

Environmental Scientist / Ecologist, Vice President

Dr. Zengel is an Environmental Scientist and Ecologist with 20 years of experience. His topical expertise includes wetlands, coastal resources, aquatic habitats, water quality, wildlife, fisheries, marine invertebrates, and endangered species. His regional expertise includes the Gulf of Mexico, Southeastern U.S., and Caribbean regions, though he also has experience working in nearly all coastal states and regions in the U.S. (including Alaska, New England, California, etc.) and international experience in Mexico, Central America, and the Middle East. Dr. Zengel's specialty areas include: (a) scientific oil spill planning, response, Natural Resource Damage Assessment (NRDA), and coastal restoration; (b) wetland functional assessment, monitoring, permitting, and mitigation; (c) Section 7 endangered species consultation, Biological Assessment, and Habitat Conservation Plan development; and (d) leadership of natural resource studies under a variety of authorities, such as the National Environmental Policy Act (NEPA). Dr. Zengel has published in several peer-reviewed journals and regularly presents invited and contributed talks at professional conferences.

## **EDUCATION**

Ph.D., Wildlife and Fisheries Biology, Clemson University, South Carolina (2008). Affiliated with the Baruch Institute of Coastal Ecology and Forest Science. Dissertation: Wild Pig Habitat Use, Substrate Disturbance, and Understory Vegetation at Congaree National Park.

M.S., Environmental Engineering Sciences, University of Florida (1993). Affiliated with the H.T. Odum Center for Wetlands and the UF Seahorse Key Marine Laboratory. Thesis: Juvenile and Forage Fish Species Assemblages in Different Habitat Zones of a Shallow Nearshore Seagrass Meadow.

B.S., Zoology with High Honors, University of Florida (1991). Elected to Phi Beta Kappa. Thesis: Pelagic *Sargassum* Rafts as a Model for Island Biogeography Theory.

## **CERTIFICATIONS**

Professional Wetland Scientist (PWS) (2005).

## **PROFESSIONAL EXPERIENCE**

Vice President, Environmental Sciences, Research Planning, Inc. (RPI), Tallahassee, Florida (June 2014 to present).

Vice President, National Practice Director (Sciences), Atkins North America, Tallahassee, Florida (2013-2014).

Associate Vice President, Principal Environmental Scientist, Atkins North America, Tallahassee, Florida (2011-2013).

Associate Vice President, Regional Practice Manager (Environmental Sciences, Eastern U.S.), Atkins North America, Tallahassee, Florida (2009-2011).

Group Manager (Environmental Sciences, Northwest Florida), Atkins North America, Tallahassee, Florida (2006-2009).

Senior Scientist II-III, Atkins North America, Tallahassee, Florida (2003-2006).

Scientist/Senior Scientist, Research Planning, Inc. (RPI), Columbia, South Carolina (1994-2003).

Wetland Scientist, University of Arizona, Environmental Research Laboratory, Department of Soil, Water, and Environmental Sciences, Tucson, Arizona (1993-1994).

Fisheries Biologist, U.S. Fish and Wildlife Service, National Fisheries Research Center, Estuarine and Anadromous Studies Section, Gainesville, Florida (1991-1993).

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Research Diver, University of Florida, Department of Fisheries and Aquatic Sciences, Gainesville, Florida (1991).

**Dr. Zengel's experience with NRDA, oil spill science, and coastal marsh ecology is detailed below:**

Deepwater Horizon Oil Spill, Coastal Marsh Fauna Injury Assessment, Louisiana (2011-present). Dr. Zengel is currently serving as the principal investigator for the NOAA-led injury assessment for coastal marsh fauna as part of the *Deepwater Horizon* NRDA case. This work has involved sampling design, field studies, data analyses, interpretation, literature review, and injury quantification for impacts to marsh periwinkles (*Littoraria irrorata*) and fiddler crabs (*Uca* spp.). Dr. Zengel is also contributing to other injury assessment and restoration planning working groups and topics involving coastal marshes, including coastal wetland vegetation, coastal marsh erosion, shoreline oiling distribution, toxicology, coastal marsh birds, nearshore fauna, and coastal marsh restoration scaling.

