

Ann L. Miracle
Statement of Professional Qualifications

Senior Scientist in the Environmental Assessment Group, Earth Systems Science Division, Pacific Northwest National Laboratory, Richland, WA.

Education:

Ph.D., Molecular Immunology, University of South Florida, Tampa, 2001.
M.S. Degree, Molecular Genetics, University of Florida, Gainesville, 1993.
B.A. Degree, Biology, University of Virginia, Charlottesville, 1988.

Qualifications:

Dr. Miracle has over 10 years' experience at PNNL and 4 years' experience with the USEPA in aquatic ecology, Endangered Species Act consultation, ecological risk assessment, and environmental impact assessment. At PNNL, she participated in the preparation of two programmatic EISs related to the Office of Energy Initiatives, U.S. Army program.

Dr. Miracle has provided assistance to the Nuclear Regulatory Commission (NRC) in the completion of environmental impact assessments. In her involvement with NRC, Dr. Miracle has conducted aquatic ecology assessments, biological assessments for consultation with U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS), and essential fish habitat assessments for consultation with the NMFS.

Employment History and Selected Projects:

May 2005 to Present — PACIFIC NORTHWEST NATIONAL LABORATORY, Richland, WA.

Dr. Miracle is a senior scientist specializing in aquatic ecology, NEPA, and protected species/habitat assessments, including the assessment of effects to aquatic resources from nuclear energy licensing and relicensing, renewable energy projects such as marine hydrokinetic systems, solar arrays, and hydropower. She has managed project teams and mentored staff for a number of programs over the last 10 years. Dr. Miracle has recently been appointed to serve as the Aquatic Ecology Subcommittee Chair under the Environmental and Siting Consensus Committee to develop new standards for aquatic resources under the American Nuclear Society.

Dr. Miracle has prepared technical reviews on aquatic resources for new nuclear reactor licensing for the Levy COLA, V.C. Summer COLA, Bell Bend COLA, Turkey Point COLA, and the PSEG ESP. In addition, Dr. Miracle prepared the Endangered Species Act Section 7 consultation and Magnuson-Stevens Act Essential Fish Habitat assessments for the technical reviews identified. Dr. Miracle served as the PNNL project task lead for the technical preparation of the final Environmental Impact Statement for the Levy COLA, and is the current PNNL project task lead for the Turkey Point COLA. Dr. Miracle currently serves as the project task lead for preparation of a programmatic Environmental Assessment for solar array installation for the U.S. Army.

July 2001 to April 2005 — National Exposure Research Laboratory, U.S. EPA, Cincinnati, OH.

Prior to her current position, Dr. Miracle worked for the U.S. Environmental Protection Agency first as a post-doctoral fellow, then as a research scientist and helped to develop molecular screening criteria for aquatic species in environmental risk assessments.

August 1997 to June 2001 — University of South Florida, Tampa, FL.

Dr. Miracle's graduate research centered on physiology and conservation of commercially important and protected marine species found in coastal Florida waters.

February 1994 to July 1997 — Florida Marine Research Institute, St. Petersburg, FL.

Dr. Miracle served as a marine biologist for the State of Florida and assisted with population analyses of crab and fish species in Florida waters.

June 1992 to December 1993 — University of Florida, Gainesville, FL.

Dr. Miracle examined the genetic diversity of Florida fish populations, and earned a Master of Science degree.

Professional/Academic Awards and Honors:

Outstanding Performance Award, PNNL, 2006, 2008, 2009, 2011, 2013, 2014, 2015

ORD Science Communications Award, USEPA, 2005

Bronze Medal Recipient, USEPA, 2003

Superior Accomplishment Recognition Award, USEPA, 2002 & 2004

Graduate Student of the Year, 1993, Department of Fisheries and Aquatic Sciences, University of Florida

Selected Publications:

Preparation of aquatic ecology final environmental impact statement for the Combined Licenses for Turkey Point Nuclear Plant Units 6 and 7, Final EIS published October, 2016, NUREG-2176.

Preparation of aquatic ecology final environmental impact statement for the Combined License for the Bell Bend Nuclear Power Plant, Final EIS published April, 2016, NUREG-2179.

Preparation of aquatic ecology final environmental impact statement for the PSEG (Salem County, NJ) early site permit, Biological Assessment to NMFS, Essential Fish Habitat Assessment to NMFS, Final EIS published November, 2015, NUREG-2168.

Preparation of aquatic ecology draft environmental impact statement for the Combined License for the Bell Bend Nuclear Power Plant, Draft EIS published April, 2015, NUREG-2179.

Preparation of aquatic ecology draft environmental impact statement for the PSEG (Salem County, NJ) early site permit, Biological Assessment to NMFS, Essential Fish Habitat Assessment to NMFS, Draft EIS published August, 2014, NUREG-2168.

Preparation of aquatic ecology environmental impact statement for the license renewal of Limerick Generating Station Units 1 and 2, Final Report published August 2014, NUREG-1437, Supplement 49.

Miracle, A.L. 2014. "Environmental Biomarkers". *In*: Encyclopedia of Toxicology, 3rd Edition. Elsevier. Academic Press, pp. 476–478.

Team Lead and preparation of aquatic ecology portions of the Final Environmental Impact Statement for the Levy Nuclear Plant (Levy County, FL) combined construction and operation license, Biological Assessment to FWS, Biological Assessment to NMFS, Essential Fish Habitat Assessment to NMFS, April 27, 2012, NUREG-1941.

Essential Fish Habitat Assessment for St. Lucie Units 1 and 2 License Amendment for Extended Power Uprate. January 2012, Docket No. 50-335 and 50-389.

