



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center
7600 Sand Point Way N.E.
Seattle, Washington 98115-6349

27 September 2021

Simon Kinneen, Chair
North Pacific Fishery Management Council
1007 W. 3rd Avenue
Anchorage, AK 99501

Dear Mr. Kinneen,

It gives me great pleasure to recommend the appointment of Mike Litzow as a member of the Bering Sea / Aleutian Islands (BSAI) Crab Plan Team.

Dr. Litzow has served as the Program Manager for the Alaska Fisheries Science Center - Shellfish Assessment Program for the past two years. During this time he has developed broad expertise on the ecology, population dynamics, assessment, and management of BSAI crab stocks. Dr. Litzow oversees the annual bottom trawl survey assessment that is the primary fisheries-independent data source for management of BSAI crab stocks. He is also an active collaborator on a variety of research projects on crab movement, life history, and physiology that are directly relevant to the management of BSAI stocks. This research involves collaboration with the Alaska Department of Fish and Game and crab industry groups, and Dr. Litzow enjoys strong collaborative relationships across the range of institutions involved in BSAI crab management.

In addition to this background with crab biology and management, Dr. Litzow has a strong record conducting research on the ecosystem-level impacts of climate change on Alaskan fisheries resources. It is my belief that this expertise will be particularly valuable for navigating the challenges that the Council currently faces.

Dr. Litzow received a B.S in biology from the University of Alaska Fairbanks, a M.S. in Marine Sciences from the University of California, Santa Cruz, and a Ph.D. in Marine and Antarctic Sciences from the University of Tasmania. Dr. Litzow has a familiarity with Crab Plan Team processes from participating in a number of Plan Team meetings. Most recently he presented the results of the 2021 bottom trawl survey at the September meeting of the Team.

Dr. Litzow's combination of broad ecosystem expertise and specific expertise with BSAI crabs, along with his hands-on experience with assessment surveys for BSAI stocks, makes him eminently qualified to participate in the Crab Plan Team. I am confident that this background and expertise will enable him to make many valuable contributions to the Team for years to come.

Sincerely, 

Dr. Robert Foy
Director for Science and Research



MICHAEL A. LITZOW

Alaska Fisheries Science Center • National Marine Fisheries Service
301 Research Ct. • Kodiak, Alaska 99615
907-481-1711 • mike.litzow@noaa.gov

EDUCATION

- 2015 Ph.D., Marine and Antarctic Studies, University of Tasmania, Australia
Dissertation title: Climate forcing and sudden change in marine ecosystems
Supervisors: Stewart Frusher and Alistair Hobday
- 2000 M.S., Marine Sciences, University of California, Santa Cruz
Thesis title: Prey quality and recovery of Pigeon Guillemots from the
Exxon Valdez oil spill
Advisors: Jim Estes and Don Croll
- 1996 B.S., Biological Sciences (Honors Program), University of Alaska, Fairbanks

RESEARCH THEMES

Nonstationary atmosphere-ocean interactions in the North Pacific Ocean

Effects of climate variability, climate change, and commercial fishing on marine community structure

Marine communities as complex systems – critical transitions and red noise shifts

Applying early warning indicators to marine ecosystem management

Nearshore fish ecology

PROFESSIONAL EXPERIENCE

NATIONAL MARINE FISHERIES SERVICE: NOAA Fisheries Kodiak Lab Director, Alaska Fisheries Science Center Shellfish Assessment Program Manager (2019-present)

- Program Manager for a group that conducts annual population assessment for Bering Sea crab stocks
- Science lead for a group conducting field and laboratory research on commercially-important crustaceans in Alaska, with a particular focus on ocean acidification
- Participant in a variety of research projects on marine population and community responses to climate perturbations in the northeast Pacific

UNIVERSITY OF ALASKA, FAIRBANKS: Research Assistant Professor (2018-2019); Adjunct Research Professor (2017-2018)

- Lead Principle Investigator on five funded projects covering nonstationary atmosphere-ocean-biology interactions in the North Pacific, juvenile Pacific cod ecology, and climate change effects on walleye pollock population dynamics
- co-PI on project using otolith microchemistry to recover juvenile Pacific cod temperature histories
- Extensive public outreach around climate change issues and the Gulf of Alaska Pacific cod collapse

