

Charles A. Stock

Research Oceanographer, NOAA/Geophysical Fluid Dynamics Laboratory
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Education

- 2005 Ph.D., Woods Hole Oceanographic Institution/MIT Joint Program
Civil, Environmental and Ocean Engineering
- 1998 M.S.E., Stanford University
Environmental Fluid Mechanics and Hydrology
- 1997 B.S.E., Princeton University (*magna cum laude*)
Civil and Environmental Engineering

Professional Experience

- 2008-present Research Oceanographer, NOAA Geophysical Fluid Dynamics Laboratory
- 2007-2008 Associate Research Scholar, NOAA/GFDL and Princeton University
- 2005-2007 Postdoctoral Investigator, UC Berkeley and Princeton University
- 2005 Postdoctoral Investigator, Woods Hole Oceanographic Institution
- 1998-1999 Visiting Investigator, Woods Hole Oceanographic Institution

Honors and Awards

- 2021 Reuters Hot List of World's top 1000 Climate Scientists
- 2009 Presidential Early Career Award for Scientists and Engineers
- 2006 Outstanding reviewer, American Society of Limnology and Oceanography
- 2000 Environmental Protection Agency Science to Achieve Results (STAR) graduate fellowship
- 1997 Sigma Xi book award for excellence in undergraduate research, Department of Civil and Environmental Engineering, Princeton University

Research Interests

Marine ecosystem and biogeochemical dynamics at global and regional scales; Climate change impacts; Climate downscaling; Ecological predictions on sub-seasonal to decadal time-scales; Marine resource dynamics and management.

Professional affiliations

Member, the American Society of Limnology and Oceanography
Member, the American Geophysical Union

Professional and Service Activities

- 2022-present Co-lead NOAA Climate, Ecosystems and Fisheries Initiative (CEFI) National Modeling Team
- 2022-present Member of the NOAA working group to support the UN Ocean Decade Project [Sustainability, Predictability and Resilience of Marine Ecosystems programme \(SUPREME\)](#)
- 2020-present Coordinator, Community Regional MOM6 development meetings
- 2022-present Member, NOAA CEFI National Coordination Team
- 2020-present Co-lead, NOAA Climate Program Office Marine Ecosystem Task Force
- 2020-present Scientific Advisory Board; Centre for Ocean Life; Denmark Technical University.
- 2020-2022 Scientific Steering Committee, Ocean Carbon Biogeochemistry Program (<https://www.us.ocb.org/about/>)
- 2020-2022 Co-lead, NOAA Climate, Ecosystems and Fisheries Initiative (CEFI) Implementation Team
- 2020-present Project Advisory Board: European Climate Change and Future Marine Ecosystem Services and Biodiversity Project (*FutureMARES*)
- 2021 Steering Committee, NOAA/NOS Coastal and Ocean Community Modeling Workshop
- 2021-2022 Steering Committee, CLIVAR/Ocean Carbon Biogeochemistry joint workshop Daily to Decadal Ecological Forecasting along North American Coastlines Workshop
- 2021-2022 Writing team, NOAA Weather, Water and Climate Strategy (Blue Economy and Changing Oceans societal challenges)
- 2021 Steering Committee, NOAA Climate Program Office National Marine Sanctuaries Climate Change Priorities workshop
- 2018-2020 Co-Chair, OAR-NMFS expert team on next-generation climate projections to meet NMFS climate science needs.
- 2018-2020 Member of OAR-NMFS expert team on next-generation S2S2D predictions to meet NMFS climate science needs.
- 2018 Co-chair, 2018 Ocean Sciences Meeting session: “Integrating Observations of Plankton Communities and Physiology into Numerical Models”
- 2018 Invited contributor to the Chesapeake Bay Program’s Scientific and Technical Advisory Committee workshop “Chesapeake Bay Program Climate Change Modeling 2.0”
- 2018 Co-chair, 2018 session at 4th International Effects of Climate Change on the World’s Ocean Meeting: “Management and Conservation of Species on the Move
- 2018 Co-chair, 2018 Ocean Carbon Biogeochemistry Summer Workshop session, “Phytoplankton physiological engines of biogeochemical models”
- 2018-present Member of joint US-Canadian Committee on Ocean Acidification
- 2016-2020 Member, working group for the integration of ecosystem models and ocean color, convened by the International Ocean Color Coordinating Group (IOCCG)
- 2016 Chair, NOAA Northeast Fisheries Science Center, Ecosystem Science Review Panel

- 2016-2018 Steering Committee, 4th International Effects of Climate Change on the World's Ocean conference
- 2016-2018 Chair, Early Career Scientist Committee, Geophysical Fluid Dynamics Laboratory
- 2015 Co-convenor, workshop: "Application of Seasonal to Decadal Climate Predictions for Marine Resource Management", June 3-5, 2015.
- 2014 Steering Committee, Advances in Marine Ecosystem Modeling Research Symposium, Plymouth UK
- 2013-present Member of Research Council at the Geophysical Fluid Dynamics Laboratory
- 2013 Steering committee for workshop "Understanding Climate Impacts on Fish Stocks of the Northeast Shelf Large Marine Ecosystem: Key Research Needs and Future Directions", July 2013, Providence RI.
- 2013 Co-convenor, workshop "Climate Effects on Productivity in Arctic and sub-Arctic Ecosystems", September, 2013 Reykjavik Iceland.
- 2013 Co-convenor, symposium on "Climate change and conservation of marine species: bridging the gap between ecology, climate science and policy", 26th International Congress for Conservation Biology, Baltimore, Maryland, July 25, 2013.
- 2013 Member of NOAA's Sustaining Marine Ecosystems in a Changing Climate (SMECC) working group to identify priority research and activities to forward the goal of resilient ecosystems and coastal communities in a changing climate
- 2012 Co-convened session on "Climate Change Impacts on Living Marine Resources", 2012 Ocean Sciences Meeting, Salt Lake City
- 2012-13 Member of National Institute of Mathematical and Biological Synthesis (NIMBioS) working group on ocean viral dynamics and the carbon cycle.
- 2011 Co-convened session on "The future of marine fish stocks and food webs – advancing methods for projections in the face of uncertainty", ICES Annual Science Conference, Gdansk, Poland.
- 2011 Co-convened session on "Connecting Climate Science to Fisheries Management and Ecology In a Changing World", American Fisheries Society Annual Meeting, Seattle Washington
- 2010-11 Contributing author, NOAAs climate and marine resource management needs assessment
- 2010-11 Member of the climate change impacts on cusk assessment team
- 2010 Contributor to the NOAA Ocean and Great Lakes Acidification Research Plan
- 2009 Organized workshop: "Applying IPCC-class models of global warming to fisheries prediction", June 15-17, Princeton University
- 2009 NOAA Office of Atmospheric and Oceanic Research representative to the second National Ecosystem Modeling Workshop
- 2006 Conducted workshop on the use of aquatic ecosystem models for ecosystem-based marine resource management, March 19-22, Trieste, Italy
- 2001-2002 Graduate student representative for the Applied Ocean Sciences and Engineering Department, Woods Hole/MIT Joint Program