Barataria Bay Marsh Treatment and Set-Asides Study, Louisiana (2012-present). Dr. Zengel is the principal investigator for the on-going *Deepwater Horizon* marsh treatment and set-asides study for NOAA ERD. This study is examining medium to long-term salt marsh oiling impacts, treatment effects, emergency restoration, vegetation and faunal recovery, and marsh erosion in the Barataria Bay Treatment Test Plots. Impacts and recovery of marsh periwinkle density and population structure have been particular highlights of this study, as has the comparison of marsh erosion across oiling and treatment categories. Additional sampling under this project is planned for 2014.

Oiled Marsh *In Situ* Burn Study at Delta National Wildlife Refuge, Louisiana (2014-present). Dr. Zengel is part of an interagency team (NOAA-USFWS-LDEQ) conducting a study of marsh *in situ* burning in a Roseau cane (*Phragmites australis*) tidal freshwater marsh, following a crude oil spill in Delta National Wildlife Refuge. The study is comparing marsh vegetation recovery, oiling conditions, and sediment contamination over three years among: a) heavily oiled and burned sites, b) oiled sites which were not burned, and c) adjacent reference sites which were not oiled or burned. Information gained during this study will be used to inform future responses in similar marsh settings.

Deepwater Horizon Oil Spill, Shoreline Cleanup Assessment Technique (SCAT) Program, Louisiana to Florida (2010-2013). Dr. Zengel served as a NOAA scientific lead in the Shoreline Cleanup Assessment Technique (SCAT) program during the *Deepwater Horizon* response. In this role he led the marsh cleanup treatment testing program, evaluating treatment efficacy and environmental effects, developed subsequent marsh Shoreline Treatment Recommendations (STRs), and led the multi-agency marsh cleanup monitoring teams. This work also transitioned into the on-going marsh treatment and set-asides study for NOAA ERD (described above).

Deepwater Horizon Oil Spill, Scientific Support to the Escambia County Department of Community & Environment, Florida (2010). Dr. Zengel served as a sciences advisor to Escambia County, Florida, during the initial weeks of the response to the *Deepwater Horizon* incident. This role included: contributing to response plan reviews and shoreline cleanup guidelines, conducting pre-impact baseline assessments and quantitative sampling for coastal marshes and shorelines (including vegetation, macroinvertebrates, sediments, and shellfish tissues); and advising agency staff on appropriate sampling methods for consistency with NRDA protocols.

West Bay Water Quality and Biological Monitoring Program, Florida (2003-2010). Dr. Zengel led monitoring studies associated with the construction of a 4,000-acre airport-industrial site and an associated 10,000-acre coastal mitigation area. The multiyear monitoring program, spanning pre-construction, construction, and post-construction phases included a number of monitoring stations from small headwater streams and wetlands, to tidal creeks and coastal marshes, to open-bay estuarine habitats. Sampling included estuarine and aquatic invertebrates, water quality, and sediments. Coastal wetland and stream habitat classification, mapping, and functional assessments were also conducted. Turbidity and sedimentation issues detected during the construction phase of the monitoring program resulted in additional studies associated with damage assessment and restoration activities.

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Leon County Water Quality and Biological Monitoring Program, Florida (2006-2009). Dr. Zengel was the project manager for the Leon County Water Quality and Biological Monitoring Program for over three years, overseeing field monitoring of benthic invertebrates, vegetation, water quality, and sediments; data management, statistical data analysis, and reporting; regular coordination with the County's Water Quality Scientist; and other related technical support. Sampling included 80+ monthly and/or quarterly monitoring stations located throughout the County. This long-term program monitors water bodies for compliance with state water quality criteria and contributes data to the state Total Maximum Daily Load (TMDL) program.

Intertidal Benthic Invertebrate and Water Quality Monitoring, St. Joseph Bay, Florida (2005-2007). Dr. Zengel was the project manager and lead scientist for this three-year monitoring study focused on intertidal benthic invertebrates, water quality, and sediment sampling in coastal marshes, tidal creeks, coastal lakes, nearshore seagrass beds, and low-energy sand beaches adjacent to a major realignment of U.S. Highway 98, including coastal demolition activities; construction of new roadway, bridges, and stormwater ponds; and construction of associated residential development, including conservation and mitigation areas. This project evaluated the distribution and abundance of estuarine and freshwater coastal invertebrates, in relation to construction activities and habitat/salinity zones, including sampling before and one and two years after construction.

