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Education

University of Washington, Ph.D. Aquatic and Fishery Sciences 2003-2006
- Committee: Ray Hilborn (advisor), Andre Punt, Tim Essington

Montana State University, MSc Biology 2000-2003
- Advisor: Dan Goodman

University of California San Diego, BSc Ecology and Evolution 1995-1999

Employment

Statistician Northwest Fisheries Science Center, NMFS (NOAA) 2009 - present

Affiliate Professor University of Washington (SAFS) 2013 - present

Post-doctoral researcher National Research Council 2007 - 2008

Stock assessment scientist Wellington, New Zealand Spring 2005

Graduate research assistant University of Washington 2003 - 2006

Journal Articles (peer - reviewed)

132. Davies, S.C., P.L. Thompson, C. Gomez, J. Nephin, A. Knudby, A.E. Park, S.K. Friesen, L.J. Pollock, E.M. Rubidge, S.C. Anderson, J.C. Iacarella, D.A. Lyons, A. MacDonald, A. McMillan, **E.J. Ward**, A.M. Holdsworth, N. Swart, J. Price, and K.L. Hunter. 2023. Addressing uncertainty when projecting marine species distributions under climate change. *Ecography*, :e06731. [link](#)
131. Liu, O.R., **E.J. Ward**, S.C. Anderson, K.S. Andrews, L.A. Barnett, S. Brodie, G. Carroll, J. Fiechter, M.A. Haltuch, and C.J. Harvey. 2023. Species redistribution creates unequal outcomes for multispecies fisheries under projected climate change. *Science Advances*, 9:eadg5468.
130. Jefferson, T.A., M.A. Smultea, and **E.J. Ward**. 2023. Distribution and abundance of californian (zalophus californianus) and steller (eumetopias jubatus) sea lions in the inshore waters of washington, 2013-2016. *Aquatic Mammals*, 49:16.
129. Wilson, S.M., J.H. Anderson, and **E.J. Ward**. 2023. Estimating phenology and phenological shifts with hierarchical modeling. *Ecology*, 104:e4061. [link](#)
128. Gaydos, J.K., J.S. Leger, S. Raverty, H. Nollens, M. Haulena, **E.J. Ward**, C.K. Emmons, M.B. Hanson, K. Balcomb, D. Ellifrit, M.N. Weiss, and D. Giles. 2023. Epidemiology of skin changes in endangered southern resident killer whales (orcinus orca). *PLOS ONE*, 18:e0286551. [link](#)
127. Wilson, S.M., J.W. Moore, **E.J. Ward**, C.W. Kinsel, J.H. Anderson, T.W. Buehrens, C.N. Carr-Harris, P.C. Cochran, T.D. Davies, M.R. Downen, L. Godbout, P.J. Lisi, M.N.C. Litz, D.A. Patterson, D.T. Selbie, M.R. Sloat, E.J. Suring, I.A. Tattam, and

