Deborah French-McCay, Ph.D.

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Director, Research & Model Development; Modeling Pollutant Fate, Effects, and Mitigation

Qualifications: Ph.D. Biological Oceanography | Graduate School of Oceanography, University of Rhode Island | 1984
A.B. Zoology | Rutgers College | 1974

Location: 55 Village Square Drive
South Kingstown, RI 02879, USA

Overview

Dr French-McCay (formerly Dr French) specializes in quantitative assessments and modeling of oil and hazardous material releases for impact, risk, and natural resource damage assessments (NRDA); evaluating transport and fates, exposure, and effects of hazardous materials and suspended materials on individual organisms, populations and aquatic ecosystems. Dr French-McCay is an internationally recognized expert in oil and chemical spill fate and effects modeling. She leads development of RPS' (formerly RPS ASA) oil and chemical spill models (SIMAP and CHEMMAP) and manages numerous projects utilizing these models to evaluate oil/chemical trajectory and fate, impacts and ecological risks. Her population modeling work includes models for plankton, benthic invertebrates, fisheries, birds, and mammals. She has developed and applied suspended sediment and water quality effects models for freshwater, marine and wetland ecosystems. She has performed mitigation scaling using food web models to calculate needed compensation for adverse impacts on aquatic life and ecosystems. Dr French-McCay has been principal investigator and primary author of more than one hundred technical reports and papers evaluating oil trajectory and fate, exposure, effects, and ecological risks. She has provided expert testimony in hearings regarding environmental risk and impact assessments. Dr French-McCay is the Director of Research and Model Development at RPS.

Areas of Expertise

- Model development: OILMAP, CHEMAP, SIMAP, LARVMAP
- Operational and accidental spill/discharge modelling
- Environmental Risk Assessments related to oil and chemical releases
- NRDA
- Cumulative environmental impact assessments
- Population modelling
- Permitting and regulatory compliance
- Expert testimony

Sectors

- Oil & Gas
- Renewable Energy
- Government
- Water
- Non-profit

Experience

RPS (formerly Applied Science Associates, Inc.) **1984-present**

Oil and Chemical Spill Fate and Effects Modeling, Impact and Natural Resource Damage Assessment

- Principal investigator/project manager for the Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME) and the Natural Resource Damage Assessment Model for Great Lakes Environments (NRDAM/GLE) which are used in "Type A" assessments of damages due to spills of toxic substances under US regulations (Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and of oils under the Oil Pollution Act of 1990 (OPA)).
- Principal developer of the physical fates model component of the NRDAM/CME, NRDAM/GLE, and ASA's derivative models SIMAP and CHEMMAP, which estimate oil and chemical distribution and concentrations over time after a spill.
- Developed biological effects model components of the NRDAM/CME, NRDAM/GLE, and ASA's derivative model SIMAP, which estimate pollutant-induced losses in productivity, fisheries yield and wildlife.
- Developed aquatic toxicity model and supporting toxicological database such that mortality is a function of concentration and duration of exposure; this toxicity model forms part of the NRDAM/CME, NRDAM/GLE and other model systems (e.g., SIMAP, CHEMMAP) developed by Applied Science Associates, Inc.
- Developed the restoration model components of the NRDAM/CME and NRDAM/GLE, which determine appropriate restoration actions and approximates costs.
- Principal Investigator in the development of biological databases for fishery species and wildlife by habitat and season for 77 coastal, 11 Great Lakes and 10 inland freshwater biological provinces of the United States. These data support the NRDA models.
- Principal Investigator in the development of a Primary Restoration Guidance Manual which evaluates feasibility, effectiveness and success, and costs of restoration of wetland and aquatic natural resources. This supports NOAA's OPA NRDA regulations.
- Provided technical support and modeling to federal and state trustees to estimate fates, injuries and natural resource damages resulting from 50-100 actual oil spills.
- Deepwater Horizon oil spill of April-July 2010 in the Gulf of Mexico; Expert for US Government/NOAA of Water Column Technical Working Group, which evaluated impacts to marine fish and invertebrates. Performed modeling analyses of spill fates and biological effects for quantification of injuries. Dr. French-McCay was lead of the Offshore Water Column, Plankton and Fish Technical Working Group in development of over 40 work plans for cruises each involving one or more vessels in the Gulf of Mexico that collected physical, chemical and biological data for use in the NRDA. She led the effort of conducting oil transport, fate and exposure modeling using the SIMAP model to evaluate injuries for water column organisms. She collaborated with hydrodynamic modelers, evaluating their hydrodynamic model output as input to the SIMAP model. Dr. French-McCay also oversaw the development of biological density and

