NOAA Omics Strategy Report, FY25 Q3

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

Administrative and Agency Priorities

- **NOAA Fisheries evaluates the first application of environmental DNA (eDNA) in a fisheries stock assessment.** The hake 2025 stock assessment "Status of the Pacific Hake (whiting) stock in U.S. and Canadian waters in 2025" incorporates a biomass index for hake generated from eDNA data collected over the 2019, 2021, and 2023 Hake survey, evaluating this index relative to other metrics collected for this species. This is the first use of eDNA for a fisheries stock assessment, showing that the metric of abundance is on par with other metrics used in the stock assessment. Environmental DNA collections made on a single platform can also be used for generating biomass indices for many other species.

- **NOAA 'Omics Members Awarded $2.34M Grant To Develop eDNA and AI-Assisted Tools To Detect Invasive Soft Corals In Hawaii.** The project, led by researchers at the NOAA Fisheries Pacific Islands Fisheries Science Center (PIFSC), will develop, compare, and apply multiple 'omics methods (quantitative PCR/qPCR and Nanopore MinION metabarcoding) to detect invasive pulse coral, *Unomia stolonifera* (Figure 1) and other invasives using eDNA. *Unomia* decimates coral reefs, is rapidly spreading, and thus poses a serious environmental and economic risk to the Indo-Pacific region. This project advances Aquatic Invasive Species (AIS) mitigation and biosecurity measures in Department of Defense installations and surrounding areas, and serves NOAA's mission to prevent, monitor, control, and research the introduction and spread of aquatic invasive species.

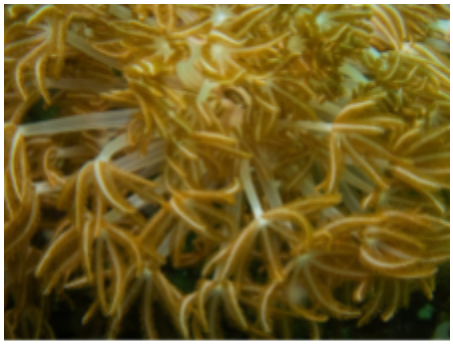

Figure : Pulse coral, Unomia stolonifera. Credit: USGS, Stefan Obenauer.

- **Toxin Producing Bacteria Identified In Collaborative Study.** Harmful algal blooms within the Great Lakes have great potential to impact human and economic health via toxins secreted into the water by bacteria. Researchers at the Great Lakes Environmental Research Laboratory and the Cooperative Institute for Great Lakes Research have identified an impactful toxin producing bacteria within Lake Erie (Figure 2). By leveraging

Figure : Satellite image of Lake Erie. Credit: NOAA Great Lakes CoastWatch MODIS Satellite Image – July 6, 2020

'shotgun' sequencing researchers identified a cyanobacteria that has capabilities to produce saxitoxin, one of the most dangerous natural toxins known. These efforts can help resource managers and scientists understand the environmental conditions that influence the abundance of this cyanobacteria and consequently potential for saxitoxin production, in order to strengthen harmful algal bloom forecasting and mitigation strategies.

People

- **New Hire To Serve At NOAA Fisheries Pacific Islands Fisheries Science Center.** Dr. Eric Garcia has recently joined the NOAA Fisheries PIFSC to contribute to developing bioinformatic pipelines for processing and analysis of eDNA datastreams. Dr. Garcia will leverage his background in bioinformatics and genetics to build automatable workflows that are accessible to all NOAA researchers to streamline analysis of eDNA metabarcoding data (Figure 3).

Figure : Dr. Eric Garcia to join NOAA Fisheries PIFSC

Projects

- **Genetic Stock Identification Of Black-Footed Albatross Caught As Bycatch:** Researchers from the Alaska Fisheries Science Center along with colleagues from other agencies and universities published a paper using whole genome and targeted sequencing to identify the stock of origin of albatross caught as bycatch in fisheries across the Pacific. The study identified disproportionate bycatch from specific breeding colonies, indicating that

fisheries bycatch impacts certain colonies disproportionately more than others. This study provides impactful information for management of migratory species.

- **An 'Omics-Powered Tool For Genetic Monitoring Of Chinook Salmon In The California Central Valley.** The NOAA Fisheries Southwest Fisheries Science Center Molecular Ecology and Genetic Analysis team leveraged whole genome sequencing to identify genetic markers capable of reliably distinguishing, for the first time, all the major runs of Chinook salmon in California's Central Valley. Additionally, this panel of markers provides sufficient power for identifying full-sibling and parent-offspring pairs, enabling full-life-cycle monitoring of fish via parentage- and sibling-based tagging.

Partnerships

- **Close-Kin Mark-Recapture Effort Toward Atlantic Bluefin Tuna.** A close-kin mark-recapture (CKMR) workshop for West Atlantic bluefin tuna was held August 22-28, 2024, hosted by Commonwealth Scientific and Industrial Research Organization (CSIRO) in Hobart, Australia. The analytical workshop closed out the pilot phases of the CKMR project, led by NOAA SEFSC and CSIRO researchers, and successfully produced a spawner absolute abundance estimate. A workshop final report is in preparation and review in April 2025. The next phase of the program includes transitioning to operational data collection from existing surveys, CKMR model updates and advancement, and integration into the existing management strategy evaluation.

Synergies Across S&T Focus Areas

- **NOAA 'Omics X Uncrewed Systems.** NOAA 'Omics and Ocean Exploration Cooperative Institute scientists and researchers have contributed to a collaborative publication to create a State-of-the-Art Review of Aquatic eDNA Sampling Technologies and Instrumentation. The new publication, in preprint, covers advancements, challenges, and future prospects of

Figure : SeaTrac, pictured, has capabilities to take samples via an internal 3rd Generation Environmental Sample Processor, a device developed by Monterey Bay Aquarium Research Institute (MBARI) and NOAA researchers. Credit: NOAA/GLERL

global eDNA autonomous samplers. ‘Omics and eDNA autonomous samplers (Figure 4) help researchers routinely collect molecular samples from extreme depths, under ice sheets, and in previously inaccessible areas.