Reviewer for the National Science Foundation; Nature; Nature Geosciences; Proceedings of the National Academy of Sciences; Global Change Biology; Limnology and Oceanography; Continental Shelf Research; Journal of Marine Systems; Journal of Plankton Research; Deep-sea Research; Ocean Dynamics; Dynamics of Atmospheres and Oceans; Global Biogeochemical

Cycles; Marine Ecology Progress Series; Biogeosciences; Fisheries Oceanography; Reviews in Fish Biology and Fisheries; Ocean Modelling; Geophysical Research Letters; Estuarine, Coastal, and Shelf Science; Journal of Advances in Modeling Earth Systems

Journal Articles (from most recent)

- Gomez, F.A., Lee, S-K., **Stock, C.A.**, Ross, A.C., Resplandy, L., Siedlecki, S.A., Tagklis, F., Salisbury, J.E., (2023). RC4USCoast: a river chemistry dataset for regional ocean model applications in the US East Coast, Gulf of Mexico, and US West Coast. *Earth System Science Data*, 15(5), DOI:[10.5194/essd-15-2223-2023](https://doi.org/10.5194/essd-15-2223-2023).
- Henschke, N., Espinas, **Stock, C.A.**, Liu, X., Barrier, N., Pakhomov, E.A. (2023). The role of water mass advection in staging of the Southern Ocean *Salpa thompsoni* populations. *Scientific Reports*, 13, 7088, DOI:[10.1038/s41598-023-34231-7](https://doi.org/10.1038/s41598-023-34231-7).
- Lee, M., **Stock, C.A.**, Dunne, J.P., Shevliakova, E. (2023). Linking global terrestrial and ocean biogeochemistry with process-based, coupled freshwater algae-nutrient-solid dynamics in LM3-FANSY v1.0. *Geoscientific Model Development Discussion*. DOI:[10.5194/gmd-2022-236](https://doi.org/10.5194/gmd-2022-236).
- Planchat, A., Kwiatkowski, L., Bopp, L., Torres, O., Christian, J.R., Butenschön, M., Lovato, T., Séférian, R., Chamberlain, M.A., Aumont, O., Watanabe, M., Yamamoto, A., Yool, A., Ilyina, T., Tsujino, H., Krumhardt, K.M., Schwinger, J., Tjiputra, J., Dunne, J.P, **Stock, C.A.** (2023). The representation of alkalinity and the carbonate pump from CMIP5 to CMIP6 Earth system models and implications for the carbon cycle. *EGU sphere*, 20(7), DOI:[10.5194/bg-20-1195-2023](https://doi.org/10.5194/bg-20-1195-2023).
- Smith, J.A., Pozo Buil, M., Muhling, B.A., Tommasi, D., Brodie, S., Frawley, T.H., Fiechter, J., Koenigstein, S., Himes-Cornell, A., Alexander, M.A., Bograd, S.J., Cordero-Quirós, N., Crowder, L.B., Curchitser, E.N., Green, S.J., Hardy, N.A., Haynie, A.C., Hazen, E.L., Holsman, K., Le Fol, G., Lezama-Ochoa, N., Rykaczewski, R.R., **Stock, C.A.**, Stohs, S., Sweeney, J., Welch, H., and Jacox, M.G. (2023). Projecting climate change impacts from physics to fisheries: A view from three California Current fisheries. *Progress in Oceanography*, 211, 102973, DOI:[10.1016/j.pocean.2023.102973](https://doi.org/10.1016/j.pocean.2023.102973).
- Taboada, F.G., Park, J-Y., Muhling, B.A., Tommasi, D., Tanaka, K.R. Rykaczewski, R.R., **Stock, C.A.**, and Sarmiento, J.L. (2023). Anticipating fluctuations of bigeye tuna in the Pacific Ocean from three-dimensional ocean biogeochemistry. *Journal of Applied Ecology*, 60(3), DOI:[10.1111/1365-2664.14346](https://doi.org/10.1111/1365-2664.14346).
- Cael, B B., Begouen Demeaux, C., Henson, S.A., **Stock, C.A.**, Gonzalez-Taboada, F., John, J.G., and Barton, A.D., (2022): Marine ecosystem changepoints spread under ocean warming in an Earth System Model. *Journal of Geophysical Research: Biogeosciences*, 127(5), DOI:[10.1029/2021JG006571](https://doi.org/10.1029/2021JG006571).
- Caracappa, J.C., Beet, A., Gaichas, S.K., Gamble, R.J., Hyde, K., Large, S.I., Morse, R.E., **Stock, C.A.**, Saba, V.S., (2022). A northeast United States Atlantis marine ecosystem model with ocean reanalysis and ocean color forcing. *Ecological Modelling*, 471, 110038, DOI:[10.1016/j.ecolmodel.2022.110038](https://doi.org/10.1016/j.ecolmodel.2022.110038).
- Clark, S., Hubbard, K.A., Ralston, D.K., McGillicuddy, D.J., **Stock, C.A.**, Alexander, M.A., Curchitser, E.N., (2022): Projected effects of climate change on Pseudo-nitzschia bloom dynamics in the Gulf of Maine. *Journal of Marine Systems*, 230, DOI:[10.1016/j.jmarsys.2022.103737](https://doi.org/10.1016/j.jmarsys.2022.103737).