- G.J. Wyatt. 2023. Phenological shifts and mismatch with marine productivity vary among pacific salmon species and populations. *Nature Ecology & Evolution*, 7:852–861. [link](#)
126. Kardos, M., Y. Zhang, K.M. Parsons, Y. A, H. Kang, X. Xu, X. Liu, C.O. Matkin, P. Zhang, **E.J. Ward**, M.B. Hanson, C. Emmons, M.J. Ford, G. Fan, and S. Li. 2023. Inbreeding depression explains killer whale population dynamics. *Nature Ecology & Evolution*, :1–12. [link](#)
 125. Davis, M.J., J. Anthony, **E.J. Ward**, J. Firman, and C. Lorion. 2023. Coherence among Oregon Coast coho salmon populations highlights increasing relative importance of marine conditions for productivity. *Fisheries Oceanography*, n/a:. [link](#)
 124. May, S.A., J.J. Hard, M.J. Ford, K.A. Naish, and **E.J. Ward**. 2023. Assortative mating for reproductive timing affects population recruitment and resilience in a quantitative genetic model. *Evolutionary Applications*, n/a:. [link](#)
 123. Buckner, J.H., W.H. Satterthwaite, B.W. Nelson, and **E.J. Ward**. 2022. Interactions between life history and the environment on changing growth rates of chinook salmon. *Canadian Journal of Fisheries and Aquatic Sciences*, :.
 122. Good, T.P., J.E. Jannot, K.A. Somers, and **E.J. Ward**. 2022. Using Bayesian time series models to estimate bycatch of an endangered albatross. *Fisheries Research*, 256:106492. [link](#)
 121. **Ward, E.J.**, L.A. Barnett, S.C. Anderson, C.J. Commander, and T.E. Essington. 2022. Incorporating non-stationary spatial variability into dynamic species distribution models. *ICES Journal of Marine Science*, 79:2422–2429. [link](#)
 120. **Ward, E.J.**, K.N. Marshall, and M.D. Scheuerell. 2022. Regularizing priors for Bayesian VAR applications to large ecological datasets. *PeerJ*, 10:e14332. [link](#)
 119. Brodie, S., J.A. Smith, B.A. Muhling, L.A.K. Barnett, G. Carroll, P. Fiedler, S.J. Bograd, E.L. Hazen, M.G. Jacox, K.S. Andrews, C.L. Barnes, L.G. Crozier, J. Fiechter, A. Fredston, M.A. Haltuch, C.J. Harvey, E. Holmes, M.A. Karp, O.R. Liu, M.J. Malick, M.P. Buil, K. Richerson, C.N. Rooper, J. Samhuri, R. Seary, R.L. Selden, A.R. Thompson, D. Tommasi, **E.J. Ward**, and I.C. Kaplan. 2022. Recommendations for quantifying and reducing uncertainty in climate projections of species distributions. *Global Change Biology*, 28:6586–6601. [link](#)
 118. Ettinger, A., C. Harvey, J. Samhuri, C. Emmons, M. Hanson, **E.J. Ward**, and J. Olson. 2022. Shifting phenology of an endangered apex predator tracks changes in its favored prey. *Endangered Species Research*, 48:211–223. [link](#)
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115. Essington, T.E., S.C. Anderson, L.A. Barnett, H.M. Berger, S.A. Siedlecki, and **E.J. Ward**. 2022. Advancing statistical models to reveal the effect of dissolved oxygen on the spatial distribution of marine taxa using thresholds and a physiologically based index. *Ecography*, e06249:. [link](#)
114. Feddern, M.L., G.W. Holtgrieve, and **E.J. Ward**. 2022. Delayed trophic response of a marine predator to ocean condition and prey availability during the past century. *Ecology*, e3865:. [link](#)
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112. **Ward, E.J.**, S. Anderson, M. Hunsicker, and M. Litzow. 2022. Smoothed dynamic factor analysis for identifying trends in multivariate time series. *Methods in Ecology and Evolution*, 13:908–918. [link](#)
111. Hunsicker, M., **E.J. Ward**, M. Litzow, S. Anderson, C. Harvey, J. Field, J. Gao, M. Jacox, S. Melin, A. Thompson, and P. Warzybok. 2022. Tracking and forecasting community responses to climate perturbations in the california current ecosystem. *PLOS Climate*, 1:e0000014. [link](#)
110. Anderson, S.C., **E.J. Ward**, P.A. English, and L.A.K. Barnett. 2022. sdmTMB: an R package for fast, flexible, and user-friendly generalized linear mixed effects models with spatial and spatiotemporal random fields. *bioRxiv*, :. [link](#)
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105. Ohlberger, J., **E.J. Ward**, R. Brenner, M. Hunsicker, S. Haught, D. Finnoff, M. Litzow, T. Schwoerer, G. Ruggerone, and C. Hauri. 2021. Non-stationary and interactive effects of climate and competition on pink salmon productivity. *Global Change Biology*, 28:2026–2040. [link](#)
104. Waples, R.S., R.K. Waples, and **E.J. Ward**. 2021. Pseudoreplication in genomics-scale datasets. *Molecular Ecology Resources*, 22:503–518. [link](#)
103. Stewart, J.D., J.W. Durban, H. Fearnbach, L.G. Barrett-Lennard, P.K. Casler, **E.J. Ward**, and D.R. Dapp. 2021. Survival of the fattest: linking body condition to