life history data for use in modeling baseline biological densities and production foregone due to the spill. She developed and implemented population models, using published fish life history models and vital rates, to extrapolate from instantaneous direct injuries to additional production lost to the ecosystem due to injured organisms being removed from the environment. Technical reports are available at: [https://www.doi.gov/deepwaterhorizon/adminrecord].

- Hawaiian Molasses Spill NRDA (State of Hawaii) – Dr. French-McCay managed an analysis quantifying natural resource injuries to fish and invertebrates caused by spilled molasses in Honolulu Harbor and Ke'ehi Lagoon. Due to a pipeline burst, approximately 233,000 tons of molasses spilled into the marine system resulting in prolonged hypoxic conditions. Quantified production foregone and gained by various restoration options.
- Provides technical support to NOAA's Office of Response & Restoration / Assessment & Restoration Division and state trustees in on-going natural resource damage assessment cases.
- Provided training to federal and state trustees, industry, and private parties on use of modeling for NRDA, impact and risk assessment.

Modeling and Analysis of Pollutant Fates and Effects, Ecological Risk Assessment

- Project Manager and model developer for ASA's spill fates and biological effects model systems: SIMAP for oil spills and CHEMMAP for chemical spills. These models are used for impact and risk assessment, as well as natural resource damage assessment.
- CHEMMAP Model Development – Dr. French-McCay designed and managed the development of RPS ASA's CHEMMAP model system, which evaluates fate and biological effects of chemical releases in fresh and saltwater environments, accounting for transport, dispersion, volatilization, dissolution, acid-base reactions, and adsorption of chemicals in aquatic environments.
- Principal investigator for modeling oil spill fate and environmental exposures resulting from deepwater blowouts in the Gulf of Mexico assuming various response alternatives, including subsea dispersant injection. Developed Comparative Risk Assessment model for evaluating trade-offs of dispersant use.
- Used modeling to estimate impacts resulting from hypothetical spills of the cargo of a ship carrying hazardous wastes to be incinerated at sea; applied to several coastal areas (Gulf of Mexico and North Atlantic) and 10 possible wastes; analyzed worst case and most likely scenarios and performed sensitivity analysis.
- Principal investigator for modeling analysis of potential spills resulting from groundings in San Francisco Bay in an ecological risk assessment and cost analysis for natural resource damages, response costs and socioeconomic costs (client: US Army Corps of Engineers, San Francisco District).
- Principal investigator for modeling analysis of potential spill impacts and costs in Washington state waters as part of a cost-benefit analysis for the Washington Department of Ecology's rulemaking regarding spill response requirements

- Principal investigator for modeling of spills in US waters with and without dispersant use, for use in a Programmatic Environmental Impact Statement, US Coast Guard rulemaking on response equipment regulations
- Principal investigator for preparation of an Environmental Assessment of hazardous material spill response equipment regulations, a US Coast Guard rulemaking under OPA90, where modeling was used to evaluate chemical fate and potential environmental consequences.

Modeling of Wildlife Population Dynamics and Movements

- Developed a population model and a seasonal migration model for the northern fur seal; differences by age and sex were incorporated in the models; analyzed the impact of entanglement in discarded plastics on the northern fur seal population.
- Utilized northern fur seal population and migration models along with an oil spill trajectory model to estimate impacts on the northern fur seal population.
- Bioenergetics modeling to evaluate fish consumption by cormorants and its impact on fish populations in the Narragansett Bay estuary