- Woojin, J., Park, J.-Y., **Stock, C.A.**, Dunne, J.P., Yang, X., Rosati, A. (2022). Mechanisms driving ESM-based marine ecosystem predictive skill on the east African coast. *Environmental Research Letters*, **17**, 8, DOI:[10.1088/1748-9326/ac7d63](https://doi.org/10.1088/1748-9326/ac7d63).
- Lim, H-G, Dunne, J.P., **Stock, C.A.**, Ginoux, P., John, J.G., and Krasting, J.P. (2022): Oceanic and atmospheric drivers of post-El-Niño chlorophyll rebound in the equatorial Pacific. *Geophysical Research Letters*, **49(5)**, DOI:[10.1029/2021GL096113](https://doi.org/10.1029/2021GL096113).
- Lim, H-G, Dunne, J.P., **Stock, C.A.**, Kwon, M. (2022). Attribution and predictability of climate-driven variability in global ocean color. *Journal of Geophysical Research: Oceans*, **127(10)**, DOI:[10.1029/2022JC019121](https://doi.org/10.1029/2022JC019121).
- Luo, Jessica Y., **Stock, C.A.**, Henschke, N., Dunne, J.P., O'Brien, T.D., (2022). Global ecological and biogeochemical impacts of pelagic tunicates. *Progress in Oceanography*, **205**, 102822, DOI:[10.1016/j.pocean.2022.102822](https://doi.org/10.1016/j.pocean.2022.102822).
- Muhling, B.A., Snyder, S., Hazen, E.L., Whitlock, R., Dewar, H., Park, J-Y., **Stock, C.A.**, Block, B.A., (2022). Risk and reward in foraging migrations of North Pacific albacore determined from estimates of energy intake and movement costs. *Frontiers in Marine Science*, DOI:[10.3389/fmars.2022.730428](https://doi.org/10.3389/fmars.2022.730428).
- Ross, A.C., **Stock, C.A.** (2022). Probabilistic extreme SST and marine heatwave forecasts in Chesapeake Bay: A forecast model, skill assessment, and potential value. *Frontiers in Marine Science*, 9:896961, DOI:[10.3389/fmars.2022.896961](https://doi.org/10.3389/fmars.2022.896961).
- Xue, T., Frenger, I., Oschlies, A., **Stock, C.A.**, Koeve, W., John, J.G., Prowe, F. (2022). Mixed layer depth promotes trophic amplification on a seasonal scale. *Geophysical Research Letters*, **49(12)**, DOI:[10.1029/2022GL098720](https://doi.org/10.1029/2022GL098720).
- Wei, C., Hermann, A., Hollowed, A.B., Holsman, K., Kearney, K.A., Pilcher, D.J., **Stock, C.A.**, Aydin, K.Y. (2021). Eastern Bering Sea shelf environmental and lower trophic level responses to climate forcing: Results of dynamical downscaling from CMIP6. *Deep Sea Research Part II: Topical Studies in Oceanography*, **193**, DOI:[10.1016/j.dsr2.2021.104975](https://doi.org/10.1016/j.dsr2.2021.104975).
- Drenkard, E.J., **Stock, C.A.**, Ross, A.C., Dixon, K.W., Adcroft, A., Alexander, M.A., Balaji, V., Bograd, S.J., Butenschön, M., Cheng, W., Curchitser, E.N., Di Lorenzo, E., Dussin, R., Haynie, A.C., Harrison, M.J., Hermann, A., Hollowed, A.B., Holsman, K., Holt, J., Jacox, M.J., Jang, C.J., Kearney, K.A., Muhling, B.A., Pozo Buil, M., Saba, V.S., Britt Sandø, A., Tommasi, D., and Wang, W., (2021): Next-generation regional ocean projections for living marine resource management in a changing climate. *ICES Journal of Marine Science*, fsab100, DOI:[10.1093/icesjms/fsab100](https://doi.org/10.1093/icesjms/fsab100).
- Tittensor, D., et al, including **Stock, C.A.** (2021): Next-generation ensemble projections reveal higher climate risks for marine ecosystems. *Nature Climate Change*. DOI: <https://doi.org/10.1038/s41558-021-01173-9>.
- van Denderen, P. D., Petrik, C. M., **Stock, C. A.**, & Andersen, K. H. (2021). Emergent global biogeography of marine fish food webs. *Global Ecology and Biogeography*, **30**, 1822-1834. <https://doi.org/10.1111/geb.13348>
- du Pontavice, H., Gascuel, D., Reygondeau, G., **Stock, C.A.**, and Cheung, W.W.L., (2021). Climate-induced decrease in biomass flow in marine food webs may severely affect predators and ecosystem production. *Global Change Biology*, **27(11)**, DOI:[10.1111/gcb.15576](https://doi.org/10.1111/gcb.15576).
- Eddy, T.D., Bernhardt, J.R., Blanchard, J.L., Cheung, W.W.L., Colléter, M., du Pontavice, H., Fulton, E.A., Gascuel, D., Kearney, K.A., Petrik, C.M., Roy, T., Rykaczewski, R.R., Selden, R.L., **Stock, C.A.**, Wabnitz, C.C., and Watson R.A., (2021). Energy Flow

