RPI

Zachary J. Nixon **Research Planning, Inc.**
Senior Analyst

Mr. Nixon specializes in bringing analytical and statistical rigor to environmental management, spill response, natural resource mapping and damage assessment via the use of informatics, Geographic Information Systems (GIS), geostatistics, spatial ecology, and applied spatial and quantitative analysis. As part of RPI's team for nearly 20 years, Mr. Nixon has extensive experience in the development of unique and advanced analytic techniques and software tools for spill response, damage assessments, and geomorphic and ecological mapping. Mr. Nixon designed analysis approach and served as field team member for lingering oil assessment surveys integrating observational data with sediment and water column analytical chemistry.

He has worked as part of the response or damage assessment of multiple large oil spills on behalf of resource trustees, both nationally and globally, including the Gulf of Mexico, Alaska, Saudi Arabia, and Delaware Bay, and has authored or co-authored a variety of publications and technical reports. He has led or participated in multiple coastal mapping efforts, including over 15 Environmental Sensitivity Index (ESI) mapping projects. Most recently, Mr. Nixon has been developing spill response strategies, assessments techniques, and spatial analysis tools for projects in Alaska, the Great Lakes, coastal Louisiana, and the United Arab Emirates.

EDUCATION

Master of Environmental Management, Duke University, Durham N.C. (2006)
Thesis Title: Hydrologic modification and wetland community change in the Santee River Delta

B.S., Marine Science, University of South Carolina, Columbia, S.C. (1997)

PROFESSIONAL EXPERIENCE

1996 to Present: Analyst, Research Planning, Inc., Columbia, SC

Mr. Nixon's experience is outlined separately on the following pages in four main areas:

1) Oil and Hazardous Spill Response and Assessment
2) Risk and Environmental Assessments
3) Coastal and Natural Resource Mapping
4) Tool Development

OIL AND HAZARDOUS MATERIALS SPILL RESPONSE AND ASSESSMENT

Emergency Response: Since 1996 Mr. Nixon has been part of the Scientific Support Team to the U.S. Coast Guard provided by the National Oceanic and Atmospheric Administration (NOAA) for oil and chemical spills and other emergencies. He has provided on-scene support for the Emergency Response and Assessment and Restoration Divisions of NOAA at numerous incidents, including:

2010 *Deepwater Horizon*: Served as Shoreline Cleanup Assessment Team (SCAT) Data Manager for Louisiana. Designed digital databases for storing complex shoreline survey data, and analysis applications for generating real-time survey data analysis products.

2010 Enbridge Pipeline, Kalamazoo River, Michigan: Team member for the NRDA overbank oiling survey effort.

2006 Citgo Refinery, Calcasieu Lake, Louisiana: Assisted NOAA with SCAT data management and analysis, and served as team member for NRDA sediment and biological sampling effort.

2005 *M/T Athos* Spill Natural Resource Damage Assessment: Conducted spatially explicit, quantitative population, oiling, and injury calculations for birds and wildlife resources affected by the *M/T Athos* spill.

2004 Hurricane Ivan Spills, Louisiana: SCAT team member and data analyst.

2004 Midvalley Pipeline, Ohio River, Kentucky: SCAT team member and shoreline oiling data analyst.

Long-Term and Ongoing Impact Assessments: Mr. Nixon has been part of a variety of impact assessments for medium and long-term impacts of oil spills and other coastal impacts on behalf of the Exxon Valdez Oil Spill Trustee Council (EVOSTC), NOAA's Assessment and Restoration Division and other agencies, including:

2012 Principle Investigator, *Exxon Valdez* Lingering Oil Distribution Ecological Synthesis. Developed spatial modeling and statistical analysis strategy to compare population and biomarker data for recovering species with spatial models of lingering subsurface oil for Exxon Valdez Oil Spill Trustee Council.

2010 Enbridge Pipeline, Kalamazoo River, Michigan: Assisted USGS and the USEPA with statistical survey design and data analysis, including error propagation and non-detect handling, for persistent submerged oil volume estimation in riverbed sediments.

2011 *Deepwater Horizon*: Shoreline Natural Resource Damage Assessment Data Integration. Developed data validation methods, advanced analysis and integration techniques, and spatio-temporal database structure to store, analyze and estimate shoreline injury for NOAA and other state and federal trustees.

2009 Chalk Point Pipeline Spill, Maryland: Assisted with sampling design and data analysis for long-term marsh recovery study

2008 *Selendang Ayu*, Aleutian Islands, Alaska: Mr. Nixon designed analysis approach and served as field team member for lingering oil assessment surveys integrating observational data with sediment and water column analytical chemistry.

