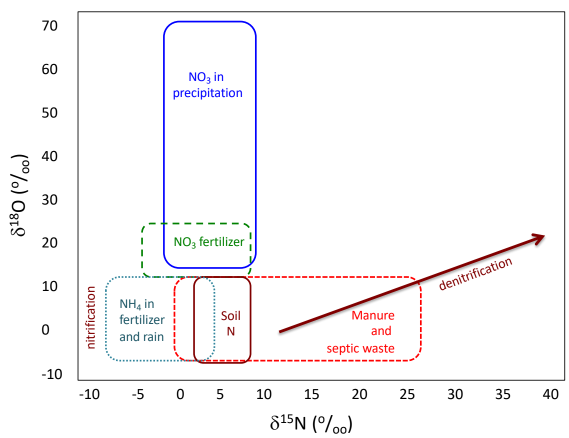

Figure 5. Typical $\delta^{18}O$-NO_3 and $\delta^{15}N$-NO_3 ranges for nitrate sources and the processes that alter these values. Modified and redrawn from Kendall (1998; Kendall et al. 2008).

Changes in carbon isotopic composition are more complicated than those of nitrogen. Most of the variability on algal $\delta^{13}C$ is due to changes in the concentrations of CO_2 in the water. CO_2 is fixed into biomass during photosynthesis and the enzymes involved discriminate against ^{13}C, but the degree to which this happens depends on availability of CO_2. These concentrations, in turn are affected by temperature, pH and the productivity of the water (Finlay 2004). In a study of a wide range of macroalgae from the Gulf of California (which used the same isotope analysis facility as used herein), values lower than $-30^{o}/_{oo}$ denoted uptake of CO_2 by diffusion, as opposed to uptake of carbon as HCO_3^- (Velázquez-Ochoa et al. 2022). Notable is the fact that the macroalga *Cladophora* takes up CO_2 via diffusion. Studies that have reported $\delta^{13}C$ discrimination by benthic algae also have reported that light availability also causes some discrimination (MacLeod and Barton 1998). Hill et al. (2008) reported that light effects depended also to some degree on the phosphorus content of the water. Where both light and phosphorus levels were relatively high, the highest $\delta^{13}C$values were found. In contrast, when phosphorus was somewhat lower even with available light, the lowest $\delta^{13}C$ values were observed. Algal cells growing in thick stands are likely to experience more CO_2 depletion and therefore may have a more positive $\delta^{13}C$, which those in thinner stands are likely to have more negative $\delta^{13}C$ values (Fig. 6).

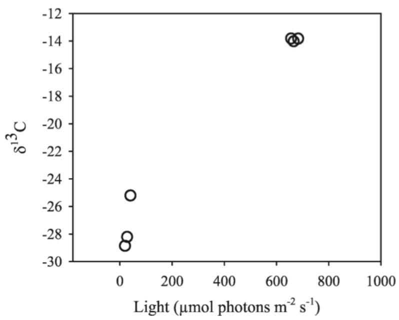

Figure 6. Algal $\delta^{13}C$ vs light in the study site reported by Hill et al. (2008).

7.0 Results

7.1. Nutrient analyses

Samples analyzed for ambient nitrogen showed higher concentrations at Site 1, the Ski Run stream than at site 2 (Table 2). Concentrations at Site 2 were below analytical limits of detection. Site 1 values for total nitrogen exceeded the TMDL of 0.3 mg/l (Allen and Howell 2020).

Table 2. ND indicates not detectable

	Nitrate+nitrite	Total nitrogen
Site 1	0.22 mg/L	1.62 mg/L
Site 2	ND	ND

7.2. Isotope enrichments

The subsamples of each of the two samples had excellent replication of both ^{15}N and ^{13}C isotopic composition (Table 3).

Table 3. Mean and standard deviation of isotope analyses.

Site number	Mean $\delta^{13}C$ ($^{o}/_{oo}$)	Standard deviation $\delta^{13}C$	Mean $\delta^{15}N$ ($^{o}/_{oo}$)	Standard deviation $\delta^{15}N$	No. of replicates
1	**-34.19**	2.55	**3.99**	1.48	4
2	**-32.03**	0.84	**12.21**	0.79	4

Differences in $\delta^{13}C$ were insignificant (ANOVA, $p>0.05$) between samples 1 and 2, but differences were significant for $\delta^{15}N$ (ANOVA< $p<0.01$) (Table 3). Values more than tripled from site 1 to site 2 in $\delta^{15}N$. Such trends would be consistent with in-water nitrogen processing via denitrification or volatilization. Such trends would also require sufficient nitrogen (as NO_3^- or NH_3) in the water column for such discrimination effects to be observed.