Gulf War Oil Spills, Shoreline Survey, Marine and Coastal Damage Assessment, Saudi Arabia (2002-2003). Dr. Zengel led the ecological field component of the Gulf War oil spills shoreline survey, documenting long-term impacts of the 1991 Gulf War oil spills along roughly 500 miles of shoreline. Dr. Zengel's responsibilities included adapting and designing the ecological survey protocol (focusing on coastal vegetation and intertidal benthic invertebrates); training, supervision, and oversight of field ecologists; five months of field work; coordination with project geologists, GPS technicians, geographers, sediment chemists, and database specialists; statistical analysis and interpretation; and reporting. This project involved substantial work with coastal marshes, mangroves, and associated intertidal invertebrates.

NOAA Emergency Response Division, Scientific Support Team, Nationwide (1994-2003, 2010-present). Dr. Zengel has served as a consultant to the NOAA Emergency Response Division's Scientific Support Team for 13 years. This work has involved scientific planning and emergency response support to NOAA and the U.S. Coast Guard for oil and chemical spills, vessel groundings, and similar incidents. Dr. Zengel has served as a SCAT Coordinator on multiple spills with a specialty in coastal wetland shorelines. He has also conducted NOAA ESI mapping throughout the U.S. and internationally, and has written or supervised more than 200 Resources at Risk reports. Dr. Zengel has also written numerous technical reviews of oil spill topics spanning various coastal habitats, incidents, and response technologies (e.g., marsh cleanup techniques, dispersant use, in situ burning, etc.).

NOAA Damage Assessment Center, Rapid Assessment Program (1994-2003). Dr. Zengel served as a consultant to the NOAA Damage Assessment Center's Rapid Assessment Program for roughly nine years, developing and contributing to NOAA rapid survey and sampling protocols (coastal marshes, intertidal invertebrates, sediments, shellfish tissues, etc.), providing field training, conducting field assessments, and contributing to NRDA studies, Environmental Assessments, and restoration plans. Example projects include field assessments of oil spills and vessels groundings; development of removal and restoration plans following vessel groundings; literature reviews on natural resource recovery following oil spills and physical impacts; and literature reviews on functional habitat assessments and restoration scaling.

U.S. Caribbean Abandoned Vessel Survey and Risk Assessment, Puerto Rico and U.S. Virgin Islands (2001-2002). Dr. Zengel conducted field surveys of over 100 abandoned vessels in Puerto Rico and the U.S. Virgin Islands for the NOAA Damage Assessment Center to assess habitat damages and future impact risk, and to prioritize vessel removal and habitat restoration needs. The focus of this effort included larger vessels located in or near mangroves, salt ponds, seagrasses, and coral reef habitats. In

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addition to habitat damages, other factors evaluated included oil spill risks, hazardous materials, hazards to navigation, wildlife entanglement, human health and safety, and other factors.

Coal Barge Grounding Damage Assessment and Restoration, Betit Bois Island, Gulf Islands National Seashore, Mississippi (2000-2001). Dr. Zengel provided technical guidance to the National Park Service for habitat evaluations, a Natural Resource Damage Assessment (NRDA) claim, and restoration planning for the removal of a grounded coal barge from nearshore waters of Gulf Islands National Seashore. Habitat types included seagrasses and sand bottom, as well as associated coastal marsh, sand beach, and tidal flats.

Tuna Longliner Vessel Removals, Environmental Assessment and Restoration Plan, Pago Pago Harbor, American Samoa (2000-2001). Dr. Zengel contributed to habitat evaluations, an Environmental Assessment, vessel removal plans, and a habitat restoration plan developed in support of the NOAA Damage Assessment Center and U.S. Coast Guard during the removal of nine tuna longliner vessels that had been grounded for several years on a reef flat in Pago Pago Harbor, following a hurricane. Major habitats included coral reef, hard bottom, algal flats, and shoreline areas. The vessels were completely removed with funding from the National Pollution Fund Center.

