



NOAA Omics Strategy Report, FY24 Q3

provided to the NOAA Science Council by the NOAA Omics Working Group

Administrative and Agency Priorities

- **National Aquatic eDNA Strategy Released.** Dr. Jane Lubchenco, Deputy Director for Climate and Environment of the White House Office of Science and Technology Policy, announced the release of the [National Aquatic eDNA Strategy](#) on June 3, 2024 at the 3rd National Marine Environmental DNA (eDNA) Workshop. The strategy “outlines opportunities to improve and deploy eDNA processes to inform the development of more effective ocean policies”, says a White House [press release](#).

NOAA Chief Scientist Dr. Sarah Kapnick was featured in the final high-level panel of the eDNA workshop, highlighting the role of eDNA technology in providing biodiversity information needed to guide decisions to sustain healthy and productive marine



Figure 1. Jane Lubchenco at Capitol Hill Oceans Week after the Living Laboratories panel with members of the National Aquatic eDNA Strategy writing team and hosts of the National Marine eDNA Workshop.

ecosystems. Later in the week, Dr. Lubchenco led the “Living Laboratories” panel discussion on the applications of eDNA at Capitol Hill Oceans Week (**Figure 1**). The diverse [panel](#) echoed Lubchenco’s sentiment that “analysis of eDNA is a powerful tool, whose time has come”. Many members of the NOAA ‘Omics Working Group contributed to the development of the National Aquatic eDNA strategy, including Kelly Goodwin, Krista Nichols, Alyse Larkin, Zachary Gold, Meredith Everett, Kim Parsons, and Gabrielle Canonico. Learn more with this [NOAA Research news story](#).

People

- **New Federal ‘Omics Lead Hired.** The Atlantic Oceanographic & Meteorological Laboratory (AOML) hired [Dr. Katherine Silliman](#) as a federal Research Biologist to oversee its ‘omics program. Dr. Silliman’s research focuses on developing ‘omics applications and data pipelines for enhanced marine biodiversity monitoring to support fisheries research and ecosystem assessments (**Figure 2**).
- **NOAA Research Lab Adds ‘Omics Staff.** AOML has added five new ‘omics staff through the Northern Gulf Institute/Mississippi State



Figure 2. Dr. Katherine Silliman is the newest federal hire for NOAA 'Omics.

University (NGI/MSU) partnership over the past six months. These hires support several projects implementing the [NOAA 'Omics Strategy](#) & [NOAA 'Omics Strategic Plan](#). Bayden Willms and Carter Rollins joined as Research Engineers and Sean Jungbluth joined as a Research Scientist working to make NOAA 'omics data more accessible on projects funded by NOAA Ocean Exploration and Global Ocean Monitoring and Observing (GOMO). Adrienne Wilson joined as a Postdoctoral Scholar working on a NOAA Ocean Acidification Program-funded project using eDNA to understand dynamics of carbon export to the deep ocean, as well as NOAA 'Omics collaborations with NOAA Fisheries to monitor fish populations using eDNA. Finally, Ann Holmes joined as a Research Scientist working on a USGS-funded project to develop metabarcoding standards for invasive species detection.

- **Bioinformatician Hired to Serve Great Lakes Research.**

Paul Den Uyl is the first hire of a full-time bioinformatician to work with the NOAA Great Lakes Environmental Research Laboratory (GLERL) through the Cooperative Institute for Great Lakes Research (CIGLR) (**Figure 3**). Den Uyl recently completed a Master's thesis on [saxitoxin-producing cyanobacteria](#), elucidating a complete set of genes encoding the neurotoxin saxitoxin in Great Lakes samples.



Figure 3. New bioinformatician, Paul Den Uyl, to aid Great Lakes HAB detection.



Figure 4. Steve Thur and Victoria Luu make pucks for toxin analysis in the 2G ESP.

- **NOAA Research Assistant Administrator Steve Thur Contributes to 'Omics Efforts.** During a recent visit to GLERL, Steve Thur helped prepare the 2nd Generation Environmental Sample Processor (2G ESP) for deployment (**Figure 4**). The 2G ESP is an autonomous platform used to monitor water for the algal toxin microcystin to provide drinking water managers with data on harmful-algal toxicity in near real-time, before the water reaches municipal water intakes.

- **IRA 'Omics Hires.** The NOAA Fisheries 'Omics Inflation Reduction Act (IRA) Strategic Initiative has provided funding for a number of new hires to support bioinformatics, population genomics, and environmental DNA projects in support of ecosystem or species assessments. These include new hires to be onboarded as term FTEs, cooperative institute and Pacific States staff, and postdocs, with hiring and onboarding in progress.

Infrastructure

- **NOAA 'Omics Technical Portal Released.** The [NOAA 'Omics Technical Portal](#) is now live! The portal provides a central repository for NOAA 'Omics resources including protocols,

data management resources, and training resources. Included in the portal are the recently published versioned controlled [NOAA PMEL OME field, DNA extraction, and PCR protocols](#) for eDNA metabarcoding following the Better Biomolecular Ocean Practices ([BeBOP](#)) for protocol development. This technical portal and the resources housed within it meet key actions from the [NOAA 'Omics Strategic Plan](#) to establish and share protocols for 'omics sampling, processing, curation and archival in alignment with national and international standards of practice.

