

# Christopher J. Somes

## Curriculum Vitae

### Current Position

Research Scientist  
Marine Biogeochemical Modelling  
GEOMAR Helmholtz Centre for Ocean Research Kiel  
Wischhofstr. 1-3  
24148 Kiel, Germany

phone: +49 431 600-2053  
email: csomes@geomar.de  
webpage: <https://www.geomar.de/en/csomes>  
ORCID: <https://orcid.org/0000-0003-2635-7617>

### Education

2013, *Ph.D.*, Oceanography, GEOMAR Helmholtz Centre/Kiel University  
2010, *M.Sc.*, Oceanography, Oregon State University  
2006, *B.Sc.*, Physics (Geophysics option), Oregon State University  
2003, *A.Eng.*, Software Engineering Technology, Oregon Institute of Technology

### Research Interests

- Climate change feedbacks associated with the biological carbon pump in the past, present, and future ocean
- Anthropogenic impacts on ocean deoxygenation and marine ecosystems
- Isotopic constraints and insights on ocean biogeochemical cycling and marine ecosystem dynamics
- Development of ocean biogeochemical, ecosystem, and Earth system models

### Professional Positions

2017-present, Research Scientist, *GEOMAR Helmholtz Centre for Ocean Research Kiel*  
2012-2017, Postdoctoral Researcher, *GEOMAR Helmholtz Centre for Ocean Research Kiel*  
2010-2012, PhD Researcher, *IFM-GEOMAR, Leibniz Institute for Marine Sciences*  
2007-2010, Graduate Research Assistant, College of Oceanic and Atmospheric Sciences, *Oregon State University*

### Professional Activities

2024-present, Steering Committee, Past Ocean Oxygenation working group, Past Global Changes (PAGES)  
2023-present, Working Group Member, Benthic Ecosystem and Carbon Synthesis (BECS), <https://www.us-ocb.org/beCS/>  
2013-present, Working Group Member, Climate Impacts on Top Ocean Predators (CLIOTOP), Isotope Subgroup, Integrated Marine Biosphere Research (IMBER)

- 2020-2024, Working Group Member, Iron Model Intercomparison Project (FeMIP), SCOR Working Group 151
- 2010-2014, Working Group Member, Nitrogen Cycling in the Oceans, Past and Present (NICOPP), Past Global Changes (PAGES)

### **Society Memberships**

The Oceanography Society, The Geochemical Society, European Geophysical Union

### **Research Grant Funding**

- 2023-2026, Principal Investigator, funded by *German Research Foundation* (DFG), “Isotopic constraints on global marine iron cycling, marine productivity, and deoxygenation”  
Amount: €317,017
- 2021-2025, Principal Investigator, funded by *German Research Foundation* (DFG), “Isotopic constraints on declining oceanic nutrient inventories weakening the marine soft-tissue biological carbon pump during the last deglaciation”  
Amount: €227,250
- 2020, Task Leader, co-Principal Investigator, funded by EU Horizon 2020 “COMFORT” Project, “Sensitivity of marine productivity, oxygen minimum zones and marine N<sub>2</sub>O dynamics to abrupt changes in the Atlantic meridional overturning circulation”  
Amount: €80,000 (out of total project budget €8.5 Million)
- 2017-2019, Principal Investigator, funded by the *Cluster of Excellence “The Future Ocean”* via the *German Research Foundation* (DFG), “Impacts of nutrient pollutants on marine productivity, deoxygenation and sedimentary feedbacks in the Anthropocene: From the coastal to the global ocean”  
Amount: €200,000

### **Journal Peer Reviews** (total number of reviews per year)

- 2024 Global Biogeochemical Cycles (1)
- 2023 Biogeosciences (1), Earth System Science Data (1)
- 2022 Nature Geoscience (2), Biogeosciences (2), Global Biogeochemical Cycles (1)
- 2021 Nature Geoscience (1), Nature Communications (3), Geophysical Research Letters (1)
- 2020 Frontiers in Marine Science (2)
- 2019 Global Biogeochemical Cycles (1), Biogeosciences (1), Frontiers in Marine Science (1), Springer Nature Book Proposal (1)
- 2018 Nature (2), Frontiers in Marine Science (1), Earth and Planetary Science Letters (2), Geoscientific Model Development (1)
- 2017 Biogeosciences (1)
- 2016 Geophysical Research Letters (2), Journal of Advances in Modeling Earth Systems (1)
- 2015 Paleoceanography (1), Geophysical Research Letters (1)
- 2013 Aquatic Geochemistry (1)

