COOPERATIVE INSTITUTE FOR CLIMATE, OCEAN, AND ECOSYSTEM STUDIES

CICOES MAGAZINE 2023

UNIVERSITY OF ALASKA FAIRBANKS

UNIVERSITY of WASHINGTON

Oregon State University

Cooperative Institute for CLIMATE, OCEAN & ECOSYSTEM STUDIES

Cooperative Institute for Climate, Ocean, and Ecosystem Studies
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ON THE COVER

A commercial fishing boat heads out into the ocean near Seward, Alaska. Researchers with NOAA Fisheries have identified a new way to help resource managers and fishermen reduce salmon bycatch by delivering more timely genetic information to people in the commercial fishing industry. *Photo: Michael Olson (iStock)*

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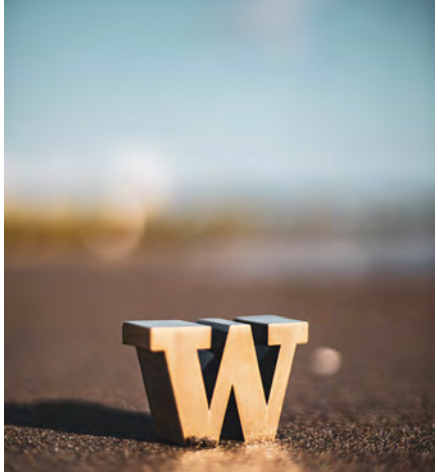


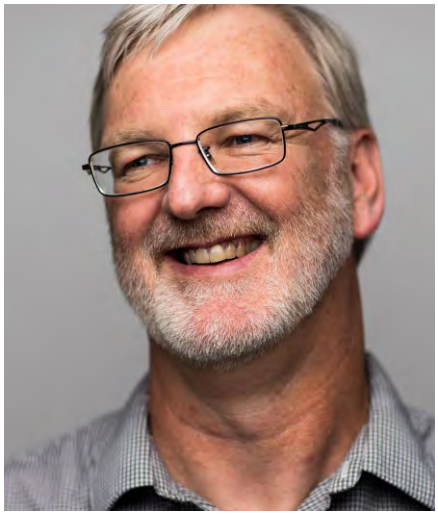
FROM THE DIRECTOR

In climate science parlance, resilience is comprised of two parts: adaptation and mitigation. That seems like a reasonable summary of the last year and a strategy for at least the near future. As we continue to mitigate and adapt to post-pandemic challenges, life and work uncertainty requires acceptance, purpose, and flexibility, all traits of resilient people and institutions. Articles that you will read in this year's magazine will demonstrate that CICOES has had another successful, resilient year in the office, in the lab, and in the field (above, below, and at sea level). Thanks to all who contributed to the 2023 CICOES Magazine.

Lots of transitions this year. At UW the administration team has seen significant turnover with Deborah Malarek (grant manager), Collen Marquist (executive assistant and safety officer), and Merly Jones (payroll coordinator) all retiring. New arrivals include Nenad Grubisa (grants specialist), Marlene Poches (executive assistant), Deb's replacement (coming soon), and the search is beginning for a new payroll coordinator. At UAF, Peter Bienik is now supporting CICOES leadership and Arina Didriksen is the new fiscal programs coordinator. Another exciting transition this year is the first appointment of eight CICOES-UAF employees that are co-located at NOAA partner laboratories in Juneau and Seattle.

We were also successful in obtaining an NSF Research Experiences for Undergraduates (REU) grant to expand and enrich the CICOES summer intern program. Thanks to the funded REU proposal led by Muyin Wang, interns are now able to extend their program participation by attending a scientific conference or continuing their research into the academic year. Applications for the 2024 program will be available the first week of January.

Another highlight of the year was the inaugural CICOES Symposium. Over 90 people registered, with representation from NOAA



headquarters and all three of our NOAA partners. The resilient symposium adapted to the concurrent UW Research Scientist and Postdoctoral Scholar strike, and provided a representative showcase of current research, ample opportunities to share research interests for future collaborations, and an 'indoor Olympics' event where enthusiastic participants had a lot of fun competing for bragging rights and annual passes to the National Parks. Thanks to all who put in a lot of work to plan and launch this event.