FARALLON INSTITUTE FOR ADVANCED ECOSYSTEM RESEARCH: Principal Scientist (2009-2017)

- Served as lead Principle Investigator on five different multi-institution collaborative research programs on Alaskan ecosystems
- Taxa studied include groundfish, crustaceans, forage fish, and salmon
- Conducted research on the dynamics of historical fisheries collapses in Alaska
- Administered combined budgets of approximately \$500,000
- Provided statistical consulting and collaboration to colleagues

BLUE WORLD RESEARCH: Owner (2008-2010)

- Principle Investigator on a collaborative project studying large scale climate-biology interactions in the northeast Pacific

NATIONAL MARINE FISHERIES SERVICE: Research Fisheries Biologist (2003-2007)

- NMFS lead for the Gulf of Alaska small-mesh trawl survey
- Cooperated extensively with colleagues at the Alaska Department of Fish and Game to conduct the annual survey and process and archive the resulting data
- Lead author on a series of papers utilizing long-term trawl survey data to make inferences about factors governing community structure in Alaskan marine ecosystems
- Leader of a collaborative study relating food web lipid dynamics to climate-forced community reorganization
- Leader of a collaborative NMFS/Alaska Department of Fish and Game study of sustainability metrics applied to historical catch time series from Alaskan fisheries
- Participated in the annual NMFS trawl survey of Bering Sea groundfish and crustacean populations

U.S. GEOLOGICAL SURVEY: Research Wildlife Biologist (1999-2002); Wildlife Biologist (1997-1999), Biological Science Technician (1996-1997)

- Project leader for a two-year inventory of fish populations in Glacier Bay National Park
- Project leader for a five-year study of the factors limiting seabird recovery following the *Exxon Valdez* oil spill
- Supervised field crews of 2-5 people in remote locations in the Gulf of Alaska
- Collaborated on study design and statistical techniques with colleagues working on a variety of marine systems

UNIVERSITY OF ALASKA, FAIRBANKS: Undergraduate Research Assistant (1995)

- Field assistant for seabird foraging ecology study
- Instructed crew in climbing techniques for accessing cliff-nesting seabirds

HONORS AND AWARDS

Elite Research Scholarship, University of Tasmania, 2011-2014

Best Student Presentation Award, Annual Meeting of the Pacific Seabird Group, 1998

