



National Association of Marine Laboratories

Position Paper on Marine & Great Lakes Farming May 2024

According to the High-Level Panel (HLP) for a Sustainable Ocean Economy¹, the ocean need not be just a victim of climate change – it can be a large part of the solution. In terms of food for a hungry world, they state: "*Under optimistic projections regarding alternative mariculture feed innovations and uptake, **the ocean could supply over six times more food than it does today** (364 million metric tons of animal protein). This represents more than two-thirds of the edible meat that the FAO estimates will be needed to feed the future global population.*"² The U.S. is a signatory to the HLP along with 16 other countries.

Climate and environmental change threatens traditional and new forms of food production. Recent studies have indicated that **marine aquaculture could be used to provide more than the needed shortfall with a lighter environmental footprint, and more climate resiliency than agriculture or fisheries**³. In some cases, development of marine aquaculture can help sequester carbon⁴ and reduce dead zones⁵.

But we are far from this vision. Even though the oceans cover 70% of the earth's surface, they only provide 2% of the world's food. Despite the small contribution to world food, seafood is a uniquely healthy product⁶ and can be raised without land or freshwater, and is insulated from droughts, floods and extremes in temperature. Aquaculture has been recognized as key to blue growth and nutritional security for the future⁷. The U.S. however lags in marine aquaculture production, ranking only 19th, falling behind North Korea in 2008, after being in the top 5 countries in the 1970's⁸.

The quality of our marine and aquaculture sciences will determine how and if we benefit from aquaculture's potential. **The nation's marine laboratories are uniquely positioned to help aquaculture develop along a path that values a triple bottom line – that is to maximize environmental, social, and economic benefits.** Like any industry, marine aquaculture needs technical innovation and science for smart industry development, however, it also needs science to inform and improve government decision making. Quality science is key to making marine aquaculture grow and prosper while honoring the numerous environmental and social laws in the U.S. Simply put, NAML labs are the key to the development of marine aquaculture that increases climate resiliency, enhances blue growth, and improves human nutritional security.

¹<https://oceanpanel.org/about-ocean-panel/>

²Costello, C., L. Cao, S. Gelcich et al. 2019. The Future of Food from the Sea. Washington, DC: World Resources Institute. Available online at <https://oceanpanel.org/future-food-sea/>

³Hall, S.J., A. Delaporte, M. J. Phillips, M. Beveridge and M. O'Keefe. 2011. Blue Frontiers: Managing the Environmental Costs of Aquaculture. The WorldFish Center, Penang, Malaysia.

⁴<https://www.nationalacademies.org/our-work/a-research-strategy-for-ocean-carbon-dioxide-removal-and-sequestration>

⁵Phoebe Racine, AnnaClaire Marley, Halley E. Froehlich, Steven D. Gaines, Ian Ladner, Ilan MacAdam-Somer, Darcy Bradley, A case for seaweed aquaculture inclusion in U.S. nutrient pollution management, Marine Policy, Volume 129, 2021, 104506,

(<https://www.sciencedirect.com/science/article/pii/S0308597X21001172>)

⁶<https://www.seafoodnutrition.org/>

⁷<https://doi.org/10.1016/j.gloenvcha.2019.101991>

⁸https://data.worldbank.org/indicator/ER.FSH.AQUA.MT?end=2021&locations=KP-US&name_desc=false&start=1998&view=chart. Besides the economic cost of imports are: the associated carbon footprint of transport; the lack of direct oversight on farming methods, and the obvious insecurity of America's food supply, which was clearly demonstrated during the recent pandemic.

We are just beginning the International Decade of the Oceans for Sustainable Development⁹, and the world is now looking at issues that harness ocean science to address the 17 United Nations Sustainable Development Goals (SDGs). Marine aquaculture has a role in almost all of the SDGs and is fast becoming the foundation for the ocean-sourced food security goals of the Decade. NAML members are key to the Decade's success not only for seafood security but for all types of sustainable ocean development.