- Through Marine Ecosystems: Confronting Transfer Efficiency. *Trends in Ecology and Evolution*, **36**(1), DOI:[10.1016/j.tree.2020.09.006](https://doi.org/10.1016/j.tree.2020.09.006).
- Friedrich, T., Powell, B.S., **Stock, C.A.**, Hahn-Woernle, L., Dussin, R., and Curchitser, E.N., (2021). Drivers of phytoplankton blooms in Hawaii: A regional model study. *Journal of Geophysical Research: Oceans*, 126(5), DOI:[10.1029/2020JC017069](https://doi.org/10.1029/2020JC017069).
- Lee, M., **Stock, C.A.**, Shevliakova, E., Malyshev, S., and Milly, P.C.D. Milly (2021). Globally prevalent land nitrogen memory amplifies water pollution following drought years. *Environmental Research Letters*, 16(1), DOI:[10.1088/1748-9326/abd1a0](https://doi.org/10.1088/1748-9326/abd1a0).
- Lim, H-G, Park, J-Y, Dunne, J.P., and **Stock, C.A.** et al., (2021): Importance of human-induced nitrogen flux increases for simulated Arctic warming. *Journal of Climate*, 34(10), DOI:[10.1175/JCLI-D-20-0180.1](https://doi.org/10.1175/JCLI-D-20-0180.1)3799-3819.
- Liu, X., **Stock, C.A.**, Dunne, J.P., Lee, M., Shevliakova, E., Malyshev, S., and Milly, P.C.D., (2021). Simulated global coastal ecosystem responses to a half-century increase in river nitrogen loads. *Geophysical Research Letters*. DOI:[10.1029/2021GL094367](https://doi.org/10.1029/2021GL094367).
- McGinty, N., Barton, A.D., Record, N.R., Finkel, Z.F., Johns, D.J., **Stock, C.A.**, and Irwin, A.J., (2021). Anthropogenic climate change impacts on copepod trait biogeography. *Global Change Biology*, 27(7), DOI:[10.1111/gcb.15499](https://doi.org/10.1111/gcb.15499)1431-1442.
- Petrik, C.M., Gonzalez Taboada, F., **Stock, C.A.**, and Sarmiento, J.L. (2021). An updated life-history scheme for marine fishes predicts recruitment variability and sensitivity to exploitation. *Global Ecology and Biogeography*, 30(4), DOI:[10.1111/gcb.13260](https://doi.org/10.1111/gcb.13260)870-882.
- Pozo Buil, M., Jacox, M.G., Fiechter, J., Alexander, M.A., Bograd, S.J., Curchitser, E.N., Edwards, C.A., Rykaczewski, R.R., and **Stock, C.A.**, (2021). A dynamically downscaled ensemble of future projections for the California Current System. *Frontiers in Marine Science*, 8, DOI:[10.3389/fmars.2021.612874](https://doi.org/10.3389/fmars.2021.612874).
- Ross, A.C., **Stock, C.A.**, Adams-Smith, D., Dixon, K.W., Findell, K.L., Saba, V.S., and Vogt, B., (2021). Anthropogenic Influences on Extreme Annual Streamflow into Chesapeake Bay from the Susquehanna River. *Bulletin of the American Meteorological Society*, 102(1), DOI:[10.1175/BAMS-D-20-0129.1](https://doi.org/10.1175/BAMS-D-20-0129.1)S25-S32.
- Stock, C.A.**, Dunne, J.P., Fan, S., Ginoux, P., John, J.G., Krasting, J.P., Laufkötter, C., Paulot, F., and Zadeh, N., (2020): Ocean Biogeochemistry in GFDL's Earth System Model 4.1 and its Response to Increasing Atmospheric CO₂. *Journal of Advances in Modeling Earth Systems*, 12(10), DOI:[10.1029/2019MS002043](https://doi.org/10.1029/2019MS002043).
- Dunne, J.P., Horowitz, L.W., Adcroft, A., Ginoux, P., Held, I.M., John, J.G., Krasting, J.P., Malyshev, S., Naik, V., Paulot, F., Shevliakova, E., **Stock, C.A.**, Zadeh, N., Balaji, V., Blanton, C., Dunne, K.A., Dupuis, C., Durachta, J.W., Dussin, R., Gauthier, P.P.G., Griffies, S.M., Guo, H., Hallberg, R., Harrison, M.J., He, J., Hurlin, W.J., McHugh, C., Menzel, R., Milly, P.C.D., Nikonov, S., Paynter, D.J., Ploshay, J.J., Radhakrishnan, A., Rand, K., Reichl, B.G., Robinson, T.E., Schwarzkopf, M.D., Sentman, L.T., Underwood, S.D., Vahlenkamp, H., Winton, M., Wittenberg, A.T., Wyman, B., Zeng, Y., and Zhao, M., (2020). The GFDL Earth System Model version 4.1 (GFDL-ESM 4.1): Overall coupled model description and simulation characteristics. *Journal of Advances in Modeling Earth Systems*, 12(11), DOI:[10.1029/2019MS002015](https://doi.org/10.1029/2019MS002015).
- Dunne, J.P., Bociu, I., Bronselaer, B., Guo, H., John, J.G., Krasting, J.P., **Stock, C.A.**, Winton, M., and Zadeh, N., (2020). Simple Global Ocean Biogeochemistry with Light, Iron, Nutrients and Gas version 2 (BLINGv2): Model description and simulation characteristics in GFDL's CM4.0. *Journal of Advances in Modeling Earth Systems*, 12(10), DOI:[10.1029/2019MS002008](https://doi.org/10.1029/2019MS002008).

