COLLEGE OF GEOSCIENCES

TEXAS A&M UNIVERSITY

27 September 2021

Chuck Tracy, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

Request for PFMC Assistance: Combining high-resolution climate simulations with ocean biogeochemistry, fisheries and decision-making models to improve sustainable fisheries.

Dear Executive Director Tracy:

By way of introduction, I am the Texas A & M University (TAMU) Project Manager of a recently-funded National Science Foundation (NSF) research pilot project that has exciting potential to help the PFMC, and west coast fisheries managers generally, to better and more effectively respond to future changing ocean conditions driven by climate change. Our Project research team would like to offer our services to the Council and collaborate with the PFMC and its various advisory groups, and with fisheries stakeholders generally through the Council process, to help create new response and modeling predictive tools for maintaining and adapting sustainable fisheries management in the face of future and accelerating climate change.

As the Council members are doubtless painfully aware, climate change-driven impacts are already driving major shifts in ocean conditions and are changing ocean ecosystems in ways that, until recently, have been very difficult to predict. A number of coupled ocean-atmosphere predictive models do exist and are being applied to climate change research, but none – until recently – have resolution levels greater than about 100 kilometers, a scale that makes them almost useless for fisheries prediction. New super-computer technology, however, now allows coupled climate change modeling projections with resolutions of about 10 km. This makes these ocean predictive models much more accurate and useful. What has not yet been done, though, is to adapt these high-resolution ocean climate change predictive models to be compatible with existing fisheries management models.

To this end, our research project is aimed at integrating the outputs from the world's currently most sophisticated coupled climate change models (10 km. resolution), that include physics, biogeochemistry and fisheries biology, with a web-based decision support system. The latter will be in a format intended to help fisheries managers and industry make better informed decisions in the face of rapidly changing future ocean conditions. Depending on need, we anticipate that we will be able to produce forecasts for varying time periods from annual to decadal, along with likely estimates of errors. We want and need to work directly with fisheries stakeholders and managers to develop these new integrated predictive tools, and therefore request your assistance and that of the PFMC. (See Attachment 1 for technical and non-technical (more detailed) abstract descriptions of this Project.)

This is a new NSF-funded Project and we are just beginning Phase 1 of development, so there is no better time to seek stakeholder and Council advisory group involvement, input and suggestions. The NSF program through which we are funded is aimed at expanding the networked Blue Economy and is therefore of direct potential use

to the U.S. fishing industry. The initial focus of our work is the California Current Large Marine Ecosystem along the U.S. west coast from California to Washington for a number of reasons, which include both its immense economic importance to both the region and U.S. fisheries and the fact that there is an excellent data set on the local ecosystem with continued, robust monitoring. If successful, these management tools could be later extended to other similar regions of the ocean.

The PFMC has well developed technical expertise in science-based fisheries management, including a number of standing committees and workgroups on science and statistics, model evaluation, ecosystems and habitat, as well as many fishery-specific management advisory panels. The project would appear to support and further expand upon the Council's Climate and Community Initiative and the climate change scenario planning exercise included within that Initiative. We wish, therefore, to collaborate closely and partner with the PFMC throughout the development of our systems. We will need Council expertise and input to help determine and assess the future data needs of the PFMC and its fishing industry stakeholders, and thus to determine how the coupled climate-impact models from this Project can best be used to inform and improve fisheries management models in responding to accelerating climate change.

We understand that the PFMC's current Fishery Ecosystem Plan (FEP), as well as current Council policy, is to develop and move toward whole ecosystem-based fisheries management systems, as opposed to the old single-species management model. Our efforts are designed both to be consistent with such a change and to help our fisheries respond to the more general challenges of climate change-driven ocean regime shifts.

To this end, we would like to work with Council Staff to set up three co-sponsored stakeholder Workshops, in parallel to and within the agenda of upcoming Council meetings, during appropriate time slots during the November, 2021 and March and April, 2022 PFMC meetings. These Workshops will present this concept to the Council family, and seek to maximize stakeholder input on how best to shape our tools so they are of maximum benefit. We will also offer participating stakeholders the separate opportunity to schedule more intensive 1-to-1 interviews. Given that Council Staff time and resources are limited, we anticipate being able to contribute towards the additional cost of these Workshops.