- prey availability and survivorship of killer whales. *Ecosphere*, 12:e03660. [link](#)
102. Jefferson, T.A., M.A. Smultea, **E.J. Ward**, and B. Berejikian. 2021. Harbor seals (*Phoca vitulina richardii*) in the inland waters of Washington State: a novel approach to stock size estimation. *PLOS ONE*, 16:e0241254. [link](#)
 101. Shelton, A.O., G.H. Sullaway, B.E. Feist, **E.J. Ward**, K.A. Somers, V.J. Tuttle, J.T. Watson, and W.H. Satterthwaite. 2021. Redistribution of salmon populations in the Northeast Pacific Ocean in response to climate. *Fish and Fisheries*, 22:503–517. [link](#)
 100. Barnett, L.A., S. Anderson, and **E.J. Ward**. 2021. Improving estimates of species distribution change by incorporating local trends. *Ecography*, 44:427–439. [link](#)
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 98. Essington, T., **E.J. Ward**, T.B. Francis, C. Greene, L. Kuehne, and D. Lowry. 2021. Historical reconstruction of the Puget Sound (Usa) groundfish community. *Marine Ecology Progress Series*, 657:173–189. [link](#)
 97. Holt, M.M., J.B. Tennessen, **E.J. Ward**, M.B. Hanson, C.E. Emmons, D.A. Giles, and J.T. Hogan. 2021. Effects of vessel distance and sex on the behavior of endangered killer whales. *Frontiers in Marine Science*, 7:1211. [link](#)
 96. Hodgson, E.E., R.A. Hovel, **E.J. Ward**, S. Lord, and J.W. Moore. 2020. Migratory diversity in an arctic fish supporting subsistence harvest. *Biological Conservation*, 248:108685. [link](#)
 95. 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:e2020GL087972. [link](#)
 94. Litzow, M., M.E. Hunsicker, **E.J. Ward**, S.C. Anderson, J. Gao, S. Zador, S. Batten, S. Dressel, J. Duffy-Anderson, E. Fergusson, R. Hopcroft, B. Laurel, and R. O'Malley. 2020. Evaluating ecosystem change as Gulf of Alaska temperature exceeds the limits of preindustrial variability. *Progress in Oceanography*, 186:102393. [link](#)
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 92. 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*, 117:7665–7671. [link](#)
 91. Chasco, B., J.T. Thorson, S. Heppell, L. Avens, J. Braun-McNeill, A.B. Bolten, K.A. Bjorndal, and **E.J. Ward**. 2020. Estimating growth and ages for species with incomplete ageing histories: a case study for loggerhead sea turtle (*Caretta caretta*) using an integrated mixed-effect model. *Marine Ecology Progress Series*, 636:221–234. [link](#)