- Paulot, F., **Stock, C.A.**, John, J.G., Zadeh, N., and Horowitz, L.W., (2020). Ocean Ammonia Outgassing: Modulation by CO₂ and Anthropogenic Nitrogen Deposition. *Journal of Advances in Modeling Earth Systems*, 12(10), DOI:[10.1029/2019MS002026](https://doi.org/10.1029/2019MS002026).
- Petrik, C.M., **Stock, C.A.**, Anderson, K., van Denderen, D., and Watson, J. (2020). Large pelagic fish are most sensitive to climate change despite pelagification of ocean food webs. *Frontiers in Marine Science*, 7, DOI:[10.3389/fmars.2020.588482](https://doi.org/10.3389/fmars.2020.588482).
- Ross, A.C., **Stock, C.A.**, Dixon, K.W., Friedrichs, M.A.M., Hood, R., Li, M., Pegion, K., Saba, V.S., and Vecchi, G.A., (2020): Estuarine forecasts at daily weather to subseasonal time scales. *Earth and Space Science*, 7(10), DOI:[10.1029/2020EA001179](https://doi.org/10.1029/2020EA001179).
- Alexander, M.A., Shin, S., Scott, J.D., Curchitser, E.N., and **Stock, C.A.** (2020). The Response of the Northwest Atlantic Ocean to Climate Change. *Journal of Climate*, 33(2), DOI:[10.1175/JCLI-D-19-0117.1](https://doi.org/10.1175/JCLI-D-19-0117.1).
- Barton, Andrew D., Gonzalez-Taboada, F., Atkinson, A., Widdicombe, C.E., and **Stock, C.A.**, (2020). Integration of temporal environmental variation by the marine plankton community. *Marine Ecology Progress Series*, 647, DOI:[10.3354/meps13432](https://doi.org/10.3354/meps13432).
- Hauri, C., Schultz, C., Hedstrom, K., Danielson, S., Irving, B., Doney, S.C., Dussin, R., Curchitser, E.N., Hill, D.F., and **Stock, C.A.** (2020). A regional hindcast model simulating ecosystem dynamics, inorganic carbon chemistry and ocean acidification in the Gulf of Alaska. *Biogeosciences*, 17, DOI:[10.5194/bg-17-3837-2020](https://doi.org/10.5194/bg-17-3837-2020)3837-3857.
- Kwiatkowski, L., Torres, O., Bopp, L., Aumont, O., Chamberlain, M.A., Christian, J.R., Dunne, J.P., Gehlen, M., Ilyina, T., John, J.G., Lenton, A., Li, H., Lovenduski, N.S., Orr, J.C., Palmieri, J., Santana-Falcón, Y., Schwinger, J., Séférian, R., **Stock, C.A.**, Tagliabue, A., Takano, Y., Tjiputra, J., Toyama, K., Tsujino, H., Watanabe, M., Yamamoto, A., Yool, A. and Ziehn, T., (2020). Twenty-first century ocean warming, acidification, deoxygenation, and upper ocean nutrient decline from CMIP6 model projections. *Biogeosciences*, 17(13), DOI:[10.5194/bg-17-3439-2020](https://doi.org/10.5194/bg-17-3439-2020).
- Luo, J.Y., Condon, R.H., **Stock, C.A.**, Duarte, C.M., Lucas, C.H., Pitt, K.A., and Cowan, R.K., (2020): Gelatinous zooplankton-mediated carbon flows in the global oceans: A data-driven modeling study. *Global Biogeochemical Cycles*, 34(9), DOI:[10.1029/2020GB006704](https://doi.org/10.1029/2020GB006704).
- Salinas-de-León, P., Andrade, S., Arnés-Urgellés, A., Bermudez, J.R., Bucaram, S., Buglass, S., Cerutti, F., Cheung, W., De la Hoz, C., Hickey, V., Jiménez-Uzcátegui, G., Keith, I., Marín Jarrín, J.R., Martí-Puig, P., Medina, M., Moya, A., Pauly, D.J., Orellana, D., Ostergaard-Klem, R., **Stock, C.A.**, Witman, J., and Worm, B., (2020). Evolution of the Galapagos in the Anthropocene. *Nature Climate Change*, 10, DOI:[10.1038/s41558-020-0761-9](https://doi.org/10.1038/s41558-020-0761-9).
- Séférian, R., Berthet, S., Yool, A., Palmieri, J., Bopp, L., Tagliabue, A., Kwiatkowski, L., Aumont, O., Christian, J.R., Dunne, J.P., Gehlen, M., Ilyina, T., John, J.G., Li, H., Long, M.C., Luo, J.Y., Nakano, H., Romanou, A., Schwinger, J., **Stock, C.A.**, Santana-Falcón, Y., Takano, Y., Tjiputra, J., Tsujino, H., Watanabe, M., Wu, T., Wu, F., Yamamoto, A., (2020). Tracking Improvement in Simulated Marine Biogeochemistry Between CMIP5 and CMIP6. *Current Climate Change Reports*, 6, DOI:[10.1007/s40641-020-00160-095-119](https://doi.org/10.1007/s40641-020-00160-095-119).
- Tanaka, K.R., Torre, M.P., Saba, V.S., **Stock, C.A.**, and Chen, Y., (2020). An ensemble high-resolution projection of changes in the future habitat of American lobster and sea scallop in the Northeast US continental shelf. *Diversity and Distributions*, 26(8), DOI:[10.1111/ddi.13069](https://doi.org/10.1111/ddi.13069).

- Park, J-Y, **Stock, C.A.**, Dunne, J.P., Yang, X., and Rosati, A. (2019). Seasonal to multiannual marine ecosystem prediction with a global Earth system model. *Science*, 365(6450), DOI:[10.1126/science.aav6634](https://doi.org/10.1126/science.aav6634).
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Reports and Book Chapters

- Dutkiewicz, S., Baird, M., Ciavatta, S., Henson, S.A., Hickman, A., Rousseaux, C.S., and **Stock, C.A.** (2020). Chapter 1: Bridging Satellite Ocean Colour Remote Sensing and Biogeochemical/Ecosystem Modelling. *Synergy between Ocean Colour and Biogeochemical/Ecosystem Models*. [Dutkiewicz, S. (ed.)], Dartmouth, NS, Canada:

- International Ocean Colour Coordinating Group (IOCCG), IOCCG Report Series, No. 19, DOI:[10.25607/OBP-711](https://doi.org/10.25607/OBP-711) 1-4pp.
- Dutkiewicz, S., Rousseaux, C.S., Ciavatta, S., **Stock, C.A.**, Baird, M., Chai, F., Muhling, B.A., and Gehlen, M., (2020). Chapter 3: Biogeochemical And Ecosystem Models: What Are They And How Can They Be Used? *Synergy between Ocean Colour and Biogeochemical/Ecosystem Models*. [Dutkiewicz, S. (ed.)], Dartmouth, NS, Canada: International Ocean Colour Coordinating Group (IOCCG), IOCCG Report Series, No. 19, DOI:[10.25607/OBP-711](https://doi.org/10.25607/OBP-711) 31-52pp.
- Dutkiewicz, S., Hickman, A., Mouw, C., Rousseaux, C.S., Ciavatta, S., Baird, M., **Stock, C.A.**, and Chai, F., (2020). Chapter 4: The (Mis)match between Biogeochemical/Ecosystem Model Variables and Ocean Colour Products. *Synergy between Ocean Colour and Biogeochemical/Ecosystem Models*. [Dutkiewicz, S. (ed.)], Dartmouth, NS, Canada: International Ocean Colour Coordinating Group (IOCCG), IOCCG Report Series, No. 19, DOI:[10.25607/OBP-711](https://doi.org/10.25607/OBP-711) 53-76pp.
- Stock, C.A.**, and Ciavatta, S. (2020). Chapter 5: Ocean Colour for Model Skill Assessment. *Synergy between Ocean Colour and Biogeochemical/Ecosystem Models*. [Dutkiewicz, S. (ed.)], Dartmouth, NS, Canada: International Ocean Colour Coordinating Group (IOCCG), IOCCG Report Series, No. 19, DOI:[10.25607/OBP-711](https://doi.org/10.25607/OBP-711) 77-94pp.
- Dutkiewicz, S., Baird, M., Ciavatta, S., Henson, S.A., Hickman, A., Mouw, C., Rousseaux, C.S., and **Stock, C.A.** (2020). Chapter 9: Summary and Recommendations. *Synergy between Ocean Colour and Biogeochemical/Ecosystem Models*. [Dutkiewicz, S. (ed.)], Dartmouth, NS, Canada: International Ocean Colour Coordinating Group (IOCCG), IOCCG Report Series, No. 19, DOI:[10.25607/OBP-711](https://doi.org/10.25607/OBP-711) 145-152pp.
- Stock, C.A.**, Hollowed, A.B., and 18 others. Climate-Fisheries Initiative Expert Team 2 Report: Delivering Climate Change Projections for NMFS Fisheries Mandates. Delivered to the CFI Scientific Steering Committee, 11/18/2019.
- Stock, C.A.**, Cheung, W.W.L., Sarmiento, J.L., and Sunderland, E. (2019). Changing Oceans. In: Predicting Future Oceans: Sustainability of Ocean and Human Systems Amidst Global Environmental Change. Elsevier. <https://doi.org/10.1016/B978-0-12-817945-1.00002-2>.
- Lipton, D., Rubenstein, M. A., Weiskopf, S. R., Carter, S. L., Peterson, J., Crozier, L., ... **Stock, C.A.**,... & Morissette, J. (2018). *Ecosystems, Ecosystem Services, and Biodiversity* (pp. 268-321). 4th National Climate Assessment, US Global Change Research Program. <https://doi.org/10.7930/NCA4.2018.CH7>.
- Silber, G.K., M. Lettrich, and P.O. Thomas (eds.); contributor: **Stock, C.A.** (2016). Report of a Workshop on Best Approaches and Needs for Projecting Marine Mammal Distributions in a Changing Climate. 12- 14 January 2016, Santa Cruz, California, USA. U.S. Dep. Commer., NOAA. NOAA Technical Memorandum NMFS-OPR-54, 50 p.
- Saba, V.S., **Stock, C.A.**, Dunne, J.P. (2015) Marine primary productivity connections to leatherback biology and behavior. In: The Leatherback Turtles: Biology and Conservation. Ed. J.R. Spotila and P.S. Tomillo, pp. 173-184.
- Dunne, J. P., Stock, C. A., & John, J. G. (2015). Representation of Eastern Boundary Currents in GFDL's Earth System Models. *California Cooperative Oceanic Fisheries Investigations Reports*, 56, 72-75.
- Link, J. S., Mason, D. M., Lederhouse, T. M., Gaichas, S. K., Hartley, T. W., Ianelli, J. N., ... **Stock, C.A.**,... & Townsend, H. M. (2015). Report from the joint OAR-NMFS modeling uncertainty workshop.