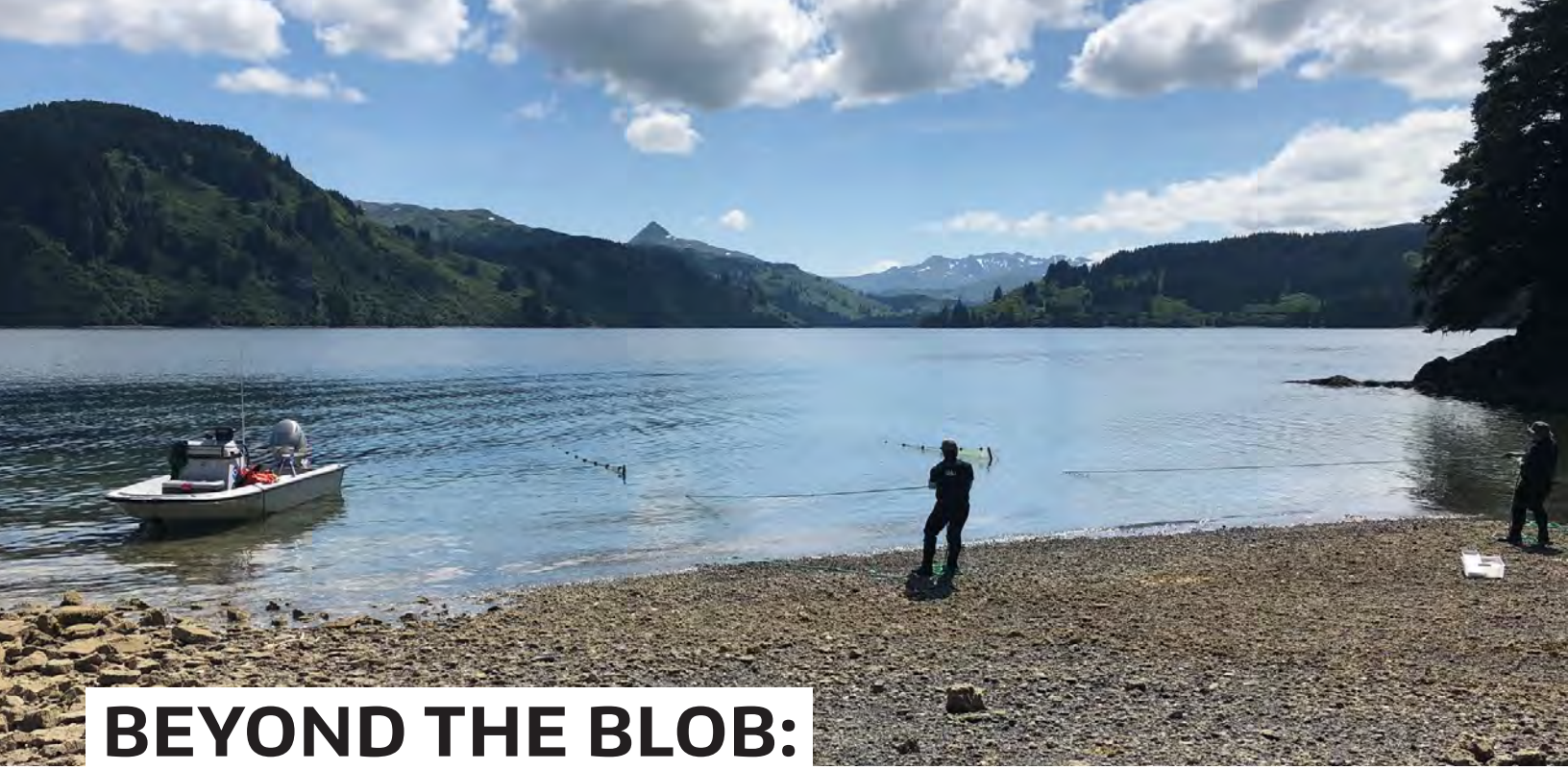
As the year nears its end, we will soon be participating in federal government funding initiatives. Between the Disaster Relief Supplemental Appropriations Act and the Inflation Reduction Act, project and new program funding will be routed through CICOES to initiate and expand collaborative research projects. These three-year programs will provide additional research opportunities for the CICOES community and potentially set the foundation for innovative, long-term collaborations.