7.3. Comparison with previous isotope analyses in the region

Gardner (2010), in a more extensive study of spatial and seasonal isotopes of NO_3^- (compared to the algae analyzed herein) in the West Fork watershed showed that the wastewater influence was most evident in the summer and winter baseflow and that a substantial biological cycling of N loading occurred prior to watershed export. Her analyses of the wastewater effluent $\delta^{15}NO_3^-$ endmember (+12.2) were in the range of widely documented wastewater values, and her value matched that reported herein from Site 2. She further reported that summer $\delta^{15}NO_3^-$ values ranged from +0.56 to +10.92 and that values were enriched at sites located downgradient from Meadow Village during summer and winter baseflow, indicating a wastewater influence on NO_3^- concentrations. She suggested that the more enriched values of $\delta^{15}N$ during summer were caused by direct nitrogen loading of wastewater irrigation into streams or quick transport if nitrogen from areas hydrographically connected to the stream. These values ruled out fertilizer nitrogen as an important source, even though this was a residential area. Moreover, her isotope analyses of NO_3^- in the West Fork watershed provided essential evidence for establishment of Total Maximum Daily Loads (TMDL) in two areas of the watershed.

<u>Summary</u>

The data presented here support the Montana Department of Environmental Quality listing of the Middle River/West Fork of the Gallatin River, as water-quality impaired. Concentrations documented for nitrogen concentration was substantial and exceeded the TMDL for total nitrogen at Site 1. The isotopic signals of nitrogen in the collected algal samples were consistent with that of wastewater.

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Velázquez-Ochoa, R., Ochoa-Izaguirre, M. J., and Soto-Jiménez, M. F. (2022) An analysis of the variability in δ^{13}C in macroalgae from the Gulf of California: indicative of carbon concentration mechanisms and isotope discrimination during carbon assimilation, Biogeosciences, 19, 1–27, https://doi.org/10.5194/bg-19-1-2022

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CURRICULUM VITAE

PATRICIA M. GLIBERT

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I. Education

1974	BA	Skidmore College, Saratoga Springs, NY, Biology [*Phi Beta Kappa*]
1976	MS	University of New Hampshire, Earth Sciences
1982	PhD	Harvard University, Organismal and Evolutionary Biology

II. Professional Background

1993 - present	Professor, University of Maryland Center for Environmental Science (UMCES), Horn Point Laboratory (HPL)
2014 - 2017	Visiting Professor, Zhejiang University, Hangzhou and Zhoushan, China
1989 - 1993	Associate Professor, UMCES, HPL
1986 - 1989	Assistant Research Scientist, UMCES, HPL
1982 - 1986	Assistant Scientist, Woods Hole Oceanographic Institution
1981 - 1982	Postdoctoral Scholar, Woods Hole Oceanographic Institution

III. Significant Honors and Awards

2001	Environment Expert Award bestowed by the Minister of Health, Kuwait.
2006	University of Maryland Board of Regents Award for Excellence in Research, Scholarship and Creative Activity.
2011	HPL Director's award for outstanding productivity.
2011	Honorary Doctorate, conferred by Linnaeus University, Sweden.
2012	Distinguished Service Award, Kuwait University
2012	Elected Fellow, AAAS
2013	Named one of the top 25 women professors in the State of Maryland (www.statestat.org)
2015	Named Sustaining Fellow, Association for the Sciences of Limnology and Oceanography
2018	Invited Distinguished Scientist, Marine Biological Laboratory, Woods Hole MA
2019	Named Sawyer Visiting Professor, Maine Maritime Academy
2020	Visiting Professor, Shanghai Jiao Tong University, Shanghai, China
2022-2024	President, Association for the Sciences of Limnology and Oceanography (ASLO)

IV. Research

A. *Research Interests*

Transformations and fate of inorganic and organic nitrogen in marine and estuarine systems; global changes in the nitrogen cycle by anthropogenic activities; eutrophication; ecology and physiology of phytoplankton in estuarine and oceanic environments; harmful algal blooms; stable isotope techniques; ecological stoichiometry; effects of ocean fertilization for carbon sequestration.