Lajas Creek Marsh Oil Spill, Assessment and Recovery Monitoring, Puerto Rico (1998-2001). Dr. Zengel conducted field surveys to assess oil spill impacts, cleanup effects, and habitat recovery in the Lajas Creek Marsh (near Bahia de San Juan) following Hurricane Georges. The hurricane resulted in the release of fuel oil from a refinery directly into the adjacent Lajas Creek Marsh following heavy rainfall and flooding. The oil spill was followed by intensive marsh cleanup including placement of fill to access the marsh, manual vegetation removal, mechanical scraping and sediment removal, and heavy sediment disturbance from cleanup equipment and foot traffic. Findings included documentation of subsurface sediment contamination and vegetation recovery over a 2-year study period.

Literature Review and Case Study of Marsh Cutting as an Oil Spill Cleanup Method, (1995-1996). Dr. Zengel conducted an extensive literature review and case study of the *Grand Eagle* oil spill for NOAA ERD, investigating the environmental effects of marsh cutting as an oil spill response option in salt and brackish marshes. This work resulted in a set of recommendations (and cautions) for spill responders dealing with oiled marshes where cutting is being considered as a cleanup option. This work was published as both a NOAA report and a peer-reviewed journal article.

Cienega de Santa Clara, Coastal Wetland Inventory and Assessment, Lower Colorado River Delta and Upper Gulf of California, Mexico (1994-1995). Dr. Zengel conducted a wetland inventory and assessment project in the Cienega de Santa Clara coastal marshes in Mexico. This work was part of an environmental assessment conducted for USFWS, associated with the construction and operation of a proposed desalination plant near the U.S./Mexico border. Responsibilities included coastal marsh mapping; vegetation, endangered species, wildlife, and fisheries surveys; analyses of aerial photography, aerial video, and GIS data; review of geomorphology, hydrology, and water quality data; and analysis of the potential impact of changes in water supply and salinity regime.

Coastal Fisheries and Benthic Invertebrate Studies at Three National Wildlife Refuges, Florida (1991-1993). Dr. Zengel designed, led, and contributed to several projects combining coastal habitat assessments, fisheries sampling, and benthic invertebrate monitoring at coastal National Wildlife Refuges (NWRs) in Florida (Cedar Keys, Lower Suwannee River, and Merritt Island NWRs). Projects evaluated juvenile fish and benthic invertebrate abundance, diversity, size, and species composition in coastal marshes, seagrass beds, and low-energy sand beach habitats. Dr. Zengel also assisted with the development of USFWS Habitat Suitability Index (HSI) models for juvenile estuarine fishes.

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**SELECTED PUBLICATIONS / PRESENTATIONS**

