

Eric J. Ward

Statistician & Research Biologist

Northwest Fisheries Science Center · 2725 Montlake Blvd E · Seattle, WA

E-mail: eric.ward@noaa.gov Phone: 206-302-1745 Web: eric-ward.github.io

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)

76. Anderson, S., and **E. Ward**. 2018. Black swans in space: modelling spatiotemporal processes with extremes. *Ecology*, .:
75. Bal, G., M. Scheuerell, and **E. Ward**. 2018. Characterizing the strength of density dependence in at-risk species through bayesian model averaging. *Ecological Modelling*, .:
74. 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*, --:-. [link](#)
73. Ohlberger, J., **E.J. Ward**, D.E. Schindler, and B. Lewis. 2018. Demographic changes in chinook salmon across the northeast pacific ocean. *Fish and Fisheries*, --:--.
72. Shelton, A.O., M.E. Hunsicker, **E.J. Ward**, B.E. Feist, R. Blake, C.L. Ward, B.C. Williams, J.T. Duffy-Anderson, A.B. Hollowed, and A.C. Haynie. 2018. Spatio-temporal models reveal subtle changes to demersal communities following the exxon valdez oil spill. *ICES Journal of Marine Science*, 75:287–297. [link](#)
71. Shelton, A.O., W.H. Satterthwaite, **E.J. Ward**, B.E. Feist, and B.J. Burke. 2018. 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*, .: [link](#)

70. **Ward, E.J.**, S.C. Anderson, A.O. Shelton, R.E. Brenner, M.D. Adkison, A.H. Beaudreau, J.T. Watson, J.C. Shriver, A.C. Haynie, and B.C. Williams. 2018. Effects of increased specialization on revenue of alaskan salmon fishers over four decades. *Journal of Applied Ecology*, 55:1082–1091. [link](#)
69. 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](#)
68. 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](#)
67. 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](#)
66. 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](#)
65. 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](#)
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. 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](#)
62. **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](#)
61. 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](#)
60. Armstrong, J.B., **E.J. Ward**, D.E. Schindler, and P.J. Lisi. 2016. Adaptive capacity at the northern front: sockeye salmon behaviourally thermoregulate during novel exposure to warm temperatures. *Conservation Physiology*, 4:. [link](#)

59. 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](#)
58. Marshall, K.N., A.C. Stier, J.F. Samhouri, R.P. Kelly, and **E.J. Ward**. 2016. Conservation challenges of predator recovery. *Conservation Letters*, 9:70–78. [link](#)
57. 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](#)
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. Stier, A.C., J.F. Samhouri, 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](#)
54. 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](#)
53. **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](#)
52. Bjorkland, R.H., S.F. Pearson, S.J. Jeffries, M.M. Lance, A. Acevedo-Gutiérrez, and **E.J. Ward**. 2015. Stable isotope mixing models elucidate sex and size effects on the diet of a generalist marine predator. *Marine Ecology Progress Series*, 526:213–225. [link](#)
51. Galloway, A.W.E., M.T. Brett, G.W. Holtgrieve, **E.J. Ward**, A.P. Ballantyne, C.W. Burns, M.J. Kainz, D.C. Müller-Navarra, J. Persson, J.L. Ravet, U. Strandberg, S.J. Taipale, and G. Alhgren. 2015. A fatty acid based bayesian approach for inferring diet in aquatic consumers. *PLOS ONE*, 10:e0129723. [link](#)
50. Sergeant, C.J., J.B. Armstrong, and **E.J. Ward**. 2015. Predator-prey migration phenologies remain synchronised in a warming catchment. *Freshwater Biology*, 60:724–732. [link](#)
49. Thorson, J.T., J.M. Cope, K.M. Kleisner, J.F. Samhouri, A.O. Shelton, and **E.J. Ward**. 2015. Giants’ shoulders 15 years later: lessons, challenges and guidelines in fisheries meta-analysis. *Fish and Fisheries*, 16:342–361. [link](#)
48. Thorson, J.T., A.O. Shelton, **E.J. Ward**, and H.J. Skaug. 2015. Geostatistical delta-generalized linear mixed models improve precision for estimated abundance indices for west coast groundfishes. *ICES Journal of Marine Science*, 72:1297–1310. [link](#)
47. Thorson, J.T., H.J. Skaug, K. Kristensen, A.O. Shelton, **E.J. Ward**, J.H. Harms, and J.A. Benante. 2015. The importance of spatial models for estimating the strength of density dependence. *Ecology*, 96:1202–1212. [link](#)