2007 *Exxon Valdez* Oil Spill Lingering Oil Survey: Mr. Nixon served as geospatial technical lead and chief of party for fieldwork, and was responsible for development of advanced statistical modeling approach, robust survey design, and implementation of custom tools to integrate GIS and statistical software packages for Exxon Valdez Oil Spill Trustee Council.

2005 *Exxon Valdez* Oil Spill Lingering Oil Survey Remediation Study. Performed geostatistical analysis, and 3-D modeling of oil-contaminated sediments and coastal geomorphology data.

2003 Gulf War Oil Spill, Jubail, Saudi Arabia. Participated in design of sampling methodology, database structure, and data collection applications, and coordinated personnel for collection, geostatistical analysis, and 3-D modeling of oil-contaminated sediments and coastal geomorphology data as part of Arabian Gulf UN Claims Commisision Gulf War Shoreline Survey.

2001 API In-Situ Burning Site Assessment. Participated in field collection and spatial analysis of post-burn environmental data and photography for spill sites in Louisiana, Utah, and Minnesota.

RPI

RISK ASSESSMENTS AND SPATIAL ANALYSIS

Marine Debris and Abandoned Vessels: Mr. Nixon has worked on a variety of marine debris and abandoned vessel issues for NOAA's Marine Debris Program, NOAA's Emergency Response Division, and the US Fish and Wildlife Service.

2013 Hurricane Sandy intertidal marine debris assessment. Served as project manager in assisting NOAA's MDP with identifying intertidal marine debris in the coastal areas of New York, New Jersey, and Connecticut via the use of advanced object based image analysis (OBIA) techniques and fieldwork.

2013 Hurricane Sandy marine debris dispersion modeling. Served as project manager in assisting NOAA's MDP with adapting marine debris dispersion models developed after Hurricanes Katrina, Rita, and Ivan for use in the coastal areas of New York, New Jersey, and Connecticut.

2009 Hurricane Katrina and Rita marine debris dispersion modeling. Served as project manager in assisting NOAA's MDP with developing novel statistical methods for modeling the dispersion of marine debris after storm events for hydrographic survey prioritization.

2006 Gulf of Mexico Marine Debris Project: Served as project manager and designed database structure and cartographic products and conducted stakeholder workshops to provide public dissemination of NOAA Marine Debris Program field data and track cleanup efforts.

2005 Project Analyst, Hurricane Rita HAZMAT Debris Analysis. Participated in study design, performed photo interpretation, fieldwork, and spatial analysis of Hurricane Rita debris issues for the Sabine National Wildlife Refuge.

2002 Project Analyst, NOAA Abandoned Vessels Survey. Provided spatial analysis and assisted in fieldwork in support of salvage survey of abandoned vessels in Puerto Rico, US Virgin Islands, and Pacific Territories.

Spatial and Geostatistical Analysis: Mr Nixon has conducted a variety of spatial modeling and geostatistical analysis in service of impact and risk assessment, including:

2009 NOAA Garden Island Bay Contamination Assessment. Performed geostatistical analysis, volume estimation, and 3-D modeling of oil-contaminated sediments and coastal geomorphology data.

2001 Poplar Pt./Anacostia River Groundwater Contamination Assessment. Provided spatial and geostatistical analysis and 3-D visualization of stratigraphic and environmental data

2001 *T/V Gilbert Taylor* Grounding Natural Resource Damage Assessment. Provided spatial and geostatistical analysis, 3-D visualization, and modeling of bathymetric data and quantification of associated seagrass injury.

2001 Todd Shipyard, Seattle WA Environmental Remediation litigation support. Provided spatial and geostatistical analysis, 3-D visualization, and modeling of sediment contamination and bathymetric data.

1999 Parris Island, SC Thermal Plume Study. Assisted with field collection and 3-dimensional modeling and spatial analysis of water quality and bathymetry data.

Contingency Planning: Mr. Nixon has participated in a number of contingency planning exercises for spills and

2010 Contingency Plan Annex Spill Risk Assessments, National Park Service, Great Lakes. Identified protection priorities for parks Designed quantitative spatial risk analysis to assess and communicate threats to NPS properties from a variety of spill sources.

1999 DOT Unusually Sensitive Areas Project. Served as project analyst for large national program for the identification of drinking water resources sensitive to petroleum pipeline spills.

