Talk #139, 12/13/23

139th meeting of the Lyncean Group of San Diego

Date: Wednesday, 13 December 2023

Location: Southwestern Yacht Club
2702 Qualtrough Street, San Diego, CA 92106 (Point Loma)

Speaker: Dr. Colleen Petrik, Assistant Professor, Scripps Institution of Oceanography, University of California San Diego (UCSD)

Source: Scripps Institution of Oceanography

Topic: Climate impacts on marine fish populations: from microscale to macroscale

Speaker Bio: Dr. Petrik's background is in biological oceanography and ecology, quantitatively rooted in mathematics and physics. She is interested in understanding how the physical marine environment affects the ecology of zooplankton and harvested fish and invertebrate species. Additionally, she explores the implications of climate variability and climate change on these relationships. Dr. Petrik uses coupled numerical models that relate the physiology and behavior of individuals to population and ecosystem dynamics. The goal of her research is to understand the fundamental biological-physical mechanisms controlling marine ecosystems, thereby

providing a sound scientific basis to inform decisions in conservation and management. Dr. Petrik's research spans all time and space scales, from modeling how an individual fish larva feeds on one copepod, to simulating how different climate change scenarios will impact all the fish in the global ocean over the next 100 years. Dr. Petrik is currently a co-lead of the NOAA Climate Program Office's Marine Ecosystems Task Force and a co-coordinator of the Fisheries and Marine Ecosystems Model Intercomparison project.

For more background information on Dr. Petrik, take a few minutes and watch the following Scripps Institute of Oceanography videos that feature her work:

"A Scientist's Life in 99 Seconds: Biological Oceanographer Colleen Petrik"

"Fishful Future: Summer 2022 Film Week with featured Researcher Colleen Petrik"

Abstract: Ocean food webs can simplistically be divided into food chains in the upper waters (pelagic) and food chains at or near the seafloor (benthic). Different types of fish act as top predators in each of these food chains and the source of energy at the base of both food chains is microscopic marine plants, called phytoplankton, that live in the pelagic. In pelagic food chains, phytoplankton are eaten by zooplankton (animals) and then by fish, whereas in benthic food chains, the phytoplankton sink, are eaten by benthic invertebrates like shellfish, then eaten by fish. Large-scale regional differences in fisheries production is predominantly controlled by the availability of zooplankton and benthic invertebrates, which have a complex relationship with phytoplankton production. We constructed a simulation model to investigate how cross-ecosystem differences in the biological (e.g. prey) and physical (e.g. temperature) environment determine fish productivity and food web structure. The model simulates three broad types of fish: small pelagic, large pelagic, and benthic fishes. The model includes predator-prey interactions, basic life cycle transitions, and physiology like consumption, metabolism, and reproduction. By applying the model to the contemporary global ocean, we learned how temperature and prey account for the different structures of fish food webs that we observe. By using the

model with climate change projections, we found changes in ecosystems exemplified by shifts from benthic-based food webs towards pelagic-based ones comprised of small pelagic rather than large pelagic fish. This model is a robust, mechanistic tool being used by my research group at SIO and colleagues at other institutions to understand, quantify, and predict global fish biomass, as well as identify gaps in our knowledge
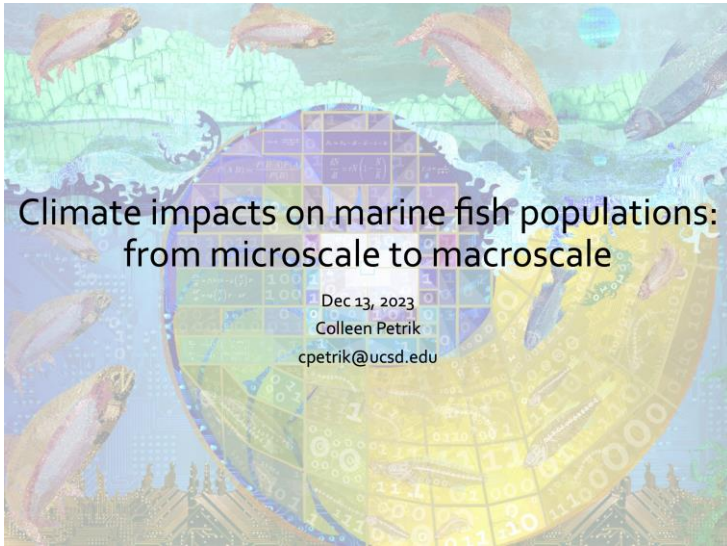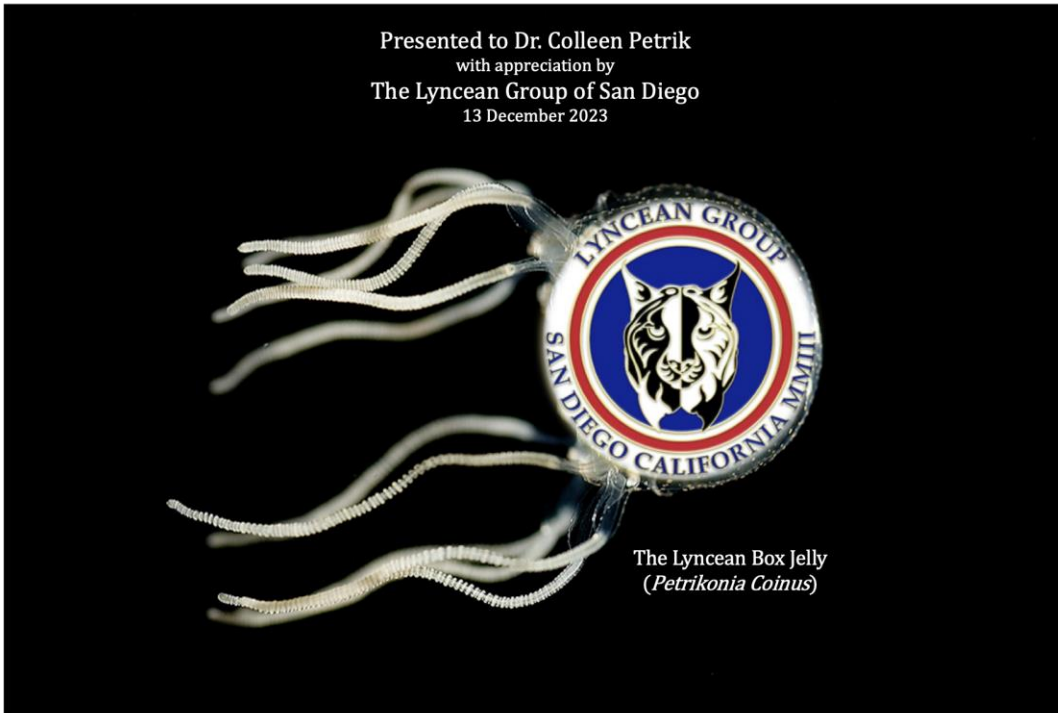
The Lyncean Coin presentation for Dr. Petrik

Bill Hagan's meeting slides are available for download here:
https://lynceans.org/wp-content/uploads/2024/01/Hagan-Meeting-Slides-12-13-23.pdf

Dr. Petrik's slide presentation is available for download here:
https://lynceans.org/wp-content/uploads/2023/12/Petrik_Lyncean_talk_website.pdf