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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 Associate 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)

113. Ettinger, A., C. Harvey, J. Samhoury, C. Emmons, M. Hanson, **E.J. Ward**, and J. Olson. 2021. Shifting phenology of an endangered apex predator tracks changes in its favored prey. *Endangered Species Research*, .
112. Scheuerell, M., **E.J. Ward**, and S.L. Katz. 2021. Using replicate sampling and informative priors to improve estimates of species interaction strengths from time series data. *Limnology and Oceanography Letters*, .
111. Schwoerer, T., R. Dial, J. Little, A. Martin, J. Morton, J. Schmidt, and **E.J. Ward**. 2021. Flight plan for the future: floatplane pilots and researchers team up to predict invasive species dispersal in alaska. *Biological Invasions*, .
110. Feddern, M., **E. Ward**, A. Warlick, and G. Holtgrieve. 2021. Recent divergent changes in alaskan pinniped trophic position detected using compound- specific stable isotope analysis. *Marine Ecology Progress Series*, .
109. Hunsicker, M., **E. Ward**, M. Litzow, S. Anderson, C. Harvey, J. Field, J. Gao, M. Jacox, S. Melin, A. Thompson, and P. Warzybok. 2021. Tracking and forecasting community responses to climate perturbations in the california current ecosystem. *PLOS Climate*, .
108. Jannot, J.E., **E.J. Ward**, K.A. Somers, B.E. Feist, T.P. Good, D. Lawson, and J.V. Carretta. 2021. Using Bayesian models to estimate humpback whale entanglements in the united states west coast sablefish pot fishery. *Frontiers in Marine Science*, 8:1595. [link](#)