- Pennings, S.C., Zengel, S., et al. 2016. Marine ecoregion and *Deepwater Horizon* oil spill affect recruitment and population structure of a saltmarsh snail. *Ecosphere* (in press).
- Zengel, S., C.L. Montague, S.C. Pennings, S.P. Powers, M. Steinhoff, G. Fricano, C. Schlemme, M. Zhang, J. Oehrig, Z. Nixon, and S. Rouhani. 2016. Impacts of the *Deepwater Horizon* oil spill on salt marsh periwinkles (*Littoraria irrorata*). *Environmental science & technology*, 50(2), pp.643-652.
- Zengel, S., S.C. Pennings, B. Silliman, C. Montague, J. Weaver, D.R. Deis, M.O. Krasnec, N. Rutherford, and Z. Nixon. 2016. *Deepwater Horizon* oil spill impacts on salt marsh fiddler crabs (*Uca* spp.). *Estuaries and Coasts*, pp.1-10.
- Zengel, S., J. Weaver, S.C. Pennings, B. Silliman, D.R. Deis, C.L. Montague, N. Rutherford, Z. Nixon, and A.R. Zimmerman. 2016. Five years of *Deepwater Horizon* oil spill effects on marsh periwinkles *Littoraria irrorata*. *Marine Ecology Progress Series*.
- Zengel, S., B. M. Bernik, N. Rutherford, Z. Nixon, and J. Michel. 2015. Heavily oiled salt marsh following the *Deepwater Horizon* oil spill, ecological comparisons of shoreline cleanup treatments and recovery. *PloS one*, 10(7), p.e0132324.
- Zengel, S., N. Rutherford, B. Bernik, Z. Nixon and J. Michel. 2014. Salt marsh remediation and the *Deepwater Horizon* oil spill, the role of vegetation planting in ecological recovery. *Proceedings of the 2014 International Oil Spill Conference* (in press).
- Michel J., E.H. Owens, S. Zengel et al. 2013. Extent and degree of shoreline oiling: *Deepwater Horizon* oil spill, Gulf of Mexico, USA. *Public Library of Science (PLOS) One* 8(6): e65087.
- Zengel, S.A. and J. Michel. 2013. *Deepwater Horizon* Oil Spill: Salt Marsh Oiling Conditions, Treatment Testing, and Treatment History in Northern Barataria Bay, Louisiana. U.S. Dept. of Commerce, NOAA Technical Memorandum NOS OR&R 42. Seattle, WA.
- Zengel, S., E. Schneider, and J. Michel. 2013. Cleanup of Heavily Oiled Salt Marsh during the *Deepwater Horizon* Oil Spill: I. Adaptive Field Testing and Operational Treatments. Invited Presentation, Gulf of Mexico Oil Spill & Ecosystem Science Conference 2013, New Orleans, Louisiana.
- Zengel, S., N. Rutherford, Z. Nixon, B. Bernik, and J. Michel. 2013. Cleanup of Heavily Oiled Salt Marsh during the *Deepwater Horizon* Oil Spill: II. Comparisons of Ecological Effects and Initial Recovery. Invited Presentation, Gulf of Mexico Oil Spill & Ecosystem Science Conference 2013, New Orleans, Louisiana.
- Zengel, S., N. Rutherford, Z. Nixon, B. Bernik, and J. Michel. 2012. Treatment of Heavily Oiled Salt Marsh during the *Deepwater Horizon* Oil Spill: Testing, Monitoring, and Application. *Restore America's Estuaries (RAE) Conference* 2012, Tampa, Florida.
- Zengel, S. and I. Mendelssohn (chairs). 2012. Wetland Science and Oil Spills: Ecological Effects, Remediation, Damage Assessment, and Restoration, Special Double Session at the INTECOL International Wetlands Conference, Orlando, Florida.
- Zengel, S. and J. Michel. 2012. *Deepwater Horizon* Oil Spill Salt Marsh Treatment Tests: Monitoring Results. Invited Presentation, INTECOL International Wetlands Conference, Orlando, Florida.
- Mendelssohn, I., Q. Lin, A. Hou, K. Carman, J. Fleeger, S. Zengel and J. Michel. 2011. The *Deepwater Horizon* Oil Spill: Impacts to Coastal Wetland Vegetation. *Coastal and Estuarine Research Federation (CERF) Annual Conference* 2011, Daytona Beach, Florida.
- Zengel, S. and J. Michel. 2011. *Deepwater Horizon* Oil Spill: Salt Marsh Treatment Tests. Invited Presentation, National Association of Environmental Professionals (NAEP) Annual Conference, Denver, Colorado.
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- Zengel, S. and J. Michel. 2011. Testing and Implementation of Treatment Methods for Marshes Heavily Oiled during the *Deepwater Horizon* Spill. Society of Environmental Toxicology & Chemistry (SETAC) Gulf Oil Spill Conference. Pensacola, Florida.
- Zengel, S. and J. Michel. 2011. *Deepwater Horizon* Oil Spill: Marsh Treatment Tests. Invited Presentation, Society of Petroleum Engineers, Exploration & Production Health, Safety, Security and Environmental Conference, Houston, Texas.
- Zengel, S. A., and W. H. Conner. 2008. Could wild pigs affect water quality and aquatic biota (invertebrates) in floodplain and stream habitats at Congaree National Park? In: G. Eidson and C.B. Sawyer, editors, Proceedings of the 2008 South Carolina Water Resources Conference, Clemson University Restoration Institute, Center for Watershed Excellence, Charleston, South Carolina.
- Zengel, S.A., J. Michel and J.A. Dahlin. 2003. Environmental effects of in situ burning of oil spills as a cleanup method in inland (wetlands) and upland habitats. *Spill Science & Technology Bulletin* 8(4): 373-377.
- Michel, J., S. Zengel, H. Hinkeldey and D. Helton. 2003. Ephemeral data collection during the emergency phase of an oil spill: Protocols and design methods for Natural Resource Damage Assessment. 2003 International Oil Spill Conference Proceedings, American Petroleum Institute, Washington, D.C.
- Henry, C., R. Pavia, S.A. 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. 2003 International Oil Spill Conference Proceedings, American Petroleum Institute, Washington, D.C.
- Zengel, S., Z. Nixon, C. Plank, J. Hanifen, D. Sa and D. Braud. 2002. Environmental Sensitivity Mapping and GIS: The Louisiana G-WIS Database. Fourth Biennial Freshwater Spills Symposium. EPA, Cleveland, Ohio, March 19-21, 2002.
- 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., M.O. Hayes, B. Benggio, and F. Lopez. 2001. Oil penetration and vegetation recovery in the Lajas Creek Marsh, Puerto Rico. 2001 International Oil Spill Conference Proceedings, American Petroleum Institute, Washington, D.C.
- Michel, J., S. Zengel, L. Cotsapas, J. Dahlin, and J. Hoff. 2001. Assessment and emergency restoration of vessel grounding damages on coral reef flats, Pago Pago Harbor, American Samoa. 2001 International Oil Spill Conference Proceedings. American Petroleum Institute, Washington, D.C.
- Zengel, S., J. Dahlin, J. Michel, C. Headley, and D. Fritz. 1999. Environmental effects of in situ burning of oil spills in inland wetland and upland habitats. 1999 International Oil Spill Conference Proceedings, American Petroleum Institute, Washington, D.C.
- Michel, J., S. Zengel, J. Payne, and D. Helton. 1999. Protocols for sample design and implementation: Collecting ephemeral data during Natural Resource Damage Assessment. 1999 International Oil Spill Conference Proceedings, American Petroleum Institute, Washington, D.C.
- Michel, J. and S.A. Zengel. 1998. Monitoring of oysters and sediment quality in Puerto de Acajutla, El Salvador. *Marine Pollution Bulletin* 36(4): 256-266.
- Zengel, S.A. and J. Michel. 1996. Vegetation cutting as a cleanup method for salt and brackish marshes impacted by oil spills: a case history and review of the effects on plant recovery. *Marine Pollution Bulletin* 32(12): 876-885.