## Submitted/In Preparation Manuscripts

- Li N., **Somes C.J.**, Landolfi A., Chien C.-T., Pahlow M., Oschlies A. (submitted preprint), Global impact of benthic denitrification on marine N<sub>2</sub> fixation and primary production simulated by a variable stoichiometry Earth system model, *EGUsphere*, <https://doi.org/10.5194/egusphere-2024-123>
- Hoogakker B. et al. (submitted preprint), Review and syntheses: Review of proxies for low-oxygen paleoceanographic reconstructions, *EGUsphere*, <https://doi.org/10.5194/egusphere-2023-2981>
- Heinze C. et al. (submitted preprint), Review and syntheses: Abrupt ocean biogeochemical change under human-made climatic forcing - warming, acidification, and deoxygenation, *Biogeosciences Discuss.*, <https://doi.org/10.5194/bg-2023-182>

## Selected Peer-Reviewed Publications (see complete list at the end of this CV)

- Derville S., Torres L.G., Newsome S., **Somes C.J.**, Valenzuela L.O., Zanden H.B.V., et al., Carroll E.L. (2023): Long-term stability in the circumpolar foraging range of a Southern Ocean predator between the eras of whaling and rapid climate change, *Proceedings of the National Academy of Sciences*, 120 (10), e2214035120, <https://doi.org/10.1073/pnas.2214035120>
- Somes C.J.**, Dale A.W., Wallmann K., Scholz F., Yao W., Oschlies A., Muglia J., Schmittner A., Achterberg E.P. (2021), Constraining global marine iron source and ligand-mediated scavenging fluxes with GEOTRACES dissolved iron measurements in an ocean biogeochemical model, *Global Biogeochemical Cycles*, 35, e2021GB006948, <https://doi.org/10.1029/2021GB006948>
- Somes, C.J.**, A. Schmittner, J. Muglia, and A. Oschlies (2017), A three-dimensional model of the marine nitrogen cycle during the Last Glacial Maximum constrained by sedimentary isotopes. *Frontiers of Marine Science*, 4:108. doi:10.3389/fmars.2017.00108
- Galbraith, E. D., Kienast, Bianchi, D.,M., Tesdal, J.-E., **Somes, C.J.**, and the NICOPP Working Group Members (2013), The acceleration of oceanic denitrification during deglacial warming, *Nature Geoscience*, 6, 579-584, doi:10.1038/ngeo1832
- Somes, C.J.**, A. Schmittner, A. Mix, R. M. Letelier, E. D. Galbraith, M. Lehmann, M. Altabet, J. P. Montoya, M. Eby, and A. Bourbonnais (2010), Simulating the global distribution of nitrogen isotopes in the ocean, *Global Biogeochemical Cycles*, 24, GB4019, doi:10.1029/2009GB003767

## Conference Session Convener

- 2023 April 25<sup>th</sup>, *EGU General Assembly*, Vienna, Austria, "Response of ocean biogeochemical cycles to climate change", Primary Chair: A. Tagliabue; Co-Chairs: **C.J. Somes**, C. Laufkötter, C. Richon
- 2022 May 26<sup>th</sup>, *EGU General Assembly*, Vienna, Austria, "Response of ocean microbes and biogeochemical cycles to past, present, and future climate change", Primary Chair: A. Tagliabue; Co-Chairs: I. Frenger, P. Buchanan, **C.J. Somes**, F. Fripiat
- 2020 February 17<sup>th</sup>-18<sup>th</sup>, *Ocean Sciences Meeting*, San Diego, CA, USA, "New Tools and Approaches to Constrain the Marine Nitrogen Cycle: From the Surface to the Sediments", Primary Chair: **C. J. Somes**; Co-Chairs: M. Benavides, A. Landolfi, C. Löscher

2018 February 14<sup>th</sup>, *Ocean Sciences Meeting*, Portland, Oregon, USA, “Understanding Controls on Marine Nitrogen Cycling: From Microbes to the Global Ocean”, Primary Chair: A. Landolfi; Co-Chairs: **C. J. Somes**, W. Koeve, Qixing (Jimmy) Ji