90. Barnett, L., **E.J. Ward**, J.E. Jannot, and A.O. Shelton. 2019. Dynamic spatial heterogeneity reveals interdependence of marine faunal density and fishery removals. *Ecological Indicators*, 107:105585. [link](#)
89. Ohlberger, J., D.E. Schindler, **E.J. Ward**, T.E. Walsworth, and T.E. Essington. 2019. Resurgence of an apex marine predator and the decline in prey body size. *Proceedings of the National Academy of Sciences*, 116:26682–26689. [link](#)
88. Tennessen, J.B., M.M. Holt, **E.J. Ward**, M.B. Hanson, C.K. Emmons, D.A. Giles, and J.T. Hogan. 2019. Hidden Markov models reveal temporal patterns and sex differences in killer whale behavior. *Scientific Reports*, 9:14951. [link](#)
87. **Ward, E.J.**, S.C. Anderson, L.A. Damiano, 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. [link](#)
86. Deacy, W.W., W.B. Leacock, **E.J. Ward**, and J.B. Armstrong. 2019. Aerial surveys cause large but ephemeral decreases in bear presence at salmon streams in Kodiak, Alaska. *PLOS ONE*, 14:1-17. [link](#)
85. Nelson, B.W., A.O. Shelton, J.H. Anderson, M.J. Ford, and **E.J. Ward**. 2019. Ecological implications of changing hatchery practices for Chinook salmon in the Salish Sea. *Ecosphere*, 10:e02922. [link](#)
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83. Beaudreau, A.H., **E.J. Ward**, R.E. Brenner, A.O. Shelton, J.T. Watson, J.C. Womack, S.C. Anderson, A.C. Haynie, K.N. Marshall, and B.C. Williams. 2019. Thirty years of change and the future of Alaskan fisheries: Shifts in fishing participation and diversification in response to environmental, regulatory, and economic pressures. *Fish and Fisheries*, 20:601-619. [link](#)
82. Anderson, S.C., and **E.J. Ward**. 2019. Black swans in space: modelling spatiotemporal processes with extremes. *Ecology*, 100:1–9. [link](#)
81. Marshall, K.N., J.T. Duffy-Anderson, **E.J. Ward**, S.C. Anderson, M.E. Hunsicker, and B.C. Williams. 2019. Long-term trends in ichthyoplankton assemblage structure, biodiversity, and synchrony in the Gulf of Alaska and their relationships to climate. *Progress in Oceanography*, 170:134 - 145. [link](#)
80. Shelton, A.O., W.H. Satterthwaite, **E.J. Ward**, B.E. Feist, and B.J. Burke. 2019. Using hierarchical models to estimate stock-specific and seasonal variation in ocean distribution, survivorship, and aggregate abundance of fall run Chinook salmon.. *Canadian Journal of Fisheries and Aquatic Sciences*, 76:95–108. [link](#)
79. Stock, B.C., **E.J. Ward**, J.T. Thorson, J.E. Jannot, and B.X. Semmens. 2019. The utility of spatial model-based estimators of unobserved bycatch. *ICES Journal of Marine Science*, 76:255–267. [link](#)
78. **Ward, E.J.**, H. Delgado-Nordmann, R.E. Brenner, A.H. Beaudreau, S.D. Moffitt, and A.O. Shelton. 2019. Assessing long-term changes in sex ratios of Pacific

- herring in Prince William Sound, Alaska. *Fisheries Research*, 211:300 - 308. [link](#)
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65. Boyd, C., D.P. DeMaster, R.S. Waples, **E.J. Ward**, and B.L. Taylor. 2017. Consistent extinction risk assessment under the U.S. Endangered Species Act. *Conservation Letters*, 10:328–336. [link](#)
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using state-space models: a case study for a threatened population of Chinook salmon in Johnson Creek, Idaho. *North American Journal of Fisheries Management*, 34:945–954. [link](#)

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24. **Ward, E.J.**, P.S. Levin, M.M. Lance, S.J. Jeffries, and A. Acevedo-Gutiérrez. 2012. Integrating diet and movement data to identify hot spots of predation risk and areas of conservation concern for endangered species. *Conservation Letters*, 5:37–47. [link](#)
23. Holtgrieve, G.W., D.E. Schindler, W.O. Hobbs, P.R. Leavitt, **E.J. Ward**, L. Bunting, G. Chen, B.P. Finney, I. Gregory-Eaves, S. Holmgren, M.J. Lisac, P.J. Lisi, K. Nydick, L.A. Rogers, J.E. Saros, D.T. Selbie, M.D. Shapley, P.B. Walsh, and A.P. Wolfe. 2011. A coherent signature of anthropogenic nitrogen deposition to remote watersheds of the northern hemisphere. *Science*, 334:1545–1548. [link](#)
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3. **Ward, E.J.** 2006. A new BEAST: Bayesian software tools for ecological trend analysis. *Wildlife Society Bulletin*, 34:1420–1424. [link](#)
2. Branch, T.A., R. Hilborn, A.C. Haynie, G. Fay, L. Flynn, J. Griffiths, K.N. Marshall, J.K. Randall, J.M. Scheuerell, **E.J. Ward**, and M. Young. 2006. Fleet dynamics and fishermen behavior: lessons for fisheries managers. *Canadian Journal of Fisheries and Aquatic Sciences*, 63:1647–1668. [link](#)
1. **Ward, E.J.** 2005. Differences between fishery-dependent and fishery-independent estimates of single-and mixed-species dolphin schools: implications for single-species stock assessments. *Marine Mammal Science*, 21:189–203. [link](#)