- Zengel, S., A. Meylan, H. Norris, M. White, L. Diveley, W. Holton, and K. Moody. 1996. Mapping sensitive sea turtle areas in Florida (for oil spill planning and response). Proceedings of the 16th Annual Symposium on Sea Turtle Biology and Conservation, Hilton Head, South Carolina.
- Glenn, E.P., C. Lee, R. Felger, and S. Zengel. 1996. Effects of water management on wetlands of the Colorado River delta, Mexico. *Conservation Biology* 10(4): 1175-1186.
- Mason, W.T., and S.A. Zengel. 1996. Foods of juvenile spotted seatrout in seagrasses at Cedar Keys, Florida. *Gulf of Mexico Science* 1996(2): 89-104.
- Zengel, S.A., V. Meretsky, E.P. Glenn, R.D. Felger, and D. Ortiz. 1995. Cienega de Santa Clara, a remnant wetland in the Rio Colorado delta (Mexico): Vegetation distribution and the effects of water flow reduction. *Ecological Engineering* 4(1): 19-36.
- Zengel, S.A., E.P. Glenn, and V. Meretsky. 1995. Cienega de Santa Clara, wetland restoration in the Rio Colorado delta, 13th Biennial Estuarine Research Federation Conference, Corpus Christi, Texas.
- Zengel, S.A., W.T. Mason, and J.P. Clugston. 1994. Use of different seagrass habitat zones by juvenile spotted seatrout, *Cynoscion nebulosus*. American Fisheries Society Technical Program, Atlantic International Chapter, 124th Annual Meeting, Halifax, Nova Scotia.
- Mason, W.T. and S.A. Zengel. 1994. Benthic invertebrates of Cedar Keys National Wildlife Refuge. *Bulletin of the North American Benthological Society*, Volume 11, No. 1 (Conference Proceedings).