Honors Program Tuition Waiver, University of Alaska Fairbanks, 1992-1996

REFEREED PUBLICATIONS

- Litzow, M. A.**, M. E. Hunsicker, N. A. Bond, B. J. Burke, C. J. Cunningham, J. L. Gosselin, E. L. Norton, E. J. Ward, and S. G. Zador. 2020. The changing physical and ecological meanings of North Pacific Ocean climate indices. *Proceedings of the National Academy of Sciences of the United States of America* 117:7665–7671.
- Litzow, M. A.**, M. E. Hunsicker, E. J. Ward, S. C. Anderson, J. Gao, S. G. Zador, S. Batten, S. C. Dressel, J. Duffy-Anderson, E. Fergusson, R. R. Hopcroft, B. J. Laurel, and R. O'Malley. 2020. Evaluating ecosystem change as Gulf of Alaska temperature exceeds the limits of preindustrial variability. *Progress in Oceanography* 186.
- Litzow, M. A.**, M. J. Malick, N. A. Bond, C. J. Cunningham, J. L. Gosselin, and E. J. Ward. 2020. Quantifying a novel climate through changes in PDO-climate and PDO-salmon relationships. *Geophysical Research Letters* 47:16
- Fedewa, E. J., T. M. Jackson, J. I. Richar, J. L. Gardner, and **M. A. Litzow**. 2020. Recent shifts in northern Bering Sea snow crab (*Chionoecetes opilio*) size structure and the potential role of climate-mediated range contraction. *Deep-Sea Research Part II: Topical Studies in Oceanography*, in press.
- Thorson, J. T., W. Cheng, A. J. Hermann, J. N. Ianelli, **M. A. Litzow**, C. A. O'Leary, and G. G. Thompson. 2020. Empirical orthogonal function regression: Linking population biology to spatial varying environmental conditions using climate projections. *Global Change Biology* 26:4638–4649.
- Thorson, J. T., L. Ciannelli, and **M. A. Litzow**. 2020. Defining indices of ecosystem variability using biological samples of fish communities: A generalization of empirical orthogonal functions. *Progress in Oceanography* 181.
- Litzow, M. A.**, L. Ciannelli, C. Cunningham, B. Johnson, and P. Puerta. 2019. Nonstationary effects of ocean temperature on Pacific salmon survival. *Canadian Journal of Fisheries and Aquatic Sciences*, 76:1923–1928.
- Litzow, M. A.**, L. Ciannelli, P. Puerta, J. J. Wettstein, R. R. Rykaczewski, and M. Opiekun. 2019. Non-stationary environmental and community relationships in the North Pacific Ocean. *Ecology* 100:ecy.2760.
- Ward, E. J., S. C. Anderson, L. C. Damaino, M. E. Hunsicker, and **M. A. Litzow**. 2019. Modeling regimes with extremes: the bayesdfa package for identifying and forecasting common trends and anomalies in multivariate time series data. *The R Journal* 11:46–55.
- Puerta, P., Ciannelli, L., Rykaczewski, R., Opiekun, M., and **Litzow, M.A.** 2019. Do Gulf of Alaska fish and crustacean populations show synchronous non-stationary responses to climate? *Progress in Oceanography* 175: 161–170.
- Litzow, M. A.**, L. Ciannelli, P. Puerta, J. J. Wettstein, R. R. Rykaczewski, and M. Opiekun. 2018. Non-stationary climate–salmon relationships in the Gulf of Alaska. *Proceedings of the Royal Society B: Biological Sciences* 285:20181855.
- Ward, E. J., M. Adkison, J. Couture, S. C. Dressel, **M. A. Litzow**, S. Moffitt, T. H. Neher, J. Trochta, and R. Brenner. 2017. Evaluating signals of oil spill impacts, climate, and species interactions in Pacific herring and Pacific salmon populations in Prince William Sound and Copper River, Alaska. *PLoS One* 12:e0172898.