B. Publications

1. Synthesis of publications and citations

Total peer reviewed journal papers (including in press but not in review): 205
Total book chapters/proceedings: 52
Other publications (peer review reports/articles for kids, public, etc): 14

Statistics as of Nov 2023	Web of Science	Google Scholar
Total number citations	18,698	29,878
Ave annual citations (2019-2022)	1,439	2,098
h' index	67	82

2. Publications

2.1 Books

2.1.1 Sole Authorship

Glibert, P.M. 2024. *Phytoplankton Whispering: An introduction to the physiology and ecology of microalgae.* Springer. In press

2.1.2 Books Edited

Glibert, P.M. and T.M. Kana (eds.). 2016. *Aquatic Microbial Ecology and Biogeochemistry: A Dual Perspective.* Springer.

Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (eds.). 2018. *Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer.

Glibert P.M., M. A. Altabet, J. Montoya and D. McGillicuddy (eds.). 2019. *The current and future ocean: Advancing science from plankton to whales–Celebrating the contributions of James J. McCarthy*. The Sea. Yale University Press.

2.2 Journal Papers and Other Articles

2023

Millette, N.C., R. J. Gast, J. Luo, H. Moeller, K. Stamieszkin, K. H. Andersen, E. Brownlee, N. Cohen, S. Duhamel, S. Dutkiewicz, **P. M. Glibert**, M. Johnson, S. Leles, A. Maloney, G. McManus, N. Poulton, S. Princiotta, R. Sanders, S. Wilken. 2023. Mixotrophs and mixotrophy: Future research priorities. *J. Plankt. Res.* doi.org/10.1093/plankt/fbad020

Li, J., Y. Gao, Y. Bao, X. Gao, and **P.M. Glibert**. 2023. Summer phytoplankton photosynthetic characteristics in the Changjiang River Estuary and the adjacent East China Sea. *Front. Mar. Sci.* doi.org/10.3389/fmars.2023.1111557

Vidyarathna, N., S. H. Ahn, **P. M. Glibert**. 2023. Thermal niche of the dinoflagellate *Karlodinium veneficum* across different salinity and light levels. *J. Plankt. Res.* doi.org/10.1093/plankt/fbad019

Glibert, P.M. and M. Li. Warming, wheezing, blooming waters: hypoxia and harmful algae. In: D. Baird (ed), Treatise on estuarine and coastal science, 2nd edition. Elsevier. In press.

Ahn, S., **P.M. Glibert** and C.A. Heil. In hot water: Interactions of temperature, nitrogen form and availability and photosynthetic and nitrogen uptake responses in natural *Karenia brevis* populations. *Harmful Algae.* doi.org/10.1016/j.hal.2023.102519

Chen, Y., M. Li, **P.M. Glibert** and C.A. Heil. Mu*r*Ky waters: Modeling the succession from *r* to K strategists (diatoms to dinoflagellates) following a nutrient spill from a mining facility in Florida. *Limnol. Oceanog.* doi.org/10.1002/lno.12420

Editorials and Non-reviewed Publications

Glibert, P.M. 2023. Message from the President: ASLO is global: Nurturing cross-cultural connections. *Limnol. Oceanog. Bull.* 32: 18-19

Glibert, P.M. 2023. Message from the President: Kudos to the people of ASLO. *Limnol. Oceanog. Bull.* 32: 61-62

Glibert, P.*M.* 2023. Message from the President: Trials and tribulations of transitions and transformations in publishing: what it means for you. *Limnol. Oceanogr. Bull.* 32: 110-112.

Glibert, P.M. 2023. Message from the President: Finding balance in a world of extremes. *Limnol. Oceanog. Bull.* 32: 139-140.

2022

Li, R., M. Li and **P.M. Glibert**. 2022. Coupled carbonate chemistry–harmful algal bloom models for studying effects of ocean acidification on *Prorocentrum minimum* blooms in an estuary. *Front. Mar. Sci.* doi.org/10.3389/fmars.2022.889233.

Glibert, P.M. and A. Mitra. 2022. From webs, loops, shunts and pumps to microbial multi-tasking: Evolving paradigms of marine microbial ecology, global mixoplankton importance and implications for a future ocean. *Limnol. Oceanogr.* 67: 585-597. doi.org/10.1002/lno.12018.

Ahn, S.H. and **P.M. Glibert**. 2022. Shining light on photosynthesis in the harmful dinoflagellate *Karenia mikimotoi*– Responses to short-term changes in temperature, nitrogen form and availability. *Phycology* 2:30-44. doi.org/10.3390/phycology2010002.