Fish and Invertebrate Population Modeling and Impact Assessment

- Developed population and fisheries model with spatial resolution for eggs, larvae, juvenile and adults; an associated transport model used to distribute eggs and larvae.
- Applied the spatially resolved population and fisheries model to sea scallops and Atlantic cod on Georges Bank; used this model to estimate potential impacts of offshore oil development on the populations and fisheries.
- Developed a model system LARVMAP, which simulates active (directional swimming or sinking) and passive (by currents) movements of eggs, larvae, ichthyoplankton and other life stages of aquatic biota; used for evaluating potential impacts of spills, development, entrainment and impingement
- Assessed potential impacts of the entrainment of ichthyoplankton as a result of seawater heating from regasification facilities and impacts from pipeline and LNG terminal construction and operation, for Environmental Impact Statements for proposed LNG projects: two off the coast of Louisiana in the Gulf of Mexico, one in Mount Hope Bay, Massachusetts.
- Missouri Fish Kill Calculator (Missouri Department of Conservation) - managed the development of a resource equivalency analysis model calculator for estimating injuries and damages associated with small-scale spill induced fish kills. The calculator translated injuries into fish restocking restoration measures using Resource Equivalency Analysis based on population modeling. Extensive fish life history data libraries for freshwater species occurring in the mid-west were compiled. A user interface to the fish kill calculator tool was also developed.

Suspended Sediment Modeling and Impact Assessment

- Developed impact assessment model SSDOSE associated with the suspended sediment model SSFATE. Both of these models were developed by ASA (now RPS) for the US Army Corps of Engineers. SSFATE simulates the transport and fate of sediment suspended during dredging, disposal, or cable/pipeline burial operations. SSDOSE evaluates exposure of aquatic biota to suspended sediment concentrations and resulting adverse effects.
- Evaluated potential biological impacts of dredging and filling in Narragansett Bay associated with container port development at Quonset Point
- Evaluated potential biological impacts of dredging and pipeline installation in Mount Hope Bay and the Taunton River for LNG terminal permit support (Weavers Cove Energy)
- Assessed potential impacts of suspended sediments resulting from pipeline installations, for Environmental Impact Assessments for multiple proposed oil and gas pipeline projects in the Gulf of Mexico

Ecological Evaluations for Marine Spatial Planning and Alternative Energy Siting Assessments

- Developed framework for modeling ecological values of marine biological resources, applied to the marine offshore area considered by the Rhode Island Ocean Special Area Management Plan (RI Ocean SAMP). The definition of "ecological value" was based on that used in other recent marine spatial planning valuation efforts, i.e., the intrinsic value of biodiversity without reference to anthropogenic use. Synthesized spatial distribution data were gathered from various studies performed by University of Rhode Island (URI) researchers as input to the Ecological Value Map (EVM) modeling effort. Weighting schemes were applied to normalized mapped data and the modified results summed to compute EVMs that reflect protection status, global importance of the resources, uncertainty of the data and potential impacts of developments.
- Under funding from Bureau of Ocean Energy, Management, Regulation and Enforcement (BOEMRE), and in partnership with the University of Rhode Island, developed a conceptual framework and approach for cumulative environmental impact evaluation of offshore renewable energy development, as part of a larger framework for a site evaluation tool for decision makers. This extends the work on the RI Ocean SAMP to include consideration of cumulative impacts and a framework for application to offshore waters of the US. Socioeconomic uses and values are also included in the framework.

Restoration and Mitigation Scaling

- Modeling habitat and population values and restoration gains
- Estimation of compensatory restoration to mitigate environmental impacts.

Expert Testimony and Hearing Experience

- Provided expert evidence to the High Court of England and Wales and the Federal Court of Australia on oil spill modeling related issues.