- McGillicuddy, D.J., Anderson, D.M., **Stock, C.A.**, Lynch, D.R., Townsend, D.W., 2008
Modeling blooms of *Alexandrium fundyense* in the Gulf of Maine. In: Babin, M.,
Roesler, C., and Cullen J. (Eds.), Real-time Observing Systems for Marine Ecosystems
Dynamics and Harmful Algal Blooms, UNESCO publishing.
- McGillicuddy, D. J., **Stock, C. A.**, Anderson, D. M., & Signell, R. P. (2003). Hindcasting
blooms of the toxic dinoflagellate *Alexandrium* spp. in the western Gulf of
Maine. *Ecological forecasting: new tools for coastal and ecosystem management*, 49-54.
- P. Glibert, E. Granéli, D. Anderson, E. Lipiatou, K. Sellner,, **Stock C.**, & A. Zingone
(2003). The EU-US scientific initiative on harmful algal blooms: a report from a
workshop jointly funded by the European Commission-Environment and Sustainable
Development Program and the US National Science Foundation. *Trieste, Italy*.

Invited Seminars and Panels

- 2023 Invited Seminar, Future Coastal Oceans Climate Workshop, Liverpool UK.
“Next-generation ocean projections for marine ecosystem management in a
changing climate”
- 2023 Talk, NOAA/OAR leadership visit to GFDL. “Climate and Marine Ecosystems”.
- 2023 Invited Seminar. MIT Program in Atmospheres Oceans and Climate (PAOC)
Symposium. “Anticipating and Acting on Ocean Change”.
- 2023 Invited lecture. “The Changing Earth System”; “In Fish!” Complex Systems and
Ecosystem Dynamics Summer Course. Monmouth University.
- 2023 Talk, Rider University visit to GFDL. Anticipating and Adapting to Ocean
Ecosystem Changes.
- 2022 Inaugural George and Peggy Hunt Joint Fisheries Oceanography speaker;
University of Washington School of Oceanography and School of Aquatic and
Fishery Sciences. “Anticipating and Acting on Ocean Change”
- 2022 Panelist, Dialog with Brazil/MCTI on Ocean Monitoring and Research
- 2022 Panelist, Schmidt Foundation Workshop, Identifying Top Scientific Priorities for
International Ocean Biogeochemical Research
- 2022 Invited talk. “BGC Argo and NOAA’s Climate Ecosystem and Fisheries
Initiative”. BGC Argo and Fisheries Workshop.
- 2022 Invited talk. East Coast Climate Change Scenario Planning Workshop. “An
overview of Oceanographic Drivers of Change Along the U.S. East Coast”
- 2022 Invited talk. “Jasmin John’s Myriad Contributions to Marine Ecosystem
Research”. For “A Tapestry of Flying Leaps: Jasmin John’s collaborative
contributions advancing earth system modeling”
- 2022 Invited Talk, Biogeochemical Argo and Fisheries Workshop “Biogeochemical
Argo and Living Marine Resource Science and Management Decisions Across
Timescales”, BGC-Argo and Fisheries pre-workshop.
- 2022 Invited Seminar, University of Liverpool Seminar Series. “Earth System
Predictions for Resilient Living Marine Resources”.
- 2022 Invited lecture. “A Fish’s Eye View of the Changing Earth System”; “In Fish!”
Complex Systems and Ecosystem Dynamics Summer Course. Monmouth
University.