Li, M., Y. Chen, F. Zhang, Y. Song, **P.M. Glibert** and D.K. Stoecker. 2022. A three-dimensional mixotrophic model of *Karlodinium veneficum* blooms in a eutrophic estuary: seasonal and spatial dynamics and effects of nutrient ratios, prey concentration and temperature. *Harmful Algae.* 113:102203. doi.org/10.1016/j.hal.2022.102203.

Glibert, P.M., F. Wilkerson, R.C. Dugdale, A.E. Parker. 2022. Ecosystem recovery in progress? Initial nutrient and phytoplankton response to nitrogen reduction from sewage treatment upgrade in the San Francisco Bay Delta. *Nitrogen.* doi.org/10.3390/nitrogen3040037.

Glibert, P.M. W.-J. Cai, E. Hall, M. Li, K. Main, K. Rose, J. Testa, and N. Vidyarathna. 2022. Stressing over the complexities of multiple stressors in marine and estuarine systems. *Ocean-Land-Atmos. Res.* article 9787258 (27 pp). doi.org/10.34133/2022/9787258.

Book Chapters/Proceedings

Ahn, S., **P.M. Glibert** and C.A. Heil. 2022. Dynamic photo-physiological responses of dinoflagellate *Karenia brevis* to short-term changes in temperature and nitrogen substrates. Proceedings of the International Harmful Algal Bloom Conference, October 2021. doi.org/10.5281/zenodo/7034896.

Sobrinho, B., **P.M. Glibert,** V. Lyubchich, C.A. Heil, and M. Li. 2022.Time series analysis of the *Karenia brevis* blooms on the West Florida Shelf: relationships with El Niño – Southern Oscillation (ENSO) and its rate of change. Proceedings of the International Harmful Algal Bloom Conference, October 2021. doi.org/10.5281/zenodo/7036227.

Heil, C.A., S. Amin, **P.M. Glibert,** K. Hubbard, M. Li, J. Martínez Martínez, and R.Weisberg. 2022.Termination patterns of *Karenia brevis* blooms in the eastern Gulf of Mexico. Proceedings of the International Harmful Algal Bloom Conference, October 2021. doi.org/10.5281/zenodo/7034923.

Burkholder, J.M. and **P.M. Glibert**. 2022. Eutrophication and oligotrophication. *Encyclopedia of Biodiversity*, Elsevier. Vol. 4, doi.org/10.1016/B978-0-12-384719-5.00047-2.

Editorials and Non-reviewed Publications

Glibert, P.M. 2022. Message from the President: Sprigs of hope: Emerging from Covid with a fighting spirit. *Limnol. Oceanogr. Bull.* doi.org/10.1002/lob/10502.

Glibert, P.M. 2022. Message from the President: Pay it forward: lessons from a cup of coffee. *Limnol. Oceanog. Bull.* doi.org/10.1002/lob/10523.

Chen, J., W.-J. Cai, **P.M. Glibert** and D. Huang. 2022. Editorial: Eutrophication, algal blooms, hypoxia and ocean acidification in large river estuaries. *Frontiers in Mar. Sci*. doi10.3389/fmars.2022.1005105.

2021

Journal Articles

Li W., J. Ge, P. Ding, J. Ma, **P.M. Glibert,** and D. Liu. 2021. Effects of dual fronts on the spatial pattern of chlorophyll-*a* concentrations in and off the Changjiang River estuary. *Estuaries Coasts* 44, 1408–1418. doi.org/10.1007/s12237-020-00893-z.

Glibert, P.M., C.A. Heil, C.J. Madden, and S.P. Kelly. 2021. Dissolved organic nutrients at the interface of fresh and marine waters: Flow regime changes, biogeochemical cascades and picocyanobacterial blooms–the example of Florida Bay, USA. *Biogeochem*. doi.org:10.1007/s10533021-00760-4.

Wang, J., A.F. Bouwman, X. Liu, A.H.W. Beusen, R. Van Dingenen, F. Detener, Y. Yao, **P.M. Glibert,** X. Ran, Q. Yao, B. Xu, R. Yu, J. Middelburg, and Z. Yu. 2021. Harmful algal blooms in Chinese coastal waters will persist due to perturbed nutrient ratios. *Env. Sci. and Technol. Letts*. 8: 276-284.doi.org/10.1021/acs.estlett.1c00012.

Zhang, F., M. Li, **P.M. Glibert** and S.H. Ahn. 2021. A spatially-explicit mechanistic model of *Prorocentrum minimum* blooms in Chesapeake Bay. *Sci. Tot. Environ*. 769: 144528. doi.org/10.1016/j.scitotenv.2020.144528.