But to initiate and execute projects you need a functional financial transaction system. The Workday Financial Transformation software that went 'live' on July 1, in combination with college-wide shared services, has exponentially increased our administratium (a noun) at UW and interactions with our OSU and UAF financial counterparts. It was expected that replacing 30-year-old legacy systems would have glitches, but no one predicted the magnitude of the impact that this would have on how we conduct business. Have faith we are told; things will get better (they just haven't told us how or when).

The biggest event on CICOES's 2024 calendar will be the NOAA 5-year review. A Cooperative Institute is established through a Cooperative Agreement for five years with a potential renewal for an additional five years. The review occurs during the fourth year, which for us is prior to July 1, 2024. An external review panel, led by an appointee from the NOAA Scientific Advisory Board, will evaluate how we conduct collaborative research, education, and outreach with our NOAA partners. Constructive suggestions will be made to improve our science and administrative operations. We have begun laying the groundwork needed to support the process on our end, and preparations are underway to secure an 'outstanding' ranking from the review. Everyone is encouraged to contribute and participate in the scientific review. A preemptive thank you to all who have or will contribute to showcasing the great work that is accomplished across the CICOES community.

I hope that you have had a productive and fulfilling year and that next year is even better!

John K. Horne
Executive Director



BEYOND THE BLOB:

PINPOINTING THE MECHANISMS OF PACIFIC COD POPULATION DECLINE

Above: Pacific cod juveniles being collected off Kodiak, AK, for experimental work and monitoring purposes. *Photo: Ben Laurel*

By CICOES staff

THE NORTHEASTERN PACIFIC EXPERIENCED multiple years of unprecedented marine heatwaves in recent years. "The Blob," a mass of warm water that persisted from 2014-2016, increased sea surface temperatures by up to 7°C, and another heat wave occurred in 2019. Among the many ecological changes that coincided with The Blob was a catastrophic decline in Pacific cod populations in the Gulf of Alaska, reducing abundances by over 71% between the 2015 and 2017 surveys.

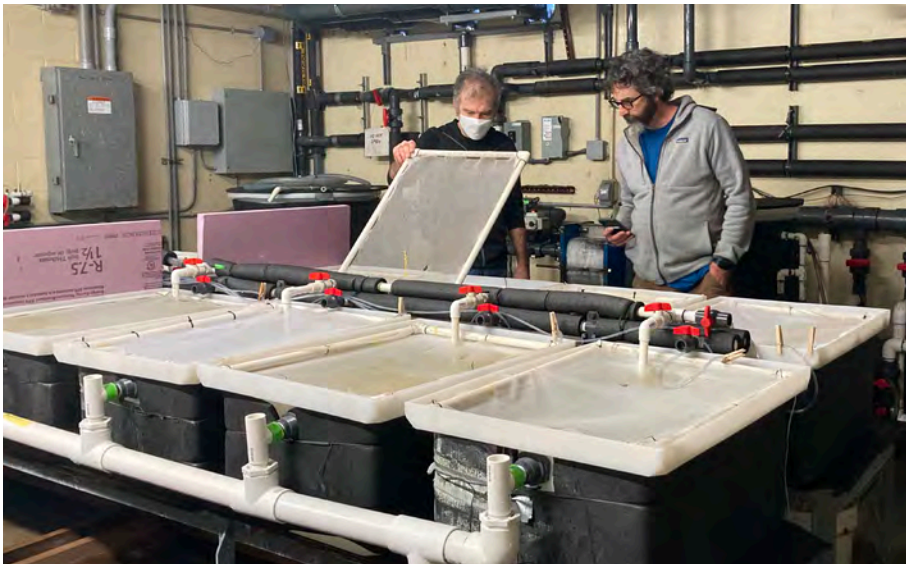
Pacific cod have historically supported the second largest groundfish fishery in Alaska, bringing in over $100 million annually in recent years. But marine heat waves, in addition to the more gradual ocean warming, have the potential to dramatically alter both the ecological and the economic landscape.