46. **Ward, E.J.**, J.H. Anderson, T.J. Beechie, G.R. Pess, and M.J. Ford. 2015. Increasing hydrologic variability threatens depleted anadromous fish populations. *Global Change Biology*, 21:2500–2509. [link](#)
45. **Ward, E.J.**, J.E. Jannot, Y. Lee, K. Ono, A.O. Shelton, and J.T. Thorson. 2015. Using spatiotemporal species distribution models to identify temporally evolving hotspots of species co-occurrence. *Ecological Applications*, 25:2198–2209. [link](#)
44. **Ward, E.J.**, K.N. Marshall, T. Ross, A. Sedgley, T. Hass, S.F. Pearson, G. Joyce, N.J. Hamel, P.J. Hodum, and R. Faucett. 2015. Using citizen-science data to identify local hotspots of seabird occurrence. *PeerJ*, 3:e704. [link](#)
43. Westley, P.A.H., A.H. Dittman, **E.J. Ward**, and T.P. Quinn. 2015. Signals of climate, conspecific density, and watershed features in patterns of homing and dispersal by pacific salmon. *Ecology*, 96:2823–2833. [link](#)
42. Anlauf-Dunn, K.J., **E.J. Ward**, M. Strickland, and K. Jones. 2014. Habitat connectivity, complexity, and quality: predicting adult coho salmon occupancy and abundance. *Canadian Journal of Fisheries and Aquatic Sciences*, 71:1864–1876. [link](#)
41. Bodey, T.W., **E.J. Ward**, R.A. Phillips, R.A.R. McGill, and S. Bearhop. 2014. Species versus guild level differentiation revealed across the annual cycle by isotopic niche examination. *Journal of Animal Ecology*, 83:470–478. [link](#)
40. 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](#)
39. Nosrati, K., G. Govers, B.X. Semmens, and **E.J. Ward**. 2014. A mixing model to incorporate uncertainty in sediment fingerprinting. *Geoderma*, 217-218:173–180. [link](#)
38. Phillips, D.L., R. Inger, S. Bearhop, A.L. Jackson, J.W. Moore, A.C. Parnell, B.X. Semmens, and **E.J. Ward**. 2014. Best practices for use of stable isotope mixing models in food-web studies. *Canadian Journal of Zoology*, 92:823–835. [link](#)
37. Shelton, A.O., J.T. Thorson, **E.J. Ward**, and B.E. Feist. 2014. Spatial semiparametric models improve estimates of species abundance and distribution. *Canadian Journal of Fisheries and Aquatic Sciences*, 71:1655–1666. [link](#)
36. Thorson, J.T., and **E.J. Ward**. 2014. Accounting for vessel effects when standardizing catch rates from cooperative surveys. *Fisheries Research*, 155:168–176. [link](#)
35. **Ward, E.J.**, E.E. Holmes, J.T. Thorson, and B. Collen. 2014. Complexity is costly: a meta-analysis of parametric and non-parametric methods for short-term population forecasting. *Oikos*, 123:652–661. [link](#)
34. Hampton, S.E., E.E. Holmes, L.P. Scheef, M.D. Scheuerell, S.L. Katz, D.E. Pendleton, and **E.J. Ward**. 2013. Quantifying effects of abiotic and biotic drivers on 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](#)
32. Holtgrieve, G.W., M.E. Arias, K.N. Irvine, D. Lamberts, **E.J. Ward**, M. Kumm, J. Koponen, J. Sarkkula, and J.E. Richey. 2013. Patterns of ecosystem metabolism in the tonle sap lake, cambodia with links to capture fisheries. *PLOS ONE*, 8:e71395. [link](#)
31. Parnell, A.C., D.L. Phillips, S. Bearhop, B.X. Semmens, **E.J. Ward**, J.W. Moore, A.L. Jackson, J. Grey, D.J. Kelly, and R. Inger. 2013. Bayesian stable isotope mixing models. *Environmetrics*, 24:387–399. [link](#)
30. Semmens, B.X., **E.J. Ward**, A.C. Parnell, D.L. Phillips, S. Bearhop, R. Inger, A. Jackson, and J.W. Moore. 2013. Statistical basis and outputs of stable isotope mixing models: comment on fry (2013). *Marine Ecology Progress Series*, 490:285–289. [link](#)
29. Thorson, J.T., and **E.J. Ward**. 2013. Accounting for space–time interactions in index standardization models. *Fisheries Research*, 147:426–433. [link](#)
28. Daele, M.V., C. Robbins, B. Semmens, **E. Ward**, L.V. Daele, and W. Leacock. 2013. Salmon consumption by kodiak brown bears (*ursus arctos middendorffi*) with ecosystem management implications. *Canadian Journal of Zoology*, 91:164–174. [link](#)
27. Westley, P.A.H., **E.J. Ward**, and I.A. Fleming. 2013. Fine-scale local adaptation in an invasive freshwater fish has evolved in contemporary time. *Proceedings of the Royal Society of London B: Biological Sciences*, 280:20122327. [link](#)
26. Holmes, E., **E.J. Ward**, and K. Wills. 2012. MARSS: multivariate autoregressive state-space models for analyzing time-series data. *R Journal*, 4:11–19.
25. **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](#)
24. **Ward, E.J.**, G.R. Pess, K. Anlauf-Dunn, and C.E. Jordan. 2012. Applying time series models with spatial correlation to identify the scale of variation in habitat metrics related to threatened coho salmon (*oncorhynchus kisutch*) in the pacific northwest. *Canadian Journal of Fisheries and Aquatic Sciences*, 69:1773–1782. [link](#)
23. Anderson, J.H., **E.J. Ward**, and S.M. Carlson. 2011. A model for estimating the minimum number of offspring to sample in studies of reproductive success. *Journal of Heredity*, 102:567–576. [link](#)
22. 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](#)
21. Francis, T.B., D.E. Schindler, G.W. Holtgrieve, E.R. Larson, M.D. Scheuerell, B.X. Semmens, and **E.J. Ward**. 2011. Habitat structure determines resource use by