Bentley, K.M., J.J. Pierson and **P.M. Glibert**. 2021. Physiological responses of the copepods *Acartia tonsa* and *Eurytemora carolleeae* to changes in the nitrogen:phosphorus quality of their food. *Nitrogen*. 2: 62-85. doi.org/10.3390/nitrogen2010005.

Weissberger, E.J. and **P.M. Glibert**. 2021. Diet of the eastern oyster, *Crassostrea virginica*, growing in a eutrophic tributary of Chesapeake Bay, Maryland, USA. *Aquaculture Rep*. 0:100655. doi.org/10.1016/j.aqrep.2021.100655.

Weissberger, E.J. and **P.M. Glibert**. 2021. Seasonal gut contents of the eastern oyster, *Crassostrea virginica*, in the Rhode River, Chesapeake Bay, USA: growth, phytoplankton and signature pigment data. *Data in Brief.* doi.org/10.1016/j.dib.2021.107176.

Li, M., F. Zhang and **P.M. Glibert**. 2021. Seasonal life strategy of *Prorocentrum minimum* in Chesapeake Bay, USA: Validation of the role of physical transport using a coupled physical-biogeochemical-harmful algal bloom model. *Limnol. Oceanogr.* 66: 3873-3886. doi.org/10.1002/lno.11925.

Gray, M., S. Alexander, B. Beal, T. Bliss, C. Burge, J. Cram, M. De Luca, J. Dumhart, **P. M. Glibert**, M. Gonsior, A. Heyes, V. Lyubchich, K. Huebert, K. McFarland, M. Parker, L. Plough, G. P. Richards, E. Schott, L. Wainger, G. Wikfors and A. Wilbur. 2021. Hatchery crashes among shellfish research hatcheries along the Atlantic coast of the United States: a case study at Horn Point Laboratory oyster research hatchery. *Aquaculture*. 546: 7372589. doi.org/10.1016/j.aquaculture.2021.737259.

Li, M.F., **P.M. Glibert** and V. Lyubchich. 2021. Machine learning algorithms for predicting *Karenia brevis* blooms in the West Florida Shelf. *J. Mar. Sci. Eng*. doi.org/10.3390/jmse0909000.

Book Chapters

Glibert, PM and G. Pitcher. 2021. Harmful algal blooms, changing ecosystem dynamics and related conceptual models. In: Bernard, S., L.R. Lain, R. Kudela and G. Pitcher (Eds.), *Observation of harmful algal blooms with ocean colour radiometry*. IOCCG Report Series, No. 20, International Ocean Colour Coordinating Group, Dartmouth, Canada. pp. 13-24.

Glibert PM and R.M. Kudela. 2021. Application of ocean colour to fish-killing *Margalefidinium* (*Cochlodinium*) blooms. In: Bernard, S., L.R. Lain, R. Kudela and G. Pitcher (Eds.), *Observation of harmful algal blooms with ocean colour radiometry*. IOCCG Report Series, No. 20, International Ocean Colour Coordinating Group, Dartmouth, Canada. pp. 99-106.

Pitcher, G. C., P.M. **Glibert,** R.M. Kudela, and M.E. Smith. 2021. Application of ocean colour to harmful high biomass algal blooms. In: Bernard, S., L.R. Lain, R. Kudela and G. Pitcher (Eds.), *Observation of harmful algal blooms with ocean colour radiometry.* IOCCG Report Series, No. 20, International Ocean Colour Coordinating Group, Dartmouth, Canada. pp. 107-121.

Glibert, P.M. 2021. Foreward 1. In: Al-Yamani, F.Y. *Fathoming the northwestern Arabian Gulf: Oceanography and marine biology*. Kuwait Instit. of Envir. Research. pp. i-ii.

Articles for Children or Public

Glibert, P.M. 2021. What are the most powerful organisms of the sea? The tiny phytoplankton, of course! *Frontiers for Young Minds*. 9:600102. doi.org/10.3389/frym.021.600102.

2020

Journal Articles

Li, M., W. Ni, F. Zhang, **P.M Glibert** and C-H. Lin. 2020. Climate-induced interannual variability and projected change of two harmful algal bloom taxa in Chesapeake Bay, U.S.A. *Sci. Tot. Environ*. 744: 140947. doi.org/10.1016/j.scitotenv.2020.14094

Gleich, S.J., L.V. Plough and **P.M. Glibert**. 2020. Photosynthetic efficiency and nutrient physiology of the diatom *Thalassiosira pseudonana* at three growth temperatures. *Mar. Biol.* doi.org/10.1007/s00227-020-03741-7.