Researchers with CICOES, UW School of Aquatic and Fishery Sciences (SAFS), Oregon State University (OSU), and NOAA are partnering to understand how warming temperatures affect Pacific cod and whether they have the capacity to withstand increased temperature stressors. Early life stages of Pacific cod — developing eggs, larvae, and juveniles — are thought to be vulnerable to temperature changes and to have contributed to the population crash due to lower recruitment rates.

NOAA biologists Ben Laurel, Louise Copeman, and Tom Hurst, together with OSU postdoc Emily Slesinger, are leading a series of experiments at the Hatfield Marine Science Center in Newport, OR, to test these early life stages in varying temperatures and monitor their performance. The researchers are finding that the highest temperatures result in the lowest survival rates in larval Pacific cod.

Precisely how the elevated temperature causes these damaging changes is a major research question as is the longer-term potential for early life stages of Pacific cod to adapt to changing climate conditions.

The experimental work at the Hatfield station suggests that while warming causes early-stage Pacific cod to develop and grow faster, it also reduces their liver size and al-



Right: Ben Laurel (NOAA AFSC, lifting the lid) and Steven Roberts (UW SAFS) inspect experimental Pacific cod that were exposed to varying temperatures. *Photo: Laura Spencer*

"Ultimately, these studies aim to pinpoint the mechanisms of mortality to explain the Pacific cod population crashes following marine heat waves."

Above: Age-0 Pacific cod juveniles being enumerated and measured from annual beach seine surveys conducted by NOAA Alaska Fisheries Science Center in Kodiak, AK. *Photo: Ben Laurel*

ters activity of some key metabolic enzymes. These effects point to potential negative changes in how lipids, which include various forms of fats and sterols, are stored, metabolized, and incorporated into cellular structures.

One way to better understand how warming affects fish is to measure gene activity. RNA-Seq, a next-generation sequencing technology, is a powerful tool that can simultaneously measure the activity of all genes expressed in a tissue to provide a holistic view of an organism's physiology. CICOES-affiliated postdoc Laura Spencer is working with NOAA biologist Ingrid Spies and SAFS Professor Steven Roberts to measure gene expression in larval fish from those laboratory experiments.

"We have found that many lipid metabolism processes are altered by high temperature during larval rearing," says Laura Spencer, "which could indicate that warming reduces energy availability, already a limited resource during the larval stage. On top of that, we see more active immune-related genes, possibly reflecting harmful inflammation or higher levels of pathogens. Warming seems to be a 'one-two punch' to larval Pacific cod."

Research is ongoing and includes more gene expression studies in juvenile fish. This is being paired with other 'omics approaches (e.g. whole-genome sequencing) to look for potential genetic variation associated with warming tolerance.

"Ultimately, these studies aim to pinpoint the mechanisms of mortality to explain the Pacific cod population crashes following marine heat waves," says Spies.

If mechanisms are more clearly understood, it may be possible to identify populations or individuals that are genetically and physiologically predisposed to fare better under warmer conditions. Understanding the physiological responses to climate change will help inform fishery management on the level of risk associated with climate-driven warming. ◆

This research was made possible by CICOES, the NOAA Ocean Acidification program, and the Pacific States Marine Fisheries Commission.

Below: Age-1 Pacific cod juveniles in experimental systems at the Hatfield Marine Science Center in Newport, OR. *Photo: Ben Laurel*