- Litzow, M. A.** 2017. Indications of hysteresis and early warning signals of reduced community resilience during a Bering Sea cold anomaly. *Marine Ecology-Progress Series* 571:13-28.
- Litzow, M. A.** and M. E. Hunsicker. 2016. Early warning signals, nonlinearity, and signs of hysteresis in real ecosystems. *Ecosphere* 7:e01614.
- Litzow, M. A.,** A. J. Hobday, S. D. Frusher, P. Dann, and G. N. Tuck. 2016. Detecting regime shifts in marine systems with limited biological data: an example from southeast Australia. *Progress in Oceanography* 141:96-108.
- Litzow, M. A.** and F. J. Mueter. 2014. Assessing the ecological importance of climate regime shifts: an approach from the North Pacific Ocean. *Progress in Oceanography* 120:110-119.
- Litzow, M. A.,** F. J. Mueter, and A. J. Hobday. 2014. Reassessing regime shifts in the North Pacific: incremental climate change and commercial fishing are necessary for explaining decadal-scale biological variability. *Global Change Biology* 20:38-50.
- Litzow, M. A.,** F. J. Mueter, and J. D. Urban. 2013. Rising catch variability preceded historical fisheries collapses in Alaska. *Ecological Applications* 23:1475-1487.
- Litzow, M. A.** and D. Urban. 2009. Fishing through (and up) Alaskan food webs. *Canadian Journal of Fisheries and Aquatic Sciences* 66:201-211.
- Litzow, M. A.,** J. D. Urban, and B. J. Laurel. 2008. Increased spatial variance accompanies reorganization of two continental shelf ecosystems. *Ecological Applications* 18:1331-1337.
- Mueter, F.J. and **M.A. Litzow.** 2008. Sea ice retreat alters the biogeography of the Bering Sea continental shelf. *Ecological Applications* 18:309-320.
- Arimitsu, M.L., Piatt, J.F., **Litzow, M.A.,** Abookire, A.A., Romano, M.D., and M.D. Robards. 2008. Distribution and spawning dynamics of capelin (*Mallotus villosus*) in Glacier Bay, Alaska: a cold water refugium. *Fisheries Oceanography* 17:137-146.
- Litzow, M. A.** and L. Ciannelli. 2007. Oscillating trophic control induces community reorganization in a marine ecosystem. *Ecology Letters* 10:1124-1134.
- Litzow, M. A.,** K. M. Bailey, F. G. Prah, and R. Heintz. 2006. Climate regime shifts and reorganization of fish communities: the essential fatty acid limitation hypothesis. *Marine Ecology-Progress Series* 315:1-11. [Feature Article]
- Litzow, M. A.** 2006. Climate regime shifts and community reorganization in the Gulf of Alaska: how do recent shifts compare with 1976/1977? *ICES Journal of Marine Science* 63:1386-1396.
- Litzow, M. A.,** J. F. Piatt, A. A. Abookire, S. G. Speckman, M. L. Arimitsu, and J. D. Figurski. 2004. Spatiotemporal predictability of schooling and nonschooling prey of Pigeon Guillemots. *Condor* 106:410-415.
- Litzow, M. A.,** J. F. Piatt, A. A. Abookire, and M. D. Robards. 2004. Energy density and variability in abundance of pigeon guillemot prey: support for the quality-variability trade-off hypothesis. *Journal of Animal Ecology* 73:1149-1156.
- Johnson, J. A., S. M. Matsuoka, D. R. Ruthrauff, **M. A. Litzow,** and M. M. Dementyev. 2004. Additions to the avifauna of St. Matthew Island, Bering Sea. *Western Birds* 35:50-52.
- Litzow, M. A.** and J. F. Piatt. 2003. Variance in prey abundance influences time budgets of breeding seabirds: evidence from pigeon guillemots *Cephus columba*. *Journal of Avian Biology* 34:54-64.

- Litzow, M. A.**, J. F. Piatt, A. K. Prichard, and D. D. Roby. 2002. Response of pigeon guillemots to variable abundance of high-lipid and low-lipid prey. *Oecologia* 132:286-295.
- Seiser, P. E., L. K. Duffy, A. D. McGuire, D. D. Roby, G. H. Golet, and **M. A. Litzow**. 2000. Comparison of pigeon guillemot, *Cepphus columba*, blood parameters from oiled and unoiled areas of Alaska eight years after the Exxon Valdez oil spill. *Marine Pollution Bulletin* 40:152-164.
- Litzow, M. A.**, J. F. Piatt, A. A. Abookire, A. K. Prichard, and M. D. Robards. 2000. Monitoring temporal and spatial variability in sandeel (*Ammodytes hexapterus*) abundance with pigeon guillemot (*Cepphus columba*) diets. *ICES Journal of Marine Science* 57:976-986.
- Litzow, M. A.**, J. F. Piatt, and J. D. Figurski. 1998. Hermit crabs in the diet of Pigeon Guillemots at Kachemak Bay, Alaska. *Colonial Waterbirds* 21:242-244.

SELECTED NON-REFEREED REPORTS

- Litzow, M. A.**, Mueter, F. J., and A. J. Hobday. 2012. Four decades of climate-biology covariation in Alaskan and North Pacific ecosystems. Project 1024 Final Report, North Pacific Research Board, Anchorage.
- Piatt, J. F. and seven co-authors, including **Litzow, M. A.** 2009. Protocols for long-term monitoring of seabird ecology in the Gulf of Alaska. *Exxon Valdez Oil Spill Trustee Council Restoration Project 00501 Final Report*, Anchorage.
- M. L. Arimitsu, **Litzow, M. A.**, Piatt, J. F., Robards, M. D., and Abookire, A. A. 2003. Marine and estuarine fish inventory of Southeast and Central Alaska Inventory and Monitoring Networks. Final Report to the National Park Service. US Geological Survey, Anchorage.
- Litzow, M. A.** 2001. Pigeon guillemot. Chapter 11 in *Cook Inlet Seabird and Forage Fish Studies*. Final Report to the *Exxon Valdez Oil Spill Trustee Council* and the Minerals Management Service. US Geological Survey, Anchorage.