107. Ohlberger, J., **E. 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*, :.
106. **Ward, E.J.**, S. Anderson, M. Hunsicker, and M. Litzow. 2021. Smoothed dynamic factor analysis for identifying trends in multivariate time series. *Methods in Ecology and Evolution*, :.
105. Commander, C., L.B. Barnett, **E.J. Ward**, S.C. Anderson, and T.E. Essington. 2021. The shadow model: how and why small choices in dynamic species distribution models affect predictions. *PeerJ*, :.
104. English, P., **E.J. Ward**, C.N. Rooper, R.E. Forrest, L.A. Rogers, K.L. Hunter, A.M. Edwards, B.M. Connors, and S.C. Anderson. 2021. Contrasting climate velocity impacts in warm and cool locations: a meta-analysis across 38 demersal fish species in the northeast pacific. *Fish and Fisheries*, :. [link](#)
103. Waples, R.S., R.K. Waples, and **E.J. Ward**. 2021. Pseudoreplication in genomics-scale datasets. *Molecular Ecology Resources*, n/a: [link](#)
102. 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](#)
101. 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](#)
100. 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](#)
99. 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](#)
98. Feddern, M.L., G.W. Holtgrieve, and **E.J. Ward**. 2021. Stable isotope signatures in historic harbor seal bone link food web-assimilated carbon and nitrogen resources to a century of environmental change. *Global Change Biology*, 27:2328–2342. [link](#)
97. 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](#)
96. 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](#)
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](#)
93. Warlick, A.J., G.M. Ylitalo, S.M. O'Neill, M.B. Hanson, C. Emmons, and **E.J. Ward**. 2020. Using Bayesian stable isotope mixing models and generalized additive models to resolve diet changes for fish eating killer whales (*Orcinus orca*). *Marine Ecology Progress Series*, 649:189-200. [link](#)
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*, :. [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:. [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](#)
84. Gonzalez, S., J.K. Horne, and **E.J. Ward**. 2019. Temporal variability in pelagic biomass distributions at wave and tidal sites and implications for standardization of biological monitoring. *International Marine Energy Journal*, 2:15-28. [link](#)
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](#)
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 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](#)
 77. Stock, B.C., **E.J. Ward**, T. Eguchi, J.E. Jannot, J.T. Thorson, B.E. Feist, and B.X. Semmens. 2018. Comparing predictions of fisheries bycatch using multiple spatiotemporal species distribution model frameworks. *Canadian Journal of Fisheries and Aquatic Sciences*, :. [link](#)
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 75. Ford, M.J., K.M. Parsons, **E.J. Ward**, J.A. Hempelmann, C.K. Emmons, M.B. Hanson, K.C. Balcomb, and L.K. Park. 2018. Inbreeding in an endangered killer whale population. *Animal Conservation*, 21:423-432. [link](#)
 74. **Ward, E.J.**, K.L. Oken, K.A. Rose, S. Sable, K. Watkins, E.E. Holmes, and M.D. Scheuerell. 2018. Applying spatiotemporal models to monitoring data to quantify fish population responses to the Deepwater Horizon oil spill in the Gulf of Mexico. *Environmental Monitoring and Assessment*, 190:530. [link](#)
 73. Stock, B.C., A.L. Jackson, **E.J. Ward**, A.C. Parnell, D.L. Phillips, and B.X. Semmens. 2018. Analyzing mixing systems using a new generation of Bayesian tracer mixing models. *PeerJ*, 6:e5096. [link](#)
 72. Bal, G., M.D. Scheuerell, and **E.J. Ward**. 2018. Characterizing the strength of density dependence in at-risk species through Bayesian model averaging. *Ecological Modelling*, 381:1-9. [link](#)
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69. Linder, H.L., J.K. Horne, and **E.J. Ward**. 2017. Modeling baseline conditions of ecological indicators: marine renewable energy environmental monitoring. *Ecological Indicators*, 83:178–191. [link](#)
68. Chasco, B.E., I.C. Kaplan, A.C. Thomas, A. Acevedo-Gutiérrez, D.P. Noren, M.J. Ford, M.B. Hanson, J.J. Scordino, S.J. Jeffries, K.N. Marshall, A.O. Shelton, C. Matkin, B.J. Burke, and **E.J. Ward**. 2017. Competing tradeoffs between increasing marine mammal predation and fisheries harvest of Chinook salmon. *Scientific Reports*, 7:15439. [link](#)
67. Anderson, S.C., **E.J. Ward**, A.O. Shelton, M.D. Adkison, A.H. Beaudreau, R.E. Brenner, A.C. Haynie, J.C. Shriver, J.T. Watson, and B.C. Williams. 2017. Benefits and risks of diversification for individual fishers. *Proceedings of the National Academy of Sciences*, 114:10797–10802. [link](#)
66. Deacy, W.W., J.B. Armstrong, W.B. Leacock, C.T. Robbins, D.D. Gustine, **E.J. Ward**, J.A. Erlenbach, and J.A. Stanford. 2017. Phenological synchronization disrupts trophic interactions between Kodiak brown bears and salmon. *Proceedings of the National Academy of Sciences*, 114:10432–10437. [link](#)
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](#)
64. Hussey, N.E., J.D. DiBattista, J.W. Moore, **E.J. Ward**, A.T. Fisk, S. Kessel, T.L. Guttridge, K.A. Feldheim, B.R. Franks, S.H. Gruber, O.C. Weideli, and D.D. Chapman. 2017. Risky business for a juvenile marine predator? Testing the influence of foraging strategies on size and growth rate under natural conditions. *Proceedings. Biological Sciences*, 284:. [link](#)
63. **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. [link](#)
62. Chasco, B., I.C. Kaplan, A. Thomas, A. Acevedo-Gutiérrez, D. Noren, M.J. Ford, M.B. Hanson, J. Scordino, S. Jeffries, S. Pearson, K.N. Marshall, and **E.J. Ward**. 2017. Estimates of Chinook salmon consumption in Washington State inland waters by four marine mammal predators from 1970 to 2015. *Canadian Journal of Fisheries and Aquatic Sciences*, 74:1173–1194. [link](#)
61. Moriarty, P.E., T.E. Essington, and **E.J. Ward**. 2016. A novel method to estimate prey contributions to predator diets. *Canadian Journal of Fisheries and Aquatic Sciences*, 74:168–177. [link](#)
60. Thorson, J.T., M.L. Pinsky, and **E.J. Ward**. 2016. Model-based inference for estimating shifts in species distribution, area occupied and centre of gravity. *Methods in Ecology and Evolution*, 7:990–1002. [link](#)