To ensure that marine farming minimizes impacts, optimizes environmental benefits, enriches our society, and strives for ever increasing sustainability, we need:

- To acknowledge the role of science to provide the information to protect and conserve water quality, oceanic natural resources (e.g., corals and sea grasses), Endangered Species Act listed species, navigation, wild fish, and existing uses.
- To use science's checks and balances (peer review) to improve the transparency and consistency of government decision making through targeting science to these needs.
- To maintain and improve marine laboratories equipped and staffed to provide research services designed to meet both societal and industry goals.
- To support key enabling infrastructure such as hatcheries and demonstration sites to help industries to innovate and governments to understand the impacts.
- To enhance educational programs for training:
 - aquaculture scientists in a range of disciplines,
 - marine farmers, managers, hatchery staff, and
 - regulators

NAML members are uniquely staffed and situated to help with detailed recommendations. We operate key and unique infrastructure that is not available elsewhere. The Association's member laboratories represent the best and brightest independent marine scientists in the country and are ready to assist with advancing environmentally, socially and economically sustainable marine farming for our Nation and the world.

⁹<https://www.oceandecade.org/>

NAML Members who may be contacted for expert opinions. These expert opinions do not necessarily represent the position(s) of NAML.

- Dr. Daniel Benetti, Professor, Department of Marine Ecosystems and Society, University of Miami Rosenstiel School of Marine and Atmospheric Science; d.benetti@miami.edu
- Dr. Reginald Blaylock, Director, Thad Cochran Marine Aquaculture Center, Gulf Coast Research Laboratory, University of Southern Mississippi; Reg.Blaylock@usm.edu
- Dr. Michael Chambers, Research Associate Professor, University of Maine Center for Sustainable Seafood Systems; Michael.Chambers@unh.edu
- Dr. Harry Daniels, Senior Associate Dean, North Carolina State University; harry_daniels@ncsu.edu
- Dr. Megan Davis, Research Professor, Florida Atlantic University, Harbor Branch Oceanographic Institute; MDavi105@fau.edu
- Dr. Delbert Gatlin, Professor & Associate Department Head for Research and Graduate Programs, Texas A&M University; d-gatlin@tamu.edu
- Dr. Matt Hawkyard, Assistant Professor Finfish Nutrition, University of Maine; matt.hawkyard@maine.edu
- Dr. Scott Lindell, Research Specialist, Applied Ocean Physics and Engineering, Woods Hole Oceanographic Institution; slindell@whoi.edu
- Dr. Sergey Nuzhdin, Professor, University of Southern California; snuzhdin@usc.edu
- Dr. Nichole Price, Senior Research Scientist, Center for Seafood Solutions Director, Bigelow Laboratory for Ocean Sciences; nprice@bigelow.org
- Dr. Kwamena K. Quagraine, Department of Agricultural Economics, Purdue University, Illinois-Indiana Sea Grant; kquagrai@purdue.edu
- Dr. Nicole Rhody, Manager, Marine & Freshwater Aquaculture Research Program, Mote Marine Laboratory; nrhody@mote.org
- Dr. Michael Rust, Senior Research Fellow, Hubbs-SeaWorld Research Institute; mrust@hswri.org
- Dr. Charles Santerre, Director, Agricultural Policy Development, Clemson University College of Agriculture, Forestry, and Life Sciences; santerr@clemson.edu
- Dr. Gregory Schwartz, Associate Professor, BRAE Department, Cal Poly San Luis Obispo; gschwa01@calpoly.edu
- Dr. Amy Schrank, Extension Program Leader, Fisheries & Aquaculture Extension Educator, University of Minnesota Sea Grant Program; aschrank@umn.edu
- Dr. LaDon Swann, Director, Mississippi-Alabama Sea Grant, and Sea Grant Aquaculture Liaison; ladon.swann@usm.edu
- Dr. Rafael Uribe, Professor, Department of Fisheries Biology, Cal Poly Humboldt; aquaculture@humboldt.edu
- Dr. Bill Walton, Acuff Professor, Marine Science and Shellfish Aquaculture Program Coordinator, Virginia Institute of Marine Science; walton@vims.edu
- Dr. Charles Yarish, Professor, Department of Ecology & Evolutionary Biology, University of Connecticut; charles.yarish@uconn.edu
- Dr. Graham Young, Executive Director, Western Regional Aquaculture Center and Professor, University of Washington; grahamy@uw.edu
- Dr. Yonathan Zohar, Professor and Chair, Dept. of Marine Biotechnology, University of Maryland Baltimore County; zohar@umbc.edu