1997 New Jersey Tidal Inlet Protection Strategies: Designed digital data structure and cartographic products.

COASTAL RESOURCE MAPPING

Mr. Nixon has served as GIS analyst or as project coastal geomorphologist on the following ESI projects used for coastal zone management, contingency planning, and hazardous material/natural disaster responses:

Georgia	1996
St. John's River	1997
El Salvador	1998
Louisiana	2001
Hawaii	2001
Guatemala	2001
Honduras	2001
Florida	2002
Central California	2005
Hudson River	2005
Puget Sound	2005
Maryland	2006
Alabama	2006
Northern California	2007

His role as geomorphologist on multiple ESI projects required extensive aerial and ground based fieldwork. Mr. Nixon spearheaded the adoption of the use of oblique digital imagery in ESI shoreline habitat mapping, replacing manual methods for greater accuracy and efficiency.

In 2004, Mr. Nixon served as the project coordinator for the Santee River Delta Vegetation Change Analysis conducted for The Nature Conservancy. He designed sampling plans, conducted fieldwork, and performed multivariate statistical and neural network analysis for examination of wetland community change due to hydrologic and salinity regime alterations.

More recently, Mr. Nixon designed the technical approach for processing of remote sensing data using advanced OBIA, data fusion and statistical and machine learning methods for several coastal habitat mapping projects in the Middle East.

TOOL DEVELOPMENT

Mr. Nixon has developed a number of specialized software and spatial analysis tools for use in coastal impact and risk assessments, and natural resource damage assessments. These include:

2013 NOAA Habitat Equivalency Analysis (HEA) GIS Toolset. Mr. Nixon served as geospatial technical lead, and designed ArcGIS integrated spatial analysis tools in Python to integrate advanced interpolation methods and automate HEA analysis for complex natural resource damage assessments.

2010 Abu Dhabi Coastal Environmental Atlas. Mr. Nixon served as technical director for the design of integrated screening tools from multiple environmental stressors to coastal habitats of the Emirate of Abu Dhabi.

2009 NOAA Climate Assessment and Proactive Response Initiative (CAPRI). Mr. Nixon designed screening tools to assess risk to hazardous waste sites and NOAA trust resources from global warming and sea level rise.

2003 NOAA Oil and Gas Infrastructure and Coastal Land Loss Risk Assessment for Louisiana. Mr Nixon designed spatial risk analysis and software tools to assess risks to coastal oil and gas infrastructure in Louisiana from coastal land loss.

SELECTED PUBLICATIONS

Zengel S, N. Rutherford, B. Bernik, Z. Nixon, and J. Michel. 2014. Salt marsh remediation and the *Deepwater Horizon* oil spill, the role of planting in vegetation and macroinvertebrate recovery. Conference Abstract. 2014 International Oil Spill Conference.

Zengel S, B. Bernik, N. Rutherford, Z. Nixon, J. Michel, and F. Csulak. 2014. Salt marsh remediation and the *Deepwater Horizon* oil spill, the role of planting in ecological recovery. Conference Abstract. Gulf of Mexico Oil Spill & Ecosystem Science Conference.

Nixon, Z. J. Michel, M.O. Hayes, G. Irvine, and J. Short. 2013. Geomorphic factors controlling the persistence of subsurface oil from the Exxon Valdez Oil Spill. Journal of Coastal Research, 69:115-127

Zengel S, N. Rutherford, Z. Nixon, B. Bernik, and J. Michel. 2013. Cleanup of heavily oiled salt marsh during the *DWH* Oil Spill: II. Comparisons of ecological effects and initial recovery. Invited Presentation. Gulf of Mexico Oil Spill & Ecosystem Science Conference. New Orleans, Louisiana.

Zengel, S., N. Rutherford, Z. Nixon, B. Bernik, and J. Michel. 2013. Cleanup of heavilly oiled salt marsh during the *DWH* Oil Spill: II. Comparisons of ecological effects and initiatl recovery. Gulf of Mexico Oil Spill and Ecosystem Science Conference, New Orleans, LA.

Michel J, E.H. Owens, S. Zengel, A. Graham, Z. Nixon, T. Allard, W. Holton, P.D. Reimer, and A. Lamarche. 2013. Extent and degree of shoreline oiling: *Deepwater Horizon* Oil Spill, Gulf of Mexico, USA. PLoS ONE 8(6): e65087

Hudgens, D, A. van Geel, Z. Nixon, B. Shorr, T. Penn, A. Dvarskas, L. Johnson, and R. Neely. 2012. NOAA HEA tools: A spatially explicit framework for habitat equivalency analysis. Invited presentation at: SETAC North America, Boston, MA.