SYNERGISTIC ACTIVITIES AND PROFESSIONAL SERVICE

- Steering Committee member, Bering Sea Snow Crab Science Workshop (Bering Sea Fisheries Research Foundation, sponsor)
- Advisory Panel member: Thresholds in a changing ocean environment: bioeconomic implications to inform adaptation decisions for Alaska's salmon fisheries (NOAA; 2019-2021)
- Member of National Center for Ecological Analysis and Synthesis Working Group: Portfolio effects as a buffer against the *Exxon Valdez Oil Spill* (2014-2016)
- Peer reviewer for: Alaska Sea Grant, *Aquatic Living Resources*, *Condor*, *Communications Biology*, *Deep-Sea Research II*, *Ecology*, *Fish and Fisheries*, *Global Change Biology*, *ICES Journal of Marine Science*, *Journal of Animal Ecology*, *Journal of Experimental Marine Biology and Ecology*, *Marine Ecology-Progress Series*, National Environmental Research Council (U.K.), National Science Foundation, *Nature Climate Change*, NOAA FATE, North Pacific Research Board, Pollock Conservation Cooperative Research Center, *Proceedings of the Royal Society B*, *Progress in Oceanography*

SELECTED RESEARCH GRANTS

- North Pacific Research Board (2020-2023) Miller, J. A., B. Laurel, L. Rogers, and **M. A. Litzow**. Thermal effects on spawn timing and early growth of Gulf of Alaska Pacific cod.
- Pollock Conservation Cooperative Research Center (2019-2021) **M. A. Litzow** and F. J. Mueter. Assessing the potential for pollock growth and productivity in the northern Bering Sea.
- NOAA Saltonstall-Kennedy Program (2018-2021) **M. A. Litzow** and F. J. Mueter. Ecological controls of Alaskan pollock size at age under rapid environmental change.
- NOAA Fisheries and the Environment Program (2018-2020) **M. A. Litzow**, M. E. Hunsicker, N. Bond, B. Burke, C. Cunningham, C. Harvey, J. Gosselin, E. Norton, E. Ward, and S. Zador. Measuring the strength of ocean-atmosphere coupling to predict climate forcing of northeast Pacific ecosystems.
- NOAA Essential Fish Habitat (2018-2019) C. Kastle, T. Helser, **M. A. Litzow**, and B. Laurel. Is nearshore habitat essential to overwintering YOY Pacific cod?
- NOAA Cooperative Research Program. (2018-2019) **M. A. Litzow**, B. Laurel, and A. Abookire. Understanding post-settlement survival for juvenile Pacific cod in the Gulf of Alaska (Yr1).
- National Science Foundation (2016-2018) **M. A. Litzow**, L. Ciannelli, and R. Rykaczewski. Collaborative Research: Non-analogue ecosystem states in the Gulf of Alaska.
- NOAA Fisheries and the Environment Program (2016-2017) **M. A. Litzow**, M. E. Hunsicker, C. Anderson, C. Harvey, S. McClatchie, E. Ward, and S. Zador. An early-warning index for abrupt change in northeast Pacific ecosystems.
- Alaska Sea Grant (2014-2016) **M. A. Litzow**. Applying regime shift indicators to understand the potential impacts of a multi-year cold event on the Bering Sea ecosystem.
- Pew Charitable Trusts (2015-2016) **M. A. Litzow** and M. E. Hunsicker. Applying regime shift indicators to ecosystem-based fisheries management.
- Institute for Marine and Antarctic Studies, U. Tasmania. (2013-2014) **M. A. Litzow**. Decadal patterns of climate-biology covariation in southeast Australian marine ecosystems.
- Alaska Sea Grant (2010-2012) **M. A. Litzow** and F. J. Mueter. Increased variance as a leading indicator of reorganization in Alaskan marine ecosystems: An empirical test.
- North Pacific Research Board (2010-2012) **M. A. Litzow**. Hare and Mantua reanalysis.