Technical Reports

26. PFMC Ad-hoc Working Group. 2020. Pacific Fishery Management Council Salmon Fishery Management Plan Impacts to Southern Resident Killer Whales: Draft Range of Alternatives and Recommendations. [link](#)
25. PFMC Ad-hoc Working Group. 2020. Pacific Fishery Management Council Salmon Fishery Management Plan Impacts to Southern Resident Killer Whales: Final Draft Risk Assessment. [link](#)
24. Jefferson, T.A., M.A. Smultea, **E.J. Ward**, and B. Berejekian. Harbor seal (*Phoca vitulina richardii*) stock size in the inland waters of Washington state: A novel approach. Puget Sound Partnership Scientific Research, Salish Sea Marine Survival Project. 2020.
23. Srinivasan, M., S.K. Brown, E. Markowitz, M. Soldevilla, E. Patterson, K. Forney, K. Murray, E. Ward, J.M. Ver Hoef, J. Redfern, and T. Eguchi. 2019. Proceedings of the 2nd National Protected Species Assessment Workshop. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-F/SPO-198, 52 p. [link](#)
22. Eguchi, T., C. Fahy, J. Jannot, K. Somers, and **E. Ward**. 2019. 2018 Leatherback sea turtle estimated bycatch reporting requirements as set out in the NMFS Biological Opinion for the continuing authorization of the Pacific Coast groundfish fisheries. National Marine Fisheries Service, SWFSC, La Jolla, CA 92039. [link](#)
21. Good, T. P., **E. Ward**, J. Jannot, R. Shama, and J. McVeigh. 2019. Observed and Estimated Bycatch of Short-tailed Albatross in U.S. West Coast Groundfish Fisheries 2002-2017. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. [link](#)
20. Harvey, C.J., N. Garfield, G.D. Williams, N. Tolimieri, E.L. Hazen, I.D. Schroeder, K.S. Andrews, C. Barceló, K. Barnas, S.J. Bograd, R.D. Brodeur, B.J. Burke, J.M. Cope, L. deWitt, J.C. Field, J.L. Fisher, T.P. Good, C.M. Greene, D.S. Holland, M.E. Hunsicker, M. Jacox, S. Kasperski, S.J. Kim, A. Leising, S.R. Melin, C.A. Morgan, B. Muhling, S.H. Munsch, K. Norman, W.T. Peterson, M.R. Poe, J.F. Samhour, W.J. Sydeman, J. Thayer, A.R. Thompson, A. Varney, B.K. Wells, T.H. Williams, J.E. Zamon, D. Lawson, S.C. Anderson, J. Gao, M.A. Litzow, S. McClatchie, **E.J.**

- Ward, S. Zador.** Ecosystem status report of the California Current for 2018: a summary of ecosystem indicators compiled by the California Current Integrated Ecosystem Assessment team (CCIEA). U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-NWFSC-145. [link](#)
19. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2017 Elwha River Steelhead Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
 18. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2017 Elwha River Chinook Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
 17. Ferguson, L., M. Srinivasan, E. Oleson, S. Hayes, S.K. Brown, R. Angliss, J. Carretta, E. Holmes, **E.J. Ward**, J. Kocik, K. Mullin, R. Dean, and J. Davis (eds.). 2017. Proceedings of the First National Protected Species Assessment Workshop. U.S. Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-F/SPO-172, 92 p. [link](#)
 16. Hanson, M.B., **E.J. Ward**, C.K. Emmons, M.M. Holt, and D.M. Holzer. 2017. Assessing the movements and occurrence of Southern Resident Killer Whales relative to the U.S. Navy's Northwest Training Range Complex in the Pacific Northwest. Prepared for: U.S. Navy, U.S. Pacific Fleet, Pearl Harbor, HI. Prepared by: National Oceanic and Atmospheric Administration, Northwest Fisheries Science Center under MIPR N00070-15-MP-4C363.[link](#)
 15. Eguchi, T., C. Fahy, J. Jannot, K. Somers, and **E. Ward**. 2017. 2016 Leatherback sea turtle estimated bycatch reporting requirements as set out in the NMFS Biological Opinion for the continuing authorization of the Pacific Coast groundfish fisheries. National Marine Fisheries Service, SWFSC, La Jolla, CA 92039. [link](#)
 14. Good, T. P., **E. Ward**, J. Jannot, R. Shama, N. Riley, and J. McVeigh. 2017. Observed and Estimated Bycatch of Short-tailed Albatross in U.S. West Coast Groundfish Fisheries 2014-2015. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. (link)[https://www.pcouncil.org/wp-content/uploads/2017/03/F5a-NMFS_Rpt6_ElectricOnly_STAL_bycatch_report_2017_Apr2017BB.pdf]
 13. Gustafson, R., Y.-W. Lee, **E. Ward**, K. Somers, V. Tuttle, J. Jannot, and J. McVeigh. 2017. Observed and Estimated Bycatch of Eulachon in 2002–2015 US West Coast Groundfish Fisheries. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. [link](#)
 12. Lee, Y.-W., R. Gustafson, J. Jannot, J. McVeigh, N. Riley, K. Somers, V. Tuttle, S. Wang, and **E. Ward**. 2017. Observed and Estimated Bycatch of Green Sturgeon in 2002–2015 US West Coast Groundfish Fisheries. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. [link](#)
 11. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2016 Elwha River Steelhead Escapement Estimate Based on

- DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
10. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2016 Elwha River Chinook Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
 9. Gustafson, R.G., L. Weitkamp, Y.W. Lee, **E.J. Ward**, K. Somers, V. Tuttle, and J. Jannot. 2016. Status Review Update of Eulachon (*Thaleichthys pacificus*) Listed under the Endangered Species Act: Southern Distinct Population Segment. [link](#)
 8. Gerrodette, T., **E.J. Ward**, R.L. Taylor, L.K. Schwarz, T. Eguchi, P.R. Wade, and G.K. Himes-Boor. 2016. Daniel Goodman's empirical approach to Bayesian statistics. Pre-print at PeerJ [link](#)
 7. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2015 Elwha River Steelhead Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
 6. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2015 Elwha River Chinook Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
 8. Eguchi, T., R. Bjorkland, C. Fahy, J. Jannot, T. Mitchell, K. Somers, **E. Ward**, B. Whiteside. 2015. Reporting requirements as set out in the NMFS Biological Opinion Leatherback sea turtles for the continuing authorization of the Pacific Coast groundfish fisheries. National Marine Fisheries Service, SWFSC, La Jolla, CA 92039. [link](#)
 7. Gustafson, R., Y.-W. Lee, **E. Ward**, K. Somers, V. Tuttle, J. Jannot. 2015. Observed and Estimated Bycatch of Eulachon in 2002–2013 US West Coast Groundfish Fisheries. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. [link](#)
 6. Lee, Y.-W., R. Gustafson, J. Jannot, J. McVeigh, N. Riley, K. Somers, V. Tuttle, S. Wang, **E. Ward**. 2015. The next link/button will exit from NWFSC web site Observed and Estimated Bycatch of Green Sturgeon in 2002–2013 US West Coast Groundfish Fisheries. National Marine Fisheries Service, NWFSC, 2725 Montlake Blvd E., Seattle, WA 98112. [link](#)
 5. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2014 Elwha River Steelhead Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.
 4. Denton, K., M. McHenry, R. Moses, **E.J. Ward**, M. Liermann, O. Stefankiv, W. Wells and G. Pess. 2014 Elwha River Chinook Escapement Estimate Based on DIDSON/ARIS Multi-Beam SONAR Data. Lower Elwha Tribe, Port Angeles, Washington.

3. **E.J. Ward**, M.J. Ford, R.G. Kope, J.K.B. Ford, A. Velez-Espino, C.K. Parken, L. LaVoy, M.B. Hanson, K.C. Balcomb. Estimating the impacts of Chinook salmon abundance and prey removal by ocean fishing on Southern Resident killer whale population dynamics. 2013. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-123, 71 p. [link](#)
2. Stout, H.A., P.W. Lawson, D.L. Bottom, T.D. Cooney, M.J. Ford, C.E. Jordan, R.G. Kope, L.M. Kruzic, G.R. Pess, G.H. Reeves, M.D. Scheuerell, T.C. Wainwright, R.S. Waples, **E.J. Ward**, L.A. Weitkamp, J.G. Williams, and T.H. Williams. 2012. Scientific conclusions of the status review for Oregon coast coho salmon (*Oncorhynchus kisutch*). U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-118, 242 p. [link](#)
1. Northwest Fisheries Science Center. 2011. Risk assessment of U.S. West Coast groundfish fisheries to threatened and endangered marine species. NWFSC, NMFS. 2725 Montlake Blvd E, Seattle, WA. [link](#)

Book Chapters

E.J. Ward 2012. Population Dynamics. In *Grzimek's Animal Life Encyclopedia*. pp. 195-208.