### **Graduate Student Supervision**

2023-present, primary advisor to Ben Perrett, Doctoral candidate, GEOMAR Helmholtz Centre for Ocean Research

2019-present, co-advisor to Na Li, Doctoral candidate, GEOMAR Helmholtz Centre for Ocean Research

2019-2023, co-advisor to Maria-Theresia Verwega, Doctorate, GEOMAR Helmholtz Centre for Ocean Research/Kiel University

### **Teaching Experience**

2021-present (every 2<sup>nd</sup> year), Teaching Assistant, Climate Feedbacks in the Earth System, 1 exercise/lab hour per week

2017-present, Co-Lecturer, Fundamentals in Marine Biogeochemical Modelling, MNF-bioc-335, Winter Semester (since 2017), 2 lecture hours per semester

2013-2016, Computer Lab Assistant, Introduction to Biological Modelling, Summer Intensive Course (2013-2016), Instructors: Prof. Andreas Oschlies and Dr. Markus Pahlow

### **Awards**

Laurel Scholarship (Graduate Tuition), 2x: 2006-2007, 2007-2008 (academic years), College of Oceanic and Atmospheric Sciences, Oregon State University

### **Recent Invited Speaker Presentations**

2023 November 28<sup>th</sup>, *Benthic Ecosystem and Carbon Synthesis Webinar*, Virtual, “The impact of reductive sedimentary iron release on changing ocean biogeochemistry simulations of the Anthropocene”, invited by Prof. Jeremy Testa

2022 September 21<sup>st</sup>, *MPI Earth System Modeling Seminar*, Hamburg, Germany, “Simulating anthropogenic controls on marine nitrogen and iron biogeochemical feedbacks and drivers of ocean productivity and deoxygenation” Invited by Dr. Tatiana Ilyina

2021 April 27<sup>th</sup>, *International UVic Earth System Model Seminar Series* (Virtual), “Modeling the global marine iron cycle: Constraints from dissolved iron observations and projected changes in the Anthropocene”, Invited by Prof. Andreas Schmittner

2021 April 15<sup>th</sup>, *Deep-sea Corals to Reconstruct Ocean Data Workshop*, Virtual Presentation, Wellington, New Zealand, “Constraining global marine iron source and scavenging fluxes with dissolved iron concentrations”, invited by Prof. Dan Sinclair

2020 October 12<sup>th</sup>, *AWI Helmholtz Centre for Polar and Marine Research*, Carbon Biogeochemistry Seminar (Virtual), “Modeling the global marine iron cycle: Constraints from dissolved iron observations and projected changes in the Anthropocene”, Invited by Dr. Christoph Voelker

### **Data Publications:**

1. Pelz M.-T., **Somes C.J.**, Tuerena R.E., Lorrain A., Close H.G., Henderson L.C., St. John Glew K., Espinasse B., Trueman C.N. (2022): A global marine particulate organic carbon-13 isotope data product (Version2). *PANGAEA*, <https://doi.org/10.1594/PANGAEA.946915>
2. Verwega, Maria-Theresia; **Somes, Christopher J**; Tuerena, Robyn E.; Lorrain, Anne (2021): A global marine particulate organic carbon-13 isotope data product. *PANGAEA*, <https://doi.org/10.1594/PANGAEA.929931>