Preparation of aquatic ecology final environmental impact statement for the V.C. Summer Nuclear Station (Fairfield County, SC) combined construction and operation license, Biological Assessment to FWS, Essential Fish Habitat Assessment to NMFS, Final EIS published in April 2011, NUREG-1939.

Preparation of aquatic ecology draft environmental impact statement for the Levy Nuclear Plant (Levy County, FL) combined construction and operation license, Biological Assessment to FWS, Biological Assessment to NMFS, Essential Fish Habitat Assessment to NMFS, Draft EIS published in August 2010, NUREG-1941.

Miracle, A.L., ND Denslow, KJ Kroll, MC Liu, and KK Wang. 2009. Spillway-induced salmon head injury triggers proteolytic degradation of brain α -spectrin similar to mammalian traumatic brain injury: Development of a biomarker assay. *PLoS ONE* 4(2):e4491. *Epub* 2009 Feb 13.

Miracle, A.L., J Duncan, C. Jonason, and T. Carlson. 2008. Head Injury Biomarker Expression for Assessing Subacute Injury and Use of a Sensor Fish Device to Characterize Passage Conditions for Juvenile Chinook Salmon Passing Through the Removable Spillway Weir at Lower Monumental Dam, 2008. U.S. Army Corps of Engineers Final Report, Walla Walla District.

Miracle, A.L. 2008. Head Injury Biomarker Expression Comparison Between Brain Tissue and Blood Samples in Juvenile Chinook Salmon at McNary Dam, 2007. U.S. Army Corps of Engineers Technical Memorandum, Walla Walla District.

Miracle, A. 2008. Head Injury Assessment of Juvenile Chinook Salmon Spill Passage Routes at McNary Dam, 2007. U.S. Army Corps of Engineers Technical Report, Walla Walla District.

Mesa MG, MH Averbeck, AG Maule, D Elliott, and AL Miracle. 2008. Mechanisms of Delayed Mortality in Juvenile Salmonids Outmigrating in the Columbia River Basin. U.S. Army Corps of Engineers Technical Report, Walla Walla District.

Miracle, A.L., Evans, C.W., Ferguson, E.A., Greenberg, B., Kille, P., Schaeffner, A.R., Sprenger, M., van Aerle, R., Versteeg, D.J. "Applications of genomic technologies to ecological risk assessments at remediation / restoration sites", in Toxicogenomics in Regulatory Ecotoxicology (Ankley, G.A., Miracle, A.L., Perkins, E., eds.), SETAC Publishing, 2008.

Villeneuve, D., Knoebl, I., Larkin, P., Miracle, A., Carter, B., Denslow, N., and Ankley, G. 2008. Altered gene expression in the brain and liver of female fathead minnows exposed to fadrozole: discovery-driven analysis using a 2000 gene microarray. J Fish Biol. 72(9):2281-2340.

Villeneuve, D.L., Blake, L.S., Brodin, J.D., Greene, K.J., Knoebl, I., Miracle, A.L., Martinovic, D., and Ankley, G.T. 2007. Transcription of key genes regulating gonadal steroidogenesis in control and ketoconazole- or vinclozolin-exposed fathead minnows. Toxicol Sci 98(2):395-407.

Larkin, P., Villeneuve, D., Knoebl, I., Miracle, A., Carter, B., Liu, L., Denslow, N., and Ankley, G. 2007. Development and validation of a 2,000 gene microarray in the fathead minnow, *Pimephales promelas*. Environ Toxicol Chem. 26(7):1497-1506.

Villeneuve, D.L., Miracle, A.L., Jensen, K.M., Degitz, S.J., Kahl, M.D., Korte, J.J., Greene, K.J., Blake, L.S., Linnam, A., and Ankley, G.T. 2007. Development of quantitative real-time PCR assays for fathead minnow (*Pimephales promelas*) gonadotropin beta subunit mRNAs to support endocrine disruptor research. Comp.Biochem Physiol C: Toxicol Pharmacol 145(2):171-183.

Cook, J.C., Denslow, N.D., Iguchi, T., Linney, E.A., Miracle, A.L., Shaw, J.R., Viant, M.R. and Zacharewski, T.R. "“Omics” approaches in the context of environmental toxicology", in Genomic Approaches for Cross-Species Extrapolation in Toxicology (Benson, W.H. and DiGiulio, R.T., eds), SETAC Publishing, 2007.

Villeneuve, D.L., Larkin, P., Knoebl, I., Miracle, A.L., Kahl, M.D., Jensen, K.M., Makynen, E.A., Durhan, E.J., Denslow, N.D., and Ankley G.T. 2007. A graphical systems model to facilitate hypothesis-based ecotoxicogenomics research on the teleost brain-pituitary-gonadal axis. Environ Sci and Technol. 41(1):321-330.

Ankley, G. T., Daston, G., Degitz, S., Denslow, N., Hoke, R., Kennedy, S., Miracle, A., Perkins, E., Snape, J., Tillitt, D., Tyler, C., Versteeg, D. Toxicogenomics in regulatory ecotoxicology: Potential applications and practical challenges. 2006. Environ. Sci. Toxicol. 40(13):4055-65.

Miracle, A.L., Ankley, G.T. and Lattier, D.L. Expression of two vitellogenin genes (*vg1* and *vg3*) in fathead minnow (*Pimephales promelas*) liver in response to exposure to steroidal estrogens and androgens. 2006. Ecotoxicol. Environ. Saf. 63:337-342

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Miracle, A.L., Hawke, N.A., Anderson, M.K., and Litman, G.W. The phylogenetic development of the cells that express, and the mechanisms that diversify, immunoglobulins and T cell antigen receptors. In: Zon L, ed. Hematopoiesis: A Developmental Approach. Oxford University Press, 2001; 565-573.

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