59. Adams, J., I.C. Kaplan, B. Chasco, K.N. Marshall, A. Acevedo-Gutiérrez, and **E.J. Ward**. 2016. A century of Chinook salmon consumption by marine mammal predators in the Northeast Pacific Ocean. *Ecological Informatics*, 34:44–51. [link](#)
58. Stier, A.C., J.F. Samhour, M. Novak, K.N. Marshall, **E.J. Ward**, R.D. Holt, and P.S. Levin. 2016. Ecosystem context and historical contingency in apex predator recoveries. *Science Advances*, 2:e1501769. [link](#)
57. Jorgensen, J.C., **E.J. Ward**, M.D. Scheuerell, and R.W. Zabel. 2016. Assessing spatial covariance among time series of abundance. *Ecology and Evolution*, 6:2472–2485. [link](#)
56. Ono, K., A.O. Shelton, **E.J. Ward**, J.T. Thorson, B.E. Feist, and R. Hilborn. 2016. Space-time investigation of the effects of fishing on fish populations. *Ecological Applications*, 26:392–406. [link](#)
55. **Ward, E.J.**, M.E. Dahlheim, J.M. Waite, C.K. Emmons, K.N. Marshall, B.E. Chasco, and K.C. Balcomb. 2016. Long-distance migration of prey synchronizes demographic rates of top predators across broad spatial scales. *Ecosphere*, 7:n/a–n/a. [link](#)
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42. Chasco, B.E., **E.J. Ward**, J.A. Hesse, C. Rabe, R. Kinzer, J.L. Vogel, and R. Orme. 2014. Evaluating the accuracy and precision of multiple abundance estimators 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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- community dynamics with multivariate autoregressive (MAR) models. *Ecology*, 94:2663–2669. [link](#)
33. Hanson, M.B., C.K. Emmons, **E.J. Ward**, J.A. Nystuen, and M.O. Lammers. 2013. Assessing the coastal occurrence of endangered killer whales using autonomous passive acoustic recorders. *The Journal of the Acoustical Society of America*, 134:3486–3495. [link](#)
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 18. Yeakel, J.D., M. Novak, P.R.G. Jr, N.J. Dominy, P.L. Koch, **E.J. Ward**, J.W. Moore, and B.X. Semmens. 2011. Merging resource availability with isotope mixing models: the role of neutral interaction assumptions. *PLOS ONE*, 6:e22015. [link](#)
 17. Berntson, E.A., R.W. Carmichael, M.W. Flesher, **E.J. Ward**, and P. Moran. 2011. Diminished reproductive success of steelhead from a hatchery supplementation program (Little Sheep Creek, Imnaha Basin, Oregon). *Transactions of the American Fisheries Society*, 140:685–698. [link](#)
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 15. **Ward, E.J.**, B.X. Semmens, E.E. Holmes, and K.C.B. Iii. 2011. Effects of multiple levels of social organization on survival and abundance. *Conservation Biology*, 25:350–355. [link](#)
 14. **Ward, E.J.**, B.X. Semmens, D.L. Phillips, J.W. Moore, and N. Bouwes. 2011. A quantitative approach to combine sources in stable isotope mixing models. *Ecosphere*, 2:1–11. [link](#)
 13. Williamson, K.S., A.R. Murdoch, T.N. Pearsons, **E.J. Ward**, and M.J. Ford. 2010. Factors influencing the relative fitness of hatchery and wild spring Chinook salmon (*Oncorhynchus tshawytscha*) in the Wenatchee River, Washington, USA. *Canadian Journal of Fisheries and Aquatic Sciences*, 67:1840–1851. [link](#)
 12. **Ward, E.J.**, B.X. Semmens, and D.E. Schindler. 2010. Including source uncertainty and prior information in the analysis of stable isotope mixing models. *Environmental Science & Technology*, 44:4645–4650. [link](#)
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 10. **Ward, E.J.**, H. Chirakkal, M. González-Suárez, D. Auriol-Gamboa, E.E. Holmes, and L. Gerber. 2010. Inferring spatial structure from time-series data: using multivariate state-space models to detect metapopulation structure of California

- sea lions in the Gulf of California, Mexico. *Journal of Applied Ecology*, 47:47–56. [link](#)
9. Semmens, B.X., **E.J. Ward**, J.W. Moore, and C.T. Darimont. 2009. Quantifying inter- and intra-population niche variability using hierarchical Bayesian stable isotope mixing models. *PLOS ONE*, 4:e6187. [link](#)
 8. **Ward, E.J.**, E.E. Holmes, and K.C. Balcomb. 2009. Quantifying the effects of prey abundance on killer whale reproduction. *Journal of Applied Ecology*, 46:632–640. [link](#)
 7. Semmens, B.X., J.W. Moore, and **E.J. Ward**. 2009. Improving Bayesian isotope mixing models: a response to Jackson et al. (2009). *Ecology Letters*, 12:E6–E8. [link](#)
 6. **Ward, E.J.**, K. Parsons, E.E. Holmes, K.C. Balcomb, and J.K. Ford. 2009. The role of menopause and reproductive senescence in a long-lived social mammal. *Frontiers in Zoology*, 6:4. [link](#)
 5. **Ward, E.J.** 2008. A review and comparison of four commonly used Bayesian and maximum likelihood model selection tools. *Ecological Modelling*, 211:1–10. [link](#)
 4. **Ward, E.J.**, R. Hilborn, R.G. Towell, and L. Gerber. 2007. A state–space mixture approach for estimating catastrophic events in time series data. *Canadian Journal of Fisheries and Aquatic Sciences*, 64:899–910. [link](#)
 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. PFMCM 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. PFMCM 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

2021– 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

Service and Outreach

Subject Editor, Ecological Applications 2013 - 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