Michel, J., Nixon, Z., Hayes, M., Irvine, G. and S. Short. 2011. The distribution of lingering subsurface oil from the *Exxon Valdez* Oil Spill. Proc. In: 2011 International Oil Spill Conference, American Petroleum Institute.

Steinhoff, M., B. Shorr, M. Baker, A. Dvarskas, A. Merten, A. Shellenbarger Jones, D. Hudgens, N. Etre, K. Glodzik, Z. Nixon, and A. Bejarano. 2011. Climate Assessment and Proactive Response Initiative. Poster presented at: PNW-SETAC, Vancouver, WA.

Barnea, N., J. Michel, B. Bray, Z. Nixon, G. Imahori, and C. Moegling. 2009. Marine debris response planning in the North-Central Gulf of Mexico. June 2009. NOAA Technical Memorandum NOS-OR&R-31.

Michel, J., Z. Nixon, J. Dahlin, D. Betenbaugh, M. White, D. Burton, and S. Turley. 2009. Recovery of interior brackish marshes seven years after the Chalk Point oil spill. Marine Pollution Bull. 58:995-1006.

Nixon, Z. 2008. Predictive modeling of storm-generated marine debris. Poster session presented at: 2008 Mississippi – Alabama Bays and Bayous Symposium, Biloxi, MS.

Nixon, Z. 2008. Modeling storm-generated marine debris. Poster session presented at: 2008 NOAA Marine Debris Information Forum, Bethesda, MD.

Nixon, Z., J. Michel, J. Hoff, D. Forsell, S. Krest, R. Hossler, K.Clark, T. Nichols. and J. Dunn. 2008. Estimating bird injury from the *M/T Athos* spill. Proc. In: 2008 International Oil Spill Conference, American Petroleum Institute.

Nixon, Z. and J. Michel. 2006. Assessment of hazardous materials and debris from Hurricane Rita in the Sabine National Wildlife Refuge. Report to U.S. Fish and Wildlife Service, Washington, D.C., 29 pp.

Michel, J., Z. Nixon, and L. Cotsapas. 2005. Evaluation of Oil Remediation Technologies for Lingering Oil from the Exxon Valdez Oil Spill in Prince William Sound, Alaska. Exxon Valdez Oil Spill Restoration Project Report #050778.

Lord-Boring, C., I. Zelo, and Z. Nixon. 2004. Abandoned vessels: impacts to coral reefs, seagrass, and mangroves in the U.S. Caribbean and Pacific territories with implications for removal. Marine Technology. Marine Technology Society Journal. 38:(3)

Henry, C., R. Pavia, S., Zengel, Z. Nixon, C. Locke, and K. Debusschere. 2003. Developing contingency planning tools to address wetland loss, ageing infrastructure, and oil spill risk in Louisiana. In: Proc. 2003 International Oil Spill Conference, American Petroleum Institute

Plank, C., and Z. Nixon. 2003. Hawaii Environmental Sensitivity Index (ESI) maps and the spatial accuracy of ESI mapping methodology. In: Proc. 2003 International Oil Spill Conference, American Petroleum Institute.

Michel, J., Z. Nixon, H. Hinkeldey, and S. Miles. 2002. Use of in situ burning as an oil spill response tool: Follow-up of four case studies. In: Proc. 2003 International Oil Spill Conference. American Petroleum Institute. pp. 1-6.

Michel, J., S. Zengel, C. Lord, and Z. Nixon. 2002. Surveys of Abandoned Vessels: U.S. Caribbean Region. NOAA Office of Response and Restoration, Silver Spring, Maryland, 52 pp. + appendices.

Zengel, S., Z. Nixon, C. Plank, J. Hanifen, D. Sa, and D. Braud, 2002. Environmental Sensitivity Mapping and GIS: the Louisiana G-WIS database. In: Fourth Biennial Freshwater Spills Symposium. EPA, Cleveland OH.

Michel, J., Z. Nixon, and H. Hinkledey. 2002. Recovery of Four Oiled Wetlands Subjected to *In Situ* Burning. API Publ. No., American Petroleum Institute, Washington, D.C., 71 pp.

Zengel, S., Z. Nixon, and J. Hanifen. 2001. Louisiana Gulf-Wide Information System: coastal habitats, wildlife, and fisheries components. Invited Presentation, 17th Annual Louisiana Remote Sensing and GIS Conference, Baton Rouge, Louisiana.

Zengel, S. and Z. Nixon. 2001. Louisiana Gulf-Wide Information System: Environmental Sensitivity Index Components. CleanGulf '01, Proceedings, abstract