Glibert, P.M. 2020. From hogs to HABs: Recent changes and current status in fertilizer use and industrial animal farms and their impacts on nitrogen and phosphorus loads and greenhouse gas emissions. *Biogeochem.*[1] doi.org/10.1007/s10533-020-00691-6.

Glibert P.M. 2020. Harmful algae at the complex nexus of eutrophication and climate change. *Harmful Algae* 91: 101583.[2] doi.org/10.1016/j.hal.2019.03.001.

Accoroni, S., C. Totti, T. Romagnoli, S. Guilietti and **P.M. Glibert**. 2020. Distribution and potential toxicity of benthic harmful dinoflagellates in waters of Florida Bay and the Florida Keys. *Mar. Environ. Res.* doi.org/10.1016/j.marenvres.2020.104891.

Li, N., M. Tong and **P.M. Glibert**. 2020. Effects of allelochemicals on photosynthetic and antioxidant defense system of *Ulva prolifera*. *Aquat. Tox.* doi.org/10.1016/j.aquatox.2020.105513.

Li, N., J. Zhang, X. Zhao, P. Wang, M. Tong and **P. M. Glibert**. 2020. Allelopathic inhibition by the bacteria *Bacillus cereus* BE23 on the growth and photosynthetic system of the macroalga *Ulva prolifera*. *J. Mar. Sci. Eng*. doi.org/10.3390/jmse.8090718.

Book Chapters

Glibert, P.M., A.H.W. Beusen, A.F. Bouwman, J.M. Burkholder, K.J. Flynn, C.A. Heil, M. Li, C.-H. Lin, C.J. Madden, A. Mitra, W. Nardin, G. Silsbe, Y. Song and F. Zhang. 2020. Multifaceted climatic change and nutrient effects on harmful algae require multifaceted models. In: Botana LM, C. Louzao and N. Vilariño (Eds.), *Climate change and marine and freshwater toxins,* 2nd edition. DeGruyter Publishers. doi.org/10.1515/9783110625738-012.

Glibert, P.M., R. Marager, D.J. Sobota and L. Bouwman. 2020. Further evidence of the Haber Bosch-Harmful Algal Bloom (HB-HAB) link and the risk of suggesting HAB control through phosphorus reductions only. In: Sutton, M.A., K.E. Mason, A. Bleeker, W.K. Hicks, C. Masso, N. Raghurram, S. Reis, M. Bekunda (Eds.), *Just Enough Nitrogen: Perspectives on how to get there for regions with too much and too little nitrogen*. Springer. doi.org/10.1007/978-3-030-58065-0_17.

2019

Journal Articles

Swarbrick, V., G. Simpson, **P.M. Glibert** and P. Leavitt. 2019. Stimulation or suppression: Drivers of dichotomous phytoplankton response to ammonium enrichment in hardwater lakes. *Limnol. Oceanogr.* 64(S1): S130-S149. doi: 10.1002/lno.11093.[3]

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[1] Invited review

[2] Invited review, Web of Science highly cited paper; one of the top cited papers of the journal.

[3] One of the top downloaded papers for *Limnol. Oceanogr.* from 2018-2019

Lin, C-H. and **P.M. Glibert**. 2019. Mixotrophy with multiple prey species measured with a multiwavelength-excitation PAM fluorometer: case study of *Karlodinium veneficum*. *J. Plankt. Res.* 41: 46-62. doi:10.1093/plankt/fby049.

Leles, S., A. Mitra, K. Flynn, U. Tillmann, D. Stoecker, H.J. Jeong, J. Burkholder, P.J. Hansen, D. Caron, **P.M. Glib**ert, G. Hallegraeff, J. Raven, R. Sanders, M. Zubkov. 2019. Sampling bias misrepresents the biogeographic significance of constitutive mixotrophs across global oceans. *Global Ecol. Biogeogr.* doi:10.1111/geb.12853.

Glibert, P.M., J.J. Middelburg, J.W. McClelland and M. J. Vander Zander. 2019. Stable isotope tracers: enriching our perspectives and questions on sources, fates, rates and pathways of major elements on aquatic systems. *Limnol. Oceanogr.* 64: 950-981. doi:10.1002/lno.11087[4]

Xu, M.N., X. Li, D. Shi, Y. Zhang, M. Dai, T. Huang, **P.M. Glibert** and S-J. Kao. 2019. Coupled effect of substrate and light on assimilation and oxidation of regenerated nitrogen in euphotic ocean. *Limnol. Oceanogr.* doi:10.1002/lno.11114.