### Full Peer-Reviewed Publication List

1. Frenger I., Landolfi A., Kvale K., **Somes C.J.**, Oschlies A., Yao W., Koeve W. (2024, in press), Misconceptions of the marine biological carbon pump in a changing climate: Thinking outside the "export" box, *Global Change Biology*, <https://doi.org/10.1111/gcb.17124>
2. Pelz M.-T., Schartau M., **Somes C.J.**, Lampe V., Slawig T. (2023): A diffusion-based kernel density estimator (diffKDE, version 1) with optimal bandwidth approximation for the analysis of data in geoscience and ecological research, *Geoscientific Model Development*, 16, 6609-6634, <https://doi.org/10.5194/gmd-16-6609-2023>
3. Derville S., Torres L.G., Newsome S., **Somes C.J.**, Valenzuela L.O., Zanden H.B.V., et al., Carroll E.L. (2023): Long-term stability in the circumpolar foraging range of a Southern Ocean predator between the eras of whaling and rapid climate change, *Proceedings of the National Academy of Sciences*, 120 (10), e2214035120, <https://doi.org/10.1073/pnas.2214035120>
4. Wallmann, K., José, Y.S., Hopwood, M.J., **Somes, C.J.**, Dale, A.W., Scholz, F., Achterberg, E.P., Oschlies, A (2022). Biogeochemical feedbacks may amplify ongoing and future ocean deoxygenation: a case study from the Peruvian oxygen minimum zone. *Biogeochemistry* . <https://doi.org/10.1007/s10533-022-00908-w>
5. **Somes C.J.**, Dale A.W., Wallmann K., Scholz F., Yao W., Oschlies A., Muglia J., Schmittner A., Achterberg E.P. (2021), Constraining global marine iron source and ligand-mediated scavenging fluxes with GEOTRACES dissolved iron measurements in an ocean biogeochemical model, *Global Biogeochemical Cycles*, 35, e2021GB006948, <https://doi.org/10.1029/2021GB006948>
6. Verwega M-T, Trahms C, Antia AN, Dickhaus T, Prigge E, Prinzler MHU, Renz M, Schartau M, Slawig T, **Somes CJ**, and Biastoch A (2021), Perspectives on Marine Data Science as a Blueprint for Emerging Data Science Disciplines. *Frontiers in Marine Science*. 8:678404. <https://doi.org/10.3389/fmars.2021.678404>
7. Kvale, K., Keller, D.P., Koeve, W., Meissner, K.J., **Somes, C.J.**, Yao, W., Oschlies A. (2021), Explicit silicate cycling in the Kiel Marine Biogeochemistry Model version 3 (KMBM3) embedded in the UVic ESCM version 2.9, *Geoscientific Model Development*, 14, 7255-7285 <https://doi.org/10.5194/gmd-14-7255-2021>
8. Verwega M.-T., **Somes C.J.**, Schartau M., Lorrain A., Tuerena R.E., Oschlies A. Slawig T. (2021), Description of a global marine particulate organic carbon-13 data set, *Earth Systems Science Data*, 13, 4861-4880, <https://doi.org/10.5194/essd-13-4861-2021>
9. St. John Glew K., Espinasse B., Hunt B.P.V, Pakhomov E.A., Bury S.J., Pinkerton M.H., Nodder S.D., Gutierrez-Rodrigues A., Safi K., Brown J.C.S., Graham L., Dunbar R.B., Mucciarone D.A., Magozzi S., **Somes C.J.**, Trueman C. (2021), Isoscape Models of the Southern Ocean: Predicting Spatial and Temporal Variability in Carbon and Nitrogen