Teaching Experience

FISH 507: Applied Time Series Analysis, University of Washington 2012 - present
Co-taught course with Eli Holmes and Mark Scheuerell [webpage](#)

Ecological Society of America (ESA) 2008 - 2011
Co-taught Analysis of Multivariate Time-Series Data Using State-Space Models, and Introduction to MARSS

NWFSC R workshop (organized & taught) 2010 - 2011

Visiting lecturer University of Washington 2007 - 2009
Taught FSH 497 Introductory modeling and programming course

External Funding

2022-2023 Non-stationary relationships between climate and fisheries in the California Current. E.J. Ward, M. Hunsicker, B. Burke, W. Satterthwaite, M. Jacox, M. Litzow, M. Malick. NWFSC grant, \$118K

2022-2024 T. Essington, M.E. Hunsicker, S.C. Anderson, *E.J. Ward*, J.T. Thorson, S. Siedlecki, L. Barnett, R. Forrest. *Climate change, distribution shifts, and choke species: A threat assessment to advance fishery ecosystem planning*. Washington Sea Grant, \$250K

2021-2023 C.E. Jordan, M.E. Hunsicker, and E.J. Ward. *Developing a dashboard for salmon data and ecosystem indicators*. NOAA Protected Species Toolbox, \$150K

2019-2021 E.J. Ward, A.O. Shelton, R. Sharma, B. Nelson. *A spatially explicit model for evaluating threats to coho salmon in freshwater and marine life stages in the Northeast Pacific Ocean*. Pacific Salmon Commission, \$229K

2019-2021 D. Finnoff, E.J. Ward, T. Miller, T. Schwoerer, M. Horning, D. Dugan. *Thresholds in a changing ocean environment: bioeconomic implications to inform adaptation decisions for Alaska's salmon fisheries*. NOAA Ocean Acidification Program, \$1,050,000.

2018-2020 A.O. Shelton, J. Watson, C. Cunningham, E.J. Ward, A. Grey, M.J. Ford, K. Sommers. *Integrating Chinook Catches from Directed Fisheries and Trawl Bycatch to Improve Distribution Information for Bycatch Avoidance and Impacts On Predators in a Changing Environment*. NOAA Protected Species, \$200K.

2018-2020 E.J. Ward, C. Harvey, J. Samhour, etc. *Spatial ecosystem state and pressure indicators and scale-dependence of temporal indicator performance*. FATE (Fisheries And The Environment), \$192K.

2018-2020 M. Hunsicker, M. Litzow, E.J. Ward, B. Burke, S. Zador, C. Cunningham, and N. Bond. *Measuring the strength of ocean-atmosphere coupling to predict climate forcing of northeast Pacific ecosystems*. FATE (Fisheries And The Environment), \$198K.

2018-2020 G. Holtgrieve, C. Harvey, and E.J. Ward. *Reconstructing a Century of Coastal Productivity and Predator Trophic Dynamics using Compound-specific Stable Isotopes from Archival Bone Specimens*. Washington Sea Grant, \$192K.

2018-2020 L. Hauser, B. Vadopalas, R. Childer, B. Hudson, B. Eudeline, and E.J. Ward. *Development of genetic risk assessment tools and Management Strategy Evaluation for Aquaculture of Native Shellfish*. Saltonstall-Kennedy Grant, \$299K.

2017-2018 E.J. Ward, G. Holtgrieve, C. Harvey. *Reconstructing a ecosystem productivity and marine mammal trophic dynamics using compound-specific stable isotopes from bone specimens*. NWFSC Internal Grants Program

2016-2018 T.E. Essington, T.B. Francis, C. Greene, L. Kuehne, D. Lowry, E.J. Ward. *Recovering historical baselines in Puget Sound*. Washington Sea Grant, \$243K.