We request, therefore, time for a short, 15-minute, initial and introductory presentation at the November, 2021 Council meeting (likely under the Administrative agenda) so we can present this Project to the full Council family. In the meantime, we hope to work with Council Staff to identify which advisory groups, Staff and Council members to include in planning our proposed Workshops. Ideally, the first Workshop should also be in parallel to the November, 2021 Council meeting. Given that in-person meetings have not yet resumed, we propose conducting all Workshops on-line using current on-line webinar meeting formats with Council staff assistance, in whatever way the Council Staff think is most appropriate and will be most effective.

Council Staff or Council members are welcome to call me at any time, if there are any questions, or to expedite the above arrangements, at Staff convenience. My personal contact information is below. We look forward to working with Council Staff on moving this promising Project forward in close collaboration with the Council. Email is the best initial contact, or cell phone, as I am frequently away from my office.

Sincerely,

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Texas A & M University

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NSF Convergence Accelerator Track E: Combining high-resolution climate simulations with ocean biogeochemistry, fisheries and decision-making models to improve sustainable fisheries.

Abstract

Non-technical description

Fish and shellfish populations are a vital source of protein for many of the world's people, and several of the largest are found along the eastern boundaries of the Pacific and Atlantic Oceans, where cold, deep water moves towards the surface, bringing nutrients that support both production by plants (phytoplankton) and the fish populations that feed on them. To ensure sustainability, fish and shellfish managers need information not only on the number of animals available at any given time, but also on potential future numbers, so that they can plan for such things as the number of fishing boats required or the size of seafood processing plants. Forecasting what will occur in such eastern boundary areas is difficult, however, because local winds rapidly change conditions. Adverse climate impacts, such as rising ocean temperatures and increasing acidity, are already affecting many coastal fishing-dependent communities, and such longer-term changes also have to be considered. The project aims to develop a decision support system, which uses the latest ocean models incorporating marine physics, chemistry and biology, to assist fish and shellfish managers in making their decisions. This is important as there are many stakeholders involved in harvesting fish and shellfish, who may have potentially conflicting interests. To this end, the research is aimed at integrating the outputs from the ocean models with a web-based decision support system that will help fisheries managers and industry make informed decisions to ensure that both the industry and its associated food production are sustainable. The investigators will work directly with the stakeholders to develop tools that are specifically able to meet their needs. The initial focus of the work is the California Current system along the U.S. west coast from California to Washington, which supports a local seafood industry valued annually at about $12 billion, with additional billions from catches landed by foreign boats in the U.S. If successful, the new tools should be extendable to other similar regions of the global ocean, thus increasing the value of the research. The project will provide training for students, including those from under-represented groups, in the use of the latest ocean models, as well as development opportunities for young faculty members at the participating institutions.

Technical description

Climate change-driven adverse ocean impacts are already affecting many rural, coastal, fishing-dependent communities, and these adverse impacts will likely accelerate for the foreseeable future. Forecasting potential changes in eastern boundary upwelling systems has benefitted recently from improvements in the resolution of global Earth system models, so that the latest eddy-resolving models at 10 km ocean resolution have greatly reduced systematic errors relative to observations. This project aims to use these advancements to improve forecasts of the fisheries potential of the California Current Ecosystem and improve decision making by managers and other stakeholders. The project will couple the output from such a high-resolution model simulation with the Marine Biogeochemistry Library and Fisheries Size and Functional Type models, thus incorporating physics, chemistry and biology with climate variability. The results will be integrated with a prototype, web-based decision support system, that uses mathematical decision analysis capabilities, to assist fisheries managers to model the complex, climate-related decision problems on which fisheries production depends. This is vital to ensure that the region can continue to support a sustainable fishery in the long term and the communities that depend on fishing for a living. In Phase 1, the project will develop a prototype of this linked decision system. The project will also develop a well-networked multidisciplinary team of modelers, social scientists, fisheries managers, economists, and industry and community stakeholders to advance convergence science and develop avenues for more sustainable fisheries under a changing climate. This team is essential for

developing tools that are directly applicable to the needs of fishery stakeholders, and will be fostered by meaningful communication between all groups throughout the project period. If successful, the model suite and decision support system should be extendable to other similar regions of the global ocean. Students and post-doctoral researchers, the next generation of scientists, will be trained in decision analyisis and to use the most current high-resolution models. Furthermore, the project will provide valuable professional development opportunities for early career female Co-PIs involved in the program.