MARINE VENTURES

ALAN D. HART, Ph.D.

Marine Environmental Consultant

Dr. Hart has over 45 years of oceanographic and environmental science experience. In April 2017, he joined Marine Ventures International, Inc. (MVI), a registered Small Business founded in 2009 to provide high quality marine environmental science technical personnel to conduct field operations and data acquisition supporting the Marine Energy Industry. Dr. Hart serves as the Executive Vice President/Senior Science and is responsible for developing and managing the MVI Subject Matter Expert Program to address marine environmental issues. In addition, he serves as a marine environmental consultant to the marine energy industry.

Education

Ph.D., Oceanography, Texas A&M University, 1981

B.S., Zoology, Texas Tech University, 1973

He has served as an environmental consultant for numerous industry clients and Federal and State agencies concerning seismic, exploration, and developmental activities in the Gulf of Mexico, Atlantic and Pacific Oceans, Mediterranean Sea, Sea of Okhotsk, Caribbean Sea, Caspian Seas, and offshore Alaska. He is experienced in assessing environmental impacts as they are related to biological, chemical, geological, and physical oceanography. Dr. Hart has developed experimental and sampling designs, performed the statistical analyses of the data, and prepared and edited the manuscripts for numerous biological assessments of offshore and coastal areas, multidisciplinary baseline studies, and ecosystem programs. He has been responsible for project management, data management, and statistical analyses for numerous baseline studies and environmental monitoring programs in connection with offshore oil and gas activities for over 35 years.

He has conducted several studies concerning predicting the environmental consequences of unintentional petroleum hydrocarbon discharges in the vicinity of sensitive biological communities. These projects involved incorporating aspects of toxicity studies from the literature, literature review of the sensitive biological communities, and modeling dispersion and movement of spilled hydrocarbons.

Dr. Hart has served as Project Manager on a number of major multidisciplinary projects, including a multimillion dollar study of offshore platforms for DOE, another major multimillion dollar study of bioaccumulation of produced water discharges into the Gulf of Mexico performed for the Offshore Operators Committee. Other important projects include a study of the environmental impacts of deepwater oil and gas activities in the Gulf of Mexico and environmental impact studies of non-aqueous drilling fluid cuttings discharges in the Gulf of