Solomon, C.M., M. Jackson and **P.M. Glibert**. 2019. Chesapeake Bay's 'forgotten' Anacostia River: Eutrophication and nutrient reduction measures. *Environ. Monitor. Assess.* 191: 265. doi.org/10.1007/s10661-019-7437-9.

Book Chapters

Glibert, P.M., M.A. Altabet, J.P. Montoya, and D.M. McGillicuddy, Jr. 2019. Advancing science from plankton to whales–Celebrating the contributions of James J. McCarthy. In: Glibert, P.M., M.A. Altabet, J. Montoya and D.M. McGillicuddy (Eds.), *The current and future ocean: Advancing science from plankton to whales–Celebrating the contributions of James J. McCarthy.* The Sea. Yale University Press. *Journal of Marine Research* 77 (Suppl): 1-8.

Glibert, P.**M**. 2019. Phytoplankton in the aqueous ecological theater: Changing conditions, biodiversity and evolving ecological concepts. In: Glibert, P.M., M.A. Altabet, J. Montoya and D.McGillicuddy (Eds.), *The current and future ocean: Advancing science from plankton to whales–Celebrating the contributions of James J. McCarthy.* The Sea. Yale University Press. *Journal of Marine Research* 77 (Suppl): 88-137.

Articles for Children or Public

Glibert, P.M., A. Mitra, K. Flynn, P.J. Hansen, H.J. Jeong and D. Stoecker. 2019. Plants are not animals and animals are not plants, right? Wrong! Tiny creatures in the sea can be both at once! *Frontiers for Young Minds.* doi:10.3389/frym.2019.00048.

Glibert, P.M. 2019. Why were the water and beaches in west Florida so gross in summer 2018? Red tides! *Frontiers for Young Minds*. doi:10.3389/frym.2019.00010.

Glibert, P.M. 2019. Harmful algal blooms: A threat to the waters of the world. Jefferson Report, The Jefferson Educational Society. https://www.jeserie.org/uploads/Algal%20Bloom%20Glibert%20FINAL%20VERSION.pdf

[4] Invited review, one of the top downloaded papers for *Limnol. Oceanogr.* from 2018-2020

2018

Journal Articles

Lin, C.-H., V. Lyubchich and **P.M. Glibert.** 2018. Time series models of decadal trends in the harmful algal species *Karlodinium veneficum* in Chesapeake Bay. *Harmful Algae.* 73: 110-118. doi.org/10.1016/j.hal.2018.02.002.

Lin, C.-H.*,* K.J. Flynn, **P.M. Glibert** and A. Mitra. 2018. Modeling effects of variable nutrient stoichiometry and temperature on mixotrophy in the harmful dinoflagellate *Karlodinium veneficum*. *Frontiers Mar. Sci*. doi.org/10.3389/fmars.2018.00320.

Liu, D. and **P.M. Glibert.** 2018. Physiological linkage of nitrogen enrichment to enhanced silicification of diatoms in winter and implications for Si cycling and harmful algal blooms. *Mar. Ecol. Progr. Ser.* 604: 51-63. doi.org/10.3354.meps12747.

Book Chapters

Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou. 2018. Introduction to the Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) synthesis volume. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (Eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 3-7.

Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou. 2018. Harmful algal blooms and the importance of understanding their ecology and oceanography. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (Eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 9-25.

Glibert, P.M., A.H.W. Beusen, J.A. Harrison, H.H. Durr, A. Bouwman and G.G. Laruelle. 2018. Changing land, sea- and airscapes: Sources of nutrient pollution affecting habitat suitability for harmful algae. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 53-76.

Glibert, P.M., C.A. Heil, F. Wilkerson and R.C. Dugdale. 2018. Nutrients and harmful algal blooms: Kinetics and flexible nutrition. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (Eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 93-112.

Flynn, K.J., A. Mitra, **P.M. Glibert** and J.M. Burkholder. 2018. Mixotrophy in harmful algae: by whom, on whom, when, why, and what next. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (Eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 113-132.