- Isotope Compositions of Particulate Organic Matter, *Global Biogeochemical Cycles*, 35, e2020GB006901, <https://doi.org/10.1029/2020GB006901>
10. Landolfi A., Prowe F.A.E., Pahlow M., **Somes C.J.**, Chien C.-T., Schartau M., Koeve W., Oschlies A. (2021), Can top-down controls expand the ecological niche of marine N<sub>2</sub> fixers?, *Frontiers in Aquatic Microbiology*, 12:690200. <https://doi.org/10.3389/fmicb.2021.690200>
  11. Farmer, J.R., Hertzberg, J.E., Cardinal, D., Fietz, S., Hendry, K., Jaccard, S.L., Paytan, A., Rafter, P., Ren, H.A., **Somes C.J.**, Sutton, J. (2020), Assessment of C, N, and Si Isotope Tracers Associated to Past Ocean Productivity, *Global Biogeochemical Cycles*, 35, e2020GB006775, <https://doi.org/10.1029/2020GB006775>
  12. Bodin N., Pethybridge H., Duffy L.M., Lorrain A., Allain V., Logan J.M., Ménard F., Graham B., Choy C.A., **Somes C.J.**, Olson R.J., Young J.W. (2021), Global data set for nitrogen and carbon stable isotopes of tunas, *Ecology*, 102(3):e03265, <https://doi.org/10.1002/ecy.3265>
  13. Médiéu, A., Point, D., Receveur, A., Gauthier, O., Allain, V., Pethybridge, H., Menkes, C.E., Gillikin, D.P., Revill, A.T., **Somes, C.J.**, Collin, J., Lorrain, A. (2020), Stable mercury concentrations of tropical tuna in the south western Pacific Ocean: an 18-year monitoring study, *Chemosphere*, 263:128024. <https://doi.org/10.1016/j.chemosphere.2020.128024>
  14. Dhurmeea, Z., Pethybridge, H., Degroote, M., Langlais, C. **Somes, C.J.**, Bourjea, J., Nikolic, N., Appadoo, C., Bodin, N., Spatial variation in stable isotope and fatty acid trophic markers in albacore tuna (*Thunnus alalunga*) from the western Indian Ocean (2020), *Deep-Sea Research I*, 161, 103286, <https://doi.org/10.1016/j.dsr.2020.103286>
  15. Logan, J.M., Pethybridge, H., Lorrain, A., **Somes, C.J.**, Allain, V., Bodin, N., Choy, C.A., Duffy, L., Goni, N., Graham, B., Langlais, C., Menard, F., Olson, R., Young, J.W. (2020), Global patterns and inferences of tuna movements and trophodynamics, *Deep Sea Research II*, 175:104775, <https://doi.org/10.1016/j.dsr2.2020.104775>
  16. Lorrain, A., Pethybridge, H., Cassar, N., Receveur, A., Allain, V., Bodin, N., Bopp, L., Choy, C.A., Duffy, L., Fry, B., Goni, N., Graham, B.S., Hobday, A.J., Logan, J.M., Menar, F., Menkes, C., Olson, D.E., Pagendam, R.J., Point, D., Revill, A.T., **Somes, C.J.**, Young, J.W. (2020), Trends in carbon isotopes suggest global changes in pelagic phytoplankton communities, *Global Change Biology*, 2020;26:458-470. <https://doi.org/10.1111/GCB.14858>
  17. Pethybridge, H., Choy, C.A., Logan, L.M., Allain, V., Lorrain, A., Bodin, N., **Somes, C.J.**, Young, J., Menard, F., Langlais, C., Duffy, L., Hobday, A.J., Kuhnert, P., Fry, B., Menkes, C., Olson, R.J. (2018). A global meta-analysis of marine predator nitrogen stable isotopes: Relationships between trophic structure and environmental conditions. *Global Ecology and Biogeography*, 2018;00:1-13. doi:10.1111/geb.12763
  18. Glock, N., Z. Erdem, K. Wallman, **C. J. Somes**, V. Liebetrau, J. Schönfeld, S. Gorb, A. Eisenhauer (2018), Coupling of oceanic carbon and nitrogen facilitates spatially resolved quantitative reconstruction of nitrate inventories, *Nature Communications*, 9:1217, doi:10.1038/s41467-018-03647-5
  19. **Somes, C. J.**, A. Schmittner, J. Muglia, and A. Oschlies (2017), A three-dimensional model of the marine nitrogen cycle during the Last Glacial Maximum constrained by sedimentary isotopes. *Frontiers of Marine Science*, 4:108. doi:10.3389/fmars.2017.00108