2016 E.J. Ward *Improving bycatch estimation through spatial statistics* \$100K.

2015 E.J. Ward, A.O. Shelton and M.J. Ford. *Portfolio Effects in Historic Chinook Hatchery Practices on Prey Availability for Southern Resident Killer Whales* National Fish and Wildlife Foundation, \$110K.

2014-2015 I. Kaplan, E.J. Ward, et al. *A spatially explicit ecosystem model for quantifying marine mammal impacts on Chinook salmon* Pacific Salmon Commission Southern Fund, \$206K.

2013-2014 T. Eguchi, E.J. Ward, and E.E. Holmes. *Developing risk assessment tools for marine sea turtles* \$100K.

2013-2014 Holmes, E.E. and E.J. Ward. *Developing web based computing tools for protected species*. \$200K.

2013 M.B. Hanson, E.J. Ward. et al. *Modeling the distribution of endangered killer whales in Pacific Northwest Navy ranges using acoustic recorder detections and satellite tagged whales*, US Navy.

2013 Shelton, A.O., E.J. Ward, J.T. Thorson, M. Bellman, B. Feist. *Integrating spatial habitat and fisheries effort data to improve abundance estimates of west coast groundfish*. \$56K.

2011 E.J. Ward et al., *Incorporating multiple data sources into a unified framework to improve estimates of adult salmon returns and population productivity*. \$33K.

2009 NSF *Comparative Analysis of Marine Ecosystem Organization: New statistical tools for analyzing community dynamics with applications to marine zooplankton*, \$347K (141K from NCEAS). Associate Investigator (Principal Investigator - E.E. Holmes)

Fellowships and Awards

2006 *Cumulative Risk Assessment for Endangered Species* 2 year NRC post-doc awarded \$92K.

2003 *National Marine Fisheries Service / Washington Sea Grant Fellowship in Population Dynamics*: Incorporating model selection and decision analysis into population dynamics modeling. Grant awarded for \$120K.

Post-docs

2023– Megan Feddern (UAF) Co-supervised with Curry Cunningham, Mary Hunsicker, Will Satterthwaite

2021–2023 Alex Jensen (UW) Co-supervised with Ryan Kelly, Ole Shelton, Will Satterthwaite

2019–2021 Christian Commander (NWFSC) Co-supervised with Lewis Barnett and Tim Essington

2017–2021 Ben Nelson (NWFSC) Co-supervised with Ole Shelton

2017–2019 Lewis Barnett (NWFSC)

2015–2017 Sean Anderson (Smith Fellow). Co-supervised with Trevor Branch

2012–2013 Guillaume Bal (NRC Research Post-doc). Co-supervised with Eli Holmes and Mark Scheuerell

2012 Jim Thorson (NRC Research Post-doc). With Michelle McClure, Eli Holmes, and Mark Scheuerell

Supervised Graduate Students or Committees

2021– Sierra Gilman (B. Gardner), SEFS, University of Washington

2019–2022 Sam May (K. Naish), SAFS, University of Washington

2017–2021 Natalie Lowell (L. Hauser), SAFS, University of Washington (NMFS Population Dynamics Fellowship)

2017–2021 Megan Feddern (G. Holtgrieve), SAFS, University of Washington

2017–2020 Elizabeth Ng (T. Essington), SAFS, University of Washington (NMFS Population Dynamics Fellowship)

2012–2018 Pam Moriarty (T. Essington), SAFS, University of Washington

2013–2016 Brandon Chasco (S. Heppell) Oregon State University (NMFS Population Dynamics Fellowship)

2014–2015 Brian Stock (B. Semmens) SIO, with Tomo Eguchi

2015–2016 Hannah Linder (J. Horne) UW

Awards

2022 NOAA Bronze Medal Award, Pacific Fisheries Management Council working group: “For leadership and problem-solving to develop innovative protections for Southern Resident killer whales and provide important fishing opportunities.”

Service and Outreach

Subject Editor, Ecological Applications 2013 - present

Subject Editor, PeerJ 2020 - present

Subject Editor, Methods in Ecology and Evolution 2022 - present

Puget Sound Seabird Survey 2005-2021

Developed survey methodology for Puget Sound's first land-based citizen science seabird survey and oversaw data analysis

Orca Bowl Washington State Sea Grant / University of Washington

Secretary & Treasurer, Statistical Ecology Section, Ecological Society of America 2010-2012