- **Increase in 'Omics Sample Processing Capacity.** Investments in infrastructure and personnel at the NOAA Pacific Marine Environmental Laboratory (PMEL) have resulted in a dramatic increase in sample processing productivity (**Figure 5**). The Ocean Molecular Ecology (OME) team has sequenced over 6,000 individual eDNA libraries over multiple target markers, demonstrating the value of 'omics investments to usher in a new era of productivity for the OME program at PMEL.

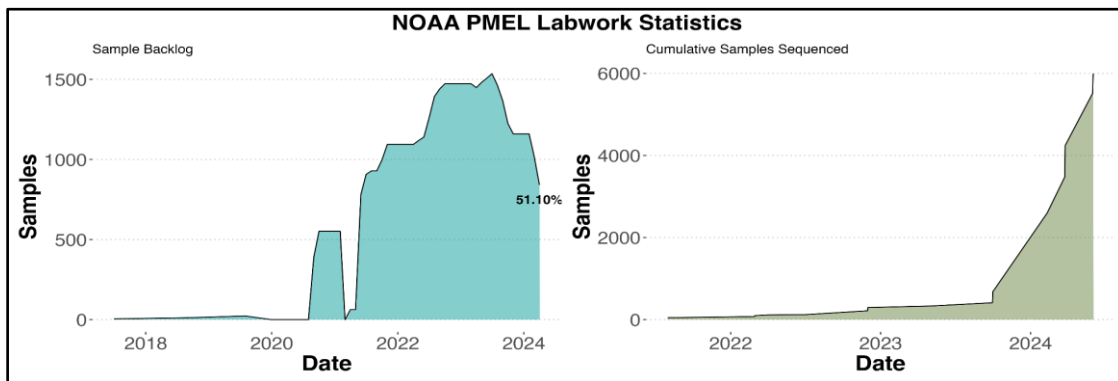


Figure 5. PMEL sample backlog and sequencing streamlining have improved with infrastructure and personnel investments.

- **Great Lakes Atlas of Multi-Omics Research (GLAMR).** A workshop was hosted by CIGLR to share capabilities, assess needs, and collect feedback for prospective users of [GLAMR](#). Twenty-six researchers participated, including scientists from GLERL, AOML, and universities across the Great Lakes basin. In addition, the [GLAMR](#) development team partnered with the Great Lakes Observing System (GLOS)—the regional IOOS association—to make harmful algal bloom (HAB) relevant 'omics data summaries available via GLOS's [Seagull platform](#). This is a first step towards making 'omics data broadly available to a variety of interested parties.
- **NOAA 'Omics Develops Critical Tool.** A [published paper and new REVAMP bioinformatics pipeline](#) by scientists at PMEL provides streamlined end-to-end metabarcoding data processing from raw reads to data exploration, visualization, and hypothesis generation. This work provides a critical tool to assess marker gene and reference database performance, highlighting the need for targeted reference sequencing efforts for key regional taxa and the importance of such efforts for improving eDNA biomonitoring approaches in the future.

Projects

- **Epigenetic DNA Patterns to Estimate Health of Wild Dolphins.** A [new paper](#) utilizes epigenetic DNA methylation patterns to estimate age and health of wild bottlenose

dolphins. This research was a collaboration among the National Marine Mammal Foundation, SEFSC, and other scientists, and provides another critical example of how epigenetics can be used as a conservation tool for better understanding free-ranging marine species.

Partnerships

- **Partnership to Predict Harmful Algal Blooms.** [NOAA Fisheries worked with partners to find methods to predict harmful algal blooms](#). Scientists at the Alaska Fisheries Science Center used eDNA as well as other methods to determine the most effective way to provide early warnings of HABs in southeast Alaska. [This study](#) was conducted in partnership with a local oyster farm, Alaska Sea Grant, University of Alaska Fairbanks, the NOAA Hollings Scholarship program, and Fordham University. Shellfish are a culturally and economically important resource in Southeast Alaska. HABs that produce paralytic shellfish toxins threaten safe subsistence harvest. To reduce public health risks and economic impacts, monitoring and predicting paralytic shellfish toxin events is crucial. Across Alaska's vast and remote coastline, it is also highly challenging. The study found that eDNA is the best method for early and accurate detection, and should be incorporated into future monitoring efforts. However, further work is needed to refine eDNA analysis to provide timely and effective bloom warnings.
- **NMFS-GMGI Partnership to Refine Epigenetic Approaches.** NOAA Fisheries' Northeast Fisheries Science Center (NEFSC) is partnering with the Gloucester Marine Genomics Institute (GMGI) to utilize DNA methylation patterns to predict age in fish, using haddock as a model species. The study stands out because wild-caught haddock can be aged using a validated method, and the NEFSC's bottom trawl survey can supply a wide range of ages (0-10 years) collected at half-year age intervals. A preliminary test of a training dataset using only 18 loci showed that age explained about 80% of the variation in methylation rates. A second run of samples is in the works to see if this high predictive value can be achieved with so few loci again, and to explore the functionality of these loci to determine if this epigenetic aging model can be applied to other fishes.

Synergies Across S&T Focus Areas

- **NOAA 'Omics x NOAA Data.** As presented at the recent Enterprise Data Management Workshop (EDMW) Elijah Hall updated the [NASA Global Change Master Directory Keywords](#) to include [50 'omics terms and variables](#). The widely used terminology was determined by the NOAA 'Omics Working Group Data & Bioinformatics Subcommittee and supported by NCEI working group member, Kristen Larson. The keywords now provide a basis for consistent definition of ['omics terms](#) within a controlled Earth Science Vocabulary.