- zooplankton in temperate lakes. *Ecology Letters*, 14:364–372. [link](#)
20. 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](#)
 19. Pattengill-Semmens, C., B. Semmens, E. Holmes, **E.J. Ward**, and B. Ruttenberg. 2011. Integrating time-series of community monitoring data. *Proceedings of the 63rd Gulf and Caribbean Fisheries Institute*, 63:214–216.
 18. **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](#)
 17. **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](#)
 16. **Ward, E.**, A. Zerbini, P. Kinas, M. H.Engel, and A. Andriolo. 2011. Estimates of population growth rates of humpback whales (megaptera novaeangliae) in the wintering grounds off the coast of brazil (breeding stock a). *Journal of Cetacean Research and Management*, Special Issue:145–149.
 15. 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](#)
 14. Zerbini, A., **E.J. Ward**, P. Kinas, M. H.Engel, and A. Andriolo. 2011. A bayesian assessment of the conservation status of humpback whales (megaptera novaeangliae) in the western atlantic ocean (breeding stock a). *Journal of Cetacean Research and Management*, Special Issue:131–144.
 13. **Ward, E.J.**, H. Chirakkal, M. González-Suárez, D. Auriolos-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](#)
 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](#)
 11. Warren, D.R., M.M. Mineau, **E.J. Ward**, and C.E. Kraft. 2010. Relating fish biomass to habitat and chemistry in headwater streams of the northeastern united states. *Environmental Biology of Fishes*, 88:51–62. [link](#)
 10. 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](#)
 9. 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](#)

8. 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](#)
7. **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](#)
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. 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](#)
2. **Ward, E.J.** 2006. A new beast: bayesian software tools for ecological trend analysis. *Wildlife Society Bulletin*, 34:1420–1424. [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

12. 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](#)
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.
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.
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.
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.
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.
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.
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

<i>FISH 507: Applied Time Series Analysis</i> , University of Washington Co-taught course with Eli Holmes and Mark Scheuerell webpage	2012 - present
<i>Ecological Society of America (ESA)</i> Co-taught Analysis of Multivariate Time-Series Data Using State-Space Models, and Introduction to MARSS	2008 - 2011
NWFSC <i>R workshop</i> (organized & taught)	2010 - 2011

External Funding

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, \$200K.

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), \$73K. **2018-2020** E.J. Ward, C. Harvey, J. Samhouri, etc. *Spatial ecosystem state and pressure indicators and scale-dependence of temporal indicator performance*. FATE (Fisheries And The Environment), \$192K.

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

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

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

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

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

2017- Lewis Barnett (NWFSC)

Supervised Graduate Students or Committees

2017- Natalie Lowell (L. Hauser), SAFS, University of Washington

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

2012-2017 Pam Moriarty (T. Essington), SAFS, University of Washington

2013-2016 Brandon Chasco (S. Heppell) Oregon State University

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-present
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