PROFESSIONAL MEMBERSHIPS

Alaska Chapter, American Fisheries Society

SELECTED PRESENTATIONS

Invited presentations and seminars

Climate change and Alaska's fisheries. Alaska Seafood Processors Leadership Institute, Anchorage, AK, 2018.

Early warning indicators and ecological responses to the 2014-2016 marine heatwave. Pacific Fisheries Management Council Scientific and Statistical Committee, Boise, ID, 2017.

Nonlinear change in North Pacific climate: are biological systems responding? Annual PICES Meeting, Nanaimo, BC, 2013.

Rising variance as a leading indicator of tipping points in marine ecosystems: a test using Alaskan crustacean fisheries. Second International Symposium on Effects of Climate Change on the World's Oceans, Yeosu, South Korea, 2012.

Climate forcing and sudden change in marine ecosystems. Ocean Sciences Seminar, Institute of Marine and Antarctic Sciences, University of Tasmania, Hobart, Australia, 2010.

Rapid climate change and fisheries ecology: some insights from Alaska. Seminar at the Commonwealth Science and Industrial Research Organization, Cleveland, Australia, 2009.

Gulf of Alaska Session overview. Alaska Marine Science Symposium, Anchorage, AK, 2006

Contributed presentations and seminars

Should fisheries biologists stop using the PDO and NPGO indices? Western Division American Fisheries Society Annual Meeting, Anchorage, AK 2018.

Nonstationary Gulf of Alaska atmosphere-ocean and climate-biology relationships. Alaska Marine Science Seminar, Anchorage, AK, 2018.

When does temperature matter to the Gulf of Alaska ecosystem, and when does it not? Fisheries Department Seminar, UAF, Juneau, AK, 2017 and Fisheries and Ocean Sciences Seminar, UAF, Fairbanks, AK, 2018.

Non-analogue ecosystem states in the Gulf of Alaska. 25th Annual PICES Meeting, San Diego, CA, 2016.

Early-warning indicators to track resilience in the Bering Sea ecosystem. Alaska Marine Science Symposium, Anchorage, AK, 2016.

Four decades of climate-biology covariation in Alaska. Alaska Marine Science Symposium, Anchorage, AK, 2012.

What can ecosystem indicators tell us about the future? Cautionary lessons from North Pacific historical data. Oral presentation, Lowell Wakefield Symposium, Anchorage, 2010.

Hare and Mantua updated: four decades of climate-biology covariation in the northeast Pacific. PICES Annual Meeting, Portland, OR, 2010.

Warming climate alters the biogeography of the southeast Bering Sea. Alaska Marine Science Symposium, Anchorage, AK 2007.

Do climate effects on Pacific cod abundance cause shifts between bottom-up and top-down control?
Alaska Marine Science Symposium, Anchorage, AK, 2006.

Public outreach presentations

Alaskan fisheries in the global warming present. Kodiak CommFish, 2018.

Climate change and Gulf of Alaska Fisheries. Kodiak Fisheries Working Group, 2018.

Predicting tipping points in Alaskan fish communities. Kodiak National Wildlife Refuge Visitors' Center Brown Bag Seminar Series, 2016.

Climate effects on Alaskan fisheries over the last four decades. Public outreach presentation, Kodiak National Wildlife Refuge Visitors' Center Brown Bag Seminar Series, 2012.

SELECTED PRESS

The Fishermen: The Big Thaw: Episode 3. Alaska Public Media Podcast, 8/22/18. [Link](#)

Gulf Of Alaska Cod Are Disappearing. Blame 'The Blob' All Things Considered, National Public Radio, 7/31/18. [Link](#)

A New Study Looks at Why Pacific Cod Are Disappearing. KMXT, Kodiak Public Radio, 2/13/18. [Link](#)

Studies Begin on the Decline of Pacific Cod. Kodiak Daily Mirror, 2/13/18. [Link](#)