- 2022 Invited talk, delivered to NOAA’s Weather Water and Climate Board, Climate Team: “A Development Update on the Climate Ecosystem and Fisheries Initiative Modeling System”.
- 2021 Invited seminar (scheduled), American Fisheries Society Meeting, Baltimore MD, “Earth System Predictions for Resilient Living Marine Resources in a Changing Climate”.
- 2021 Invited talk, Rice’s Whale Recovery Planning Workshop. “Climate Change, Ocean Ecosystems, and Living Marine Resources”
- 2021 NOAA Coastal and Ocean Community Modeling Workshop: “Toward a Nationwide Seasonal to Multi-decadal Regional Ocean Prediction System to Serve NOAA’s Living Marine Resource Mandates”
- 2021 Panelist, Deep Ocean Observing Strategies for a Predicted Ocean
- 2021 Monterey Bay Aquarium Research Institution Seminar Series: “Earth System Predictions for Resilient Living Marine Resources”
- 2021 NOAA Modelling Board TED-style talk and panel series; NOAA Climate-Fisheries Initiative.
- 2021 Ocean Carbon Biogeochemistry Summer Meeting Plenary: “Emerging Opportunities in Ecological Forecasting”
- 2021 OAR Arctic All Hands Meeting: NOAA’s Climate Fisheries Initiative and the Arctic.
- 2021 The Global Biogeochemical Argo Fleet, Knowledge to Action Workshop: “Biogeochemical Argo and Living Marine Resource Science and Management Across Time Horizons”
- 2021 Marine Biodiversity Observing Network (MBON) panel “Constraining current patterns and future trends in ocean productivity and fisheries catch”
- 2021 NOAA Oceans Portfolio: NOAA’s Climate Fisheries Initiative.
- 2020 NMFS West Coast Climate Regional Action Plan Team Modeling Workshop: Regional MOM6 and NOAA’s Climate Fisheries Initiative
- 2020 NOAA Climate Fisheries Initiative Steering Committee: Integrating NOS and OAR modeling capabilities to meet CFI objectives.
- 2020 NOAA Eastern Regional Climate Team NOAA Climate Services Monthly Meeting; “Earth System Predictions and Projections to Support NOAA’s Marine Ecosystem Mandates
- 2020 GFDL/AOML Workshop; “GFDL’s Global Ocean Biogeochemistry and Burgeoning Applications in coastal areas”.
- 2020 NOAA Sanctuaries Research Coordinators meeting; “Earth System Modeling to Support NOAA’s Marine Ecosystem Mandates”
- 2020 National Academies workshop of Earth System Predictability (Panel)
- 2020 National Academies Ocean Studies Board: “NOAA’s Climate Fisheries Initiative” (w/Mike Jacox and Anne Hollowed)
- 2020 Mid-Atlantic Ocean Forum; “Changing Climate, Changing Oceans”
- 2020 Presentation to NOAA’s Unified Modeling Committee; “Delivering regional ocean and biogeochemical projections to meet NMFS marine resource mandates”
- 2019 Scripps Institution of Oceanography; Ecology Seminar; “Ocean Biogeochemical Predictions for Marine Resource Resilience in a Changing Climate”
- 2019 Annual Meeting of the Association of Scientists in Limnology and Oceanography, San Juan Puerto Rico, “Seasonal to Decadal Earth System Predictions for Living Marine Resource Resilience”.

- 2019 MIT Global Change Forum, Cambridge, MA, “Predicting and Adapting to Ocean Thresholds”
- 2019 SOCCOM Annual Meeting (Princeton), “Seasonal to Multi-Annual Earth System Predictions for LMR resilience”
- 2018 Invited Speaker, Lamont Doherty Earth Observatory Earth Science Colloquium, “Reconciling Fisheries Yield and Ocean Productivity in a Changing Climate”
- 2018 PICES International Symposium: Understanding Changes in Pacific Transitional Areas, La Paz, Mexico, “Predicting and adapting to biome-scale marine resource changes in the North Pacific”
- 2018 Northeast Fisheries Science Center, Sandy Hook Laboratory, “Prospects of predicting and adapting to changing fisheries productivity baselines”
- 2018 Old Dominion University, Department of Ocean, Earth and Atmospheric Sciences, “Seasonal to Decadal Earth System Predictions for Living Marine Resource Resilience”
- 2017 Invited Speaker, Workshop on Climate and Disease in a Changing World, Princeton University “Seasonal to century-scale vibrio pathogen predictions for Chesapeake Bay”.
- 2017 Keynote Speaker, Lowell-Wakefield Symposium on Impacts of a Changing Environment on the Dynamics of High Latitude Fish and Fisheries. “Earth system predictions for marine resource management across space and time scales”.
- 2017 Plenary Speaker, Coastal Ocean Dynamics Gordon Research Conference, Biddeford, ME. “Connecting Coastal Ocean Predictions and Fisheries Management Decisions”.
- 2017 Invited Speaker, Meeting of the NOAA Ocean Color Coordinating Group, “Synergies between ocean color and earth system models”.
- 2017 Invited Speaker, American Petroleum Institute webinar, “Sources of uncertainties in 21st century projections of potential ecosystem stressors”.
- 2017 Panel Member, Princeton Alumni Faculty Forum, Changing the climate of climate change: avoiding a meltdown.
- 2017 Invited Speaker, Northeast Fisheries Science Center, Woods Hole, MA, “Fisheries Catch and Ocean Productivity in a Changing Climate”
- 2017 Invited Speaker, 2017 US CLIVAR Summit, PPAI Panel, Baltimore MD, Connecting seasonal climate predictions and marine resource decisions: progress and challenges.
- 2017 Invited Speaker, Rider University, “How can climate predictions help sustain marine resources in a changing climate?”
- 2016 Invited speaker, Workshop on the best approaches for projecting marine mammal distributions under climate change, Santa Cruz, CA, “Advances in seasonal to century-scale earth system predictions”.
- 2016 Invited Speaker, Modeling a living planet, A symposium celebrating the career of Jorge Sarmiento, Princeton, NJ. “Life in silico: Meeting the challenge of marine ecosystem prediction.
- 2016 Invited Speaker, NOAA Climate Program Office MAPP Webinar, Seasonal Prediction and Fisheries, “Predicting seasonal sea surface temperature anomalies in coastal ecosystems”
- 2016 Invited Speaker, Annual Meeting of the Japanese Geophysical Union, Chiba, Japan, “Trophic amplification of ocean productivity trends under climate change”.