Glibert, P.M., A. Al-Azri, J. I. Allen, A. Bouwman, A.H.W. Beusen, M. A. Burford, P. J. Harrison and M. Zhou. 2018. Key questions and recent research advances on harmful algal blooms in relation to nutrients and eutrophication. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (Eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 229-259

Glibert, P.M., G.C. Pitcher, S. Bernard, and M. Li. 2018. Advancements and continuing challenges of emerging technologies and tools for detecting harmful algal blooms, their antecedent conditions and toxins, and applications in predictive models. In: Glibert, P.M., E. Berdalet, M. Burford, G. Pitcher and M. Zhou (Eds.), *Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB)*. Springer. pp. 339-357.

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Garside, C. and **P.M. Glibert**. 1984. Computer modeling of ^{15}N uptake and remineralization experiments. *Limnol. Oceanogr.* 29: 199-204.

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Glibert, P.M. and J.C. Goldman. 1981. Rapid ammonium uptake by marine phytoplankton. *Mar. Biol. Letts.* 2: 25-31.

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Loder, T.C. and **P.M. Glibert**. 1980. Nutrient variability and fluxes in an estuarine system, pp. 111-122. In: V.S. Kennedy (ed.), *Estuarine Perspectives.* pp. 111-122. Academic Press.

4. Special issues edited

Glibert, P.M. and K. (Guest Editors). 2005. Special issue of *Harmful Algae* on *Prorocentrum minimum.* Vol. 4(3)

Glibert, P.M., and G. Pitcher (Guest Editors), 2005. Special section of *Oceanography* on *Harmful algal blooms.* Vol, 18(2).

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Burkholder, J.M. and **P.M. Glibert** (Guest Editors). 2009. Special section of *Harmful Algae* on *Strain Differences in Harmful Algae*. Vol 8(5)

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Chen, J., W.-J. Cai, **P.M. Glibert** and D. Huang (Guest editors). 2022, 2023. Eutrophication, algal blooms, hypoxia, and ocean acidification in large river systems. *Front. Mar. Sci.* Vols I, II

C. Membership in Professional Societies

American Association for the Advancement of Science (*Fellow*)
Association for the Sciences of Limnology and Oceanography (*Sustaining Fellow*, ***President-July 2022-2024***)
American Geophysical Union
The Oceanography Society
Estuarine Research Federation
International Society for the Study of Harmful Algae

V. Teaching and Training

1986- present	Member, UMCES Graduate Faculty
1986- present	Member, USM Graduate Faculty
2014-2017	Zhejiang University, Hangzhou and Zhouzhan, China

VI. Outreach and Service

A. Editorships and Journal Reviewing

Member of Editorial Board, *Harmful Algae*, 2001-2019
Member of the Editorial Board, *Limnology and Oceanography Letters* 2015-2019
Subject Editor, *Aquatic Microbial Ecology*, 1995-2001, 2007-2013
Member of Editorial board of *Estuaries and Coasts*, 2004- 2013

B. Federal, State, Local Government

Co-Chair, US National HAB Committee, 2006-2012, ex-officio member 2013-present
Member, Maryland Harmful Algal Technical Advisory Committee, 1999- present
Member, Scientific and Technical Advisory Committee, Coastal Bays, 2006-present
Expert Reviewer, EPA, Florida nutrient criteria development, 2009
Consultant on nutrient issues, California State Water Contractors and Bay Delta Conservation Plan, 2009-2015

C. National/International Working Groups and Advising

GEOHAB Scientific Steering Committee (1999-2015) and chair of the core research project on Eutrophication (1999-2017)
Co-chair, SCOR/LOICZ Working Group 132, Land based nutrient pollution and HABs, 2008-2013
Consultant to the Ministry of Oman on harmful algal blooms, 2010, 2015
Member, GEOHAB Working Group on HABs and Ocean Colour, 2010-2015
Member, working group on developing models for mixotrophy, Leverhulme Foundation, 2011-2016
Member, working group on Mixotrophs and Mixotrophy, OCB, Woods Hole

D. Testimony

Expert report for District Court: Natural Resources Defense Council vs Metropolitan Water Reclamation District of Greater Chicago

Expert report and witness testimony in US Supreme Court: Florida vs Georgia

E. Service to the Broader Community

Member and Secretary, Estuarine Research Federation Governing Board, 2007-2009; Representative CERF Policy Committee 2012-2015

Representative, Council of Aquatic Science Societies (CASS), 2011-2014

Member, Gunston School (Centreville, MD) advisory board on Chesapeake Watershed Semester Program, 2018-2021

President, Association for the Sciences of Limnology and Oceanography, July 2022- July 2024