- Testified at the US Senate Committee on Commerce, Science, and Transportation's hearing in May 2010 related to the likely environmental impacts of the Deepwater Horizon oil spill.
- Provided technical reports and expert opinion to NOAA Damage Assessment Center and other federal and state trustees in numerous natural damage assessment cases.
- Testified in permit hearings related to oil infrastructure and transportation.
- Estimated potential impacts on marine biota of once-through cooling and of stack emissions of a resource recovery facility at Quonset Point, RI on marine, freshwater and wetland biota; provided expert testimony at state government hearings for permitting the project, 1985-1990.
- Assessed potential impacts of water withdrawals and emissions from the proposed Newbay Power Plant on aquatic and terrestrial biota; testified in hearings to RI Department of Environmental Management and RI Coastal Resources Management Council in 1993 as an expert in Ecology and Environmental Impact Assessment.
- Assessed potential marine biological impacts of marina expansion and shore facility development on a small estuary (Fiddlers Cove) in Falmouth, MA; testified in town and state hearings in 1987.
- Assessed the extent and value of fresh and saltwater wetlands which might be impacted by development projects; provided information to be used in applications to Rhode Island Department of Environmental Management and Rhode Island Coastal Resources Management Council. Provided expert testimony in hearings.
- Assessed the potential water quality impacts of development projects; provided information to be used in applications to Rhode Island Department of Environmental Management and Rhode Island Coastal Resources Management Council. Provided expert testimony in hearings.

Selected Reports and Publications

French-McCay, D.P., M. Spaulding, D. Crowley, D. Mendelsohn, J. Fontenault, and M. Horn. 2021. Validation of oil trajectory and fate modeling of the Deepwater Horizon oil spill. Frontiers in Marine Science 8, doi: 10.3389/fmars.2021.618463.

French-McCay, D.P., K. Jayko, Z. Li, M. Spaulding, D. Crowley, D. Mendelsohn, M. Horn, T. Isaji, Y. H. Kim, J. Fontenault, and J. J. Rowe. 2021. Oil fate and mass balance for the Deepwater Horizon oil spill. Marine Pollution Bulletin 171: 112681. https://doi.org/10.1016/j.marpolbul.2021.112681

French-McCay, D., M. Schroeder, E. Graham, D. Reich, and J. Rowe, 2011. Ecological Value Map (EVM) for the Rhode Island Ocean Special Area Management Plan. Technical Report for the RI Ocean Special Area Management Plan, Applied Science Associates, May 20, 2011, 79 p.

French-McCay, D., D. Reich, E. Graham, M. Schroeder, and E. Shumchenia, 2010. Developing Environmental Protocols and Modeling Tools to Support Ocean Renewable Energy and Stewardship, Task 2.3 Report on the Framework for Cumulative Impact Evaluation, National Oceanographic Partnership Program (NOPP), Bureau of Ocean Energy Management (BOEM), Project Number: M10PC00097, Submitted by J. McCann, University of Rhode Island, 64 p.

Schroeder, M., D. French-McCay, J. DeAlteris, R. de Sa, Jill Rowe, and E. Graham, 2009. Biological Characterization of Mount Hope Bay and the Lower Taunton River for the Weaver's Cove Offshore Berth Project. ASA Report 08-078/BC prepared for Weaver's Cove Energy, LLC, Fall River, MA. January 2009, 75 p.

French-McCay, D., N. Whittier, R. Asch, J. Rowe, D. Schmidt Etkin, and A. Borowik, 2006. Final Environmental Assessment: Vessel and MTR Facility Response Plan Requirements for Hazardous Substances. Final Report by Applied Science Associates to U.S. Coast Guard, Office of Standards Evaluation and Development (G-PSR), Standards Evaluation and Analysis Division (G-PSR-1), September 2006

French-McCay, D., N. Whittier, M. Ward, and C. Santos, 2006. Spill hazard evaluation for chemicals shipped in bulk using modelling. Environmental Modelling & Software 21(2):158-171.

French-McCay, D.P., M. Gibson, J.S. Cobb, 2003. Scaling restoration of American lobsters: combined demographic and discounting model for an exploited species. Mar Ecol Prog Ser 264:177-196.

French-McCay, D.P., C.H. Peterson, J.T. DeAlteris and J. Catena, 2003. Restoration that targets function as opposed to structure: replacing lost bivalve production and filtration. Mar Ecol Prog Ser 264:197-212.

French-McCay, D.P., and J.J. Rowe, 2003. Habitat restoration as mitigation for lost production at multiple trophic levels. Mar Ecol Prog Ser 264:235-249.

French-McCay, D.P., 2003. Development and Application of Damage Assessment Modelling: Example Assessment for the North Cape Oil Spill. Marine Pollution Bulletin 47(9-12): 341-359.