- 2016 Invited Speaker, Ocean Global Change Biology Gordon Conference, Waterville Valley, NH, "Reconciling Ocean Productivity and Fisheries Yield in a Changing Climate"
- 2016 Invited Speaker, Pacific Islands Fisheries Science Center, "Connecting climate and marine ecosystems to inform management from seasons to centuries"
- 2016 Invited Speaker, Harvard Atmospheric and Environmental Chemistry Seminar Series, "Reconciling ocean productivity and fisheries catch in a changing climate"
- 2016 Invited Speaker, NOAA Climate Program Office MAPP Webinar, Unified Modeling for Marine Applications. "Earth system predictions for marine resource management across space and time scales".
- 2015 Invited Speaker, Applications of seasonal to decadal climate predictions to marine resource management, Princeton NJ, "Prediction of SST anomalies in Coastal Ecosystems"
- 2015 Invited Speaker, ICES/PICES workshop on modeling the effects of climate change on fish and fisheries, Seattle, Washington, "Climate Models: Emerging new capabilities for CMIP6".
- 2015 Invited Speaker, Ecosystem Tipping Points in the California Current, La Jolla, CA "Toward mechanistic prediction of abrupt ecosystem change and "tipping points" in global earth system models.
- 2014 Invited Plenary (June), Advanced in Marine Ecosystem Modeling Research (AMEMR) Meeting, Plymouth UK, "Building Confidence in Marine Ecosystem Projections in a Changing Climate".
- 2014 Presentation to NOAA Climate Working Group, Connecting Climate and Marine Ecosystems
- 2014 Invited Speaker, PICES Future Meeting workshop on Ecosystem projection model intercomparison and assessment of climate change impacts of fish and fisheries: "A brief overview of the present state and future improvements of GFDL's Earth System Models"
- 2014 Invited Seminar, Stony Brook University School of Marine and Atmospheric Sciences: "Revisiting Ryther: The global transfer of energy from phytoplankton to fish"
- 2014 Invited Speaker, "Seafood in an Uncertain Ocean - What are the impacts of climate change on the ocean, fisheries, and food security?" A Side Event at the 2014 United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea, New York, NY.
- 2013 Symposium on Climate Change and Conservation of Marine Species; "On the use of IPCC-class models to assess the impact of climate on Living Marine Resources" 26th International Congress for Conservation Biology, Baltimore MD
- 2013 National Research Council Ocean Science Board Fisheries Subcommittee Meeting "Toward and understanding of global productivity and fish distributions in a changing climate", Sandy Hook NJ
- 2013 Invited speaker, University of Washington Program on Climate Change summer symposium "Global plankton production in a changing climate: how much do we know and is it enough to make fisheries projections?"
- 2012 Invited speaker, Second International Symposium, Effects of Climate Change on the World's Oceans; Workshop on climate change projections for marine ecosystems: Best practice, limitations and interpretation, Yeosu Korea.

- 2012 MIT Oceanography and Climate Sack Lunch Seminar, “Estimating the global-scale flow of energy through the planktonic food web, Cambridge MA.
- 2012 NMFS Northeast Regional Office Protected Resource Division Climate Change Workshop, “The Impact of Climate Change on Primary and Secondary Production”, Gloucester MA
- 2012 NOAA climate and ecosystems Science Day and Congressional Visit, "Connecting Climate and Ecosystems: Progress and Challenges", Washington DC.
- 2011 Invited Plenary, NOAA Cooperative Institute for the North Atlantic Region (CINAR) workshop on climate and ecosystem change in the NW Atlantic, “Connecting climate and regional ecosystems”, Woods Hole, MA
- 2011 Invited speaker, NOAA Science Advisory Board Meeting, “Connecting climate and marine ecosystems: progress and challenges”, Washington D.C.
- 2011 Invited speaker, Connecting climate and marine ecosystems: progress and challenges, OAR Senior Research Council Meeting, Princeton NJ
- 2011 Invited speaker, American Fisheries Society Annual Meeting, “On the use of IPCC-class models to assess the impact of climate change on living marine resources”, Seattle Washington
- 2011 Invited speaker, Rutgers University Institute of Marine and Coastal Sciences, “Connecting climate and living marine resources in global-scale Earth System Models”, New Brunswick NJ
- 2010 Invited Plenary, Annual Science Meeting of the Regional Association for Research in the Gulf of Maine, "The impact of climate variability and change on ecosystem productivity across trophic levels", Portsmouth NH
- 2009 Departmental Seminar, Biological Oceanography Department, Woods Hole Oceanographic Institution, Woods Hole MA
- 2009 Sea Grant Climate Network Workshop, Climate Adaptation in Coastal Communities: A Network Approach to Outreach, Charleston, SC
- 2008 Departmental Seminar, Old Dominion University Center for Coastal Physical Oceanography, Norfolk VA
- 2008 Seminar, Horn Point Environmental Laboratory, Cambridge Maryland
- 2007 Gordon Research Conference on Coastal Ocean Modeling, “Skill assessment and parameter constraints in physical-biological models: recent examples and challenges.” New London, NH
- 2007 Departmental Seminar, Bigelow Laboratory for Ocean Sciences, Boothbay Harbor, ME
- 2007 Departmental Seminar, MIT department of Earth Atmosphere and Planetary Sciences, Boston MA
- 2006 Departmental Seminar, Department of Civil and Environmental Engineering, UC Berkeley, Berkeley, CA
- 2006 Workshop on Climate Change, Upwelling, Fisheries, and Coastal Communities, Trieste, Italy
- 2006 Workshop on Skill Assessment for Coupled Biological/Physical Models of Marine Systems, Durham, NC
- 2005 Departmental Seminar, University of California, Santa Cruz, Department of Ocean Sciences, Santa Cruz, CA
- 2004 Departmental Seminar, University of Massachusetts at Dartmouth, School of Marine Science and Technology, Dartmouth MA

2003 HABWatch Workshop on Real Time Coastal Observing Systems for Ecosystems Dynamics and Harmful Algal Blooms, Villefranche-sur-Mere, France

Recent Congressional Staff Briefing in support of NOAA's Climate Ecosystems and Fisheries Initiative:

- January 16, 2022: NOAA's Climate Ecosystems and Fisheries Initiative; Presentation to congressional staffers; Joint with Cisco Werner and Craig McLean.
- April 28, 2022: NOAA's Climate Ecosystems and Fisheries Initiative; Presentation to congressional staffers; Joint with Jon Hare, Michelle McClure and Evan Howell.
- August 12, 2022: NOAA's Climate Ecosystems and Fisheries Initiative; Presentation to congressional staffers; Joint with Michelle McClure; Kristen Koch and Evan Howell.
- October 21, 2022: Connecting Climate and Ecosystems, Congressional Visit to GFDL
- February 9, 2023: House Natural Resources Committee Briefing on Ecosystem Modeling
- February 23, 2023: Follow up House Natural Resources Committee Majority Briefing on Ecosystem Modeling

Press Interactions:

<https://www.npr.org/2023/03/08/1161859576/study-shows-the-potential-consequences-of-climate-change-for-the-ocean-food-web>

<https://www.deutschlandfunk.de/big-data-big-fish-teil-2-wie-viele-seid-ihr-100.html>