20. Muglia, J., **Somes, C.J.**, Nickelsen, L., and Schmittner, A. (2017). Combined Effects of Atmospheric and Seafloor Iron Fluxes to the Glacial Ocean. 32, 1204-1218 *Paleoceanography*. <https://doi.org:10.1002/2016pa003077>
21. Landolfi, A., **Somes, C. J.**, Koeve, W., Zamora, L. M. and Oschlies, A. (2017), Oceanic nitrogen cycling and N<sub>2</sub>O flux perturbations in the Anthropocene. *Global Biogeochemical Cycles*, 31, 1236-1255, doi:10.1002/2017GB005633
22. Schmittner, A. and **Somes, C. J.** (2016), Complementary constraints from Carbon (<sup>13</sup>C) and Nitrogen (<sup>15</sup>N) on the efficiency of the glacial ocean's soft-tissue biological pump, *Paleoceanography*, 31, 669-693, doi:10.1002/2015PA002905
23. **Somes, C. J.**, A. Landolfi, W. Koeve, and A. Oschlies (2016), Limited impact of atmospheric nitrogen deposition on marine productivity due to biogeochemical feedbacks in a global ocean model, *Geophysical Res. Lett.*, 43, 4500-4509, doi:10.1002/2016GL068335
24. **Somes, C. J.** and A. Oschlies, On the influence of "non-Redfield" dissolved organic nutrient dynamics on the spatial distribution of N<sub>2</sub> fixation and the size of the marine fixed nitrogen inventory (2015), *Global Biogeochem. Cycles*, 29, 973-993, doi:10.1002/2014GB005050
25. Young, J. W., R. J. Olson, F. Ménard, P.M. Kuhnert, L.M. Duffy, V. Allain, J. Logan, A. Lorrain, **C. J. Somes**, B. Graham, N. Goñi, H. Pethybridge, M. Simier, M. Potier, E. Romanov, D. Pagendam, C. Hannides, C.A. Choy (2015), Setting the stage for a global-scale trophic analysis of marine top predators: a multi-workshop review, *Reviews in Fish Biology and Fisheries*, 25, 261-272, doi:10.1007/s11160-014-9368-4
26. Moore, R. M., M. Kienast, M. Fraser, J. J. Cullen, C. Deutsch, S. Dutkiewicz, M. J. Follows, **C. J. Somes** (2014), Extensive hydrogen supersaturations in the western South Atlantic Ocean suggest substantial underestimation of nitrogen fixation, *J. of Geophys. Res. Oceans*, 119, 4340-4350, doi:10.1002/2014JC010017
27. **Somes, C. J.**, Oschlies, A., and Schmittner, A. (2013), Isotopic constraints on the pre-industrial oceanic nitrogen budget, *Biogeosciences*, 10, 5889-5910, doi:10.5194/bg-10-5889-2013
28. Galbraith, E. D., Kienast, M., Albuquerque, A. L., Altabet, M., Batista, F., Bianchi, D., Calvert, S. E., Contreras Quintana, S., Crosta, X., De Pol Holz, R., Dubois, N., Etourneau, J., Francois, R., Hsu, T.-C., Ivanochko, T., Jaccard, S. L., Kao, S.-J., Kiefer, T., Kienast, S., Lehmann, M. F., Martinez, P., McCarthy, M., Meckler, A. N., Mix, A. C., Mobius, J., Pedersen, T. F., Quan, T. M., Robinson, R. S., Ryabenko, E., Schmittner, A., Schneider, R., Schneider-Mor, A., Shigemitsu, M., Sinclair, D., **Somes, C. J.**, Studer, A. S., Tesdal, J.-E., Thunell, R., and Yang, J.-Y. T. (2013), The acceleration of oceanic denitrification during deglacial warming, *Nature Geoscience*, 6, 579-584, doi:10.1038/ngeo1832
29. Navarro, J., M. Coll, **C. J. Somes**, R. J. Olson (2013), Trophic niche of squids: Insights from isotopic data in marine systems worldwide, *Deep Sea Research II*, 95, 93-102, doi:10.1016/j.dsr2.2013.01.031
30. Robinson, R. S., Kienast, M., Luiza Albuquerque, A., Altabet, M., Contreras, S., De Pol Holz, R., Dubois, N., Francois, R., Galbraith, E., Hsu, T.-C., Ivanochko, T., Jaccard, S., Kao, S.-J., Kiefer, T., Kienast, S., Lehmann, M., Martinez, P., McCarthy, M., Möbius, J., Pedersen, T., Quan, T. M., Ryabenko, E., Schmittner, A., Schneider, R., Schneider-Mor, A., Shigemitsu, M., Sinclair, D., **Somes, C. J.**, Studer, A., Thunell, R., and Yang, J.-

Y.: A review of nitrogen isotopic alteration in marine sediments (2012),  
*Paleoceanography*, 27, PA4203, doi:10.1029/2012PA002321

31. **Somes, C. J.**, A. Schmittner, and M. A. Altabet (2010), Nitrogen isotope simulations show the importance of atmospheric iron deposition for nitrogen fixation across the Pacific Ocean, *Geophys. Res. Lett.*, 37, L23605, doi:10.1029/2010GL044537
32. **Somes, C. J.**, A. Schmittner, A. Mix, R. M. Letelier, E. D. Galbraith, M. Lehmann, M. Altabet, J. P. Montoya, M. Eby, and A. Bourbonnais (2010), Simulating the global distribution of nitrogen isotopes in the ocean, *Global Biogeochem. Cycles*, 24, GB4019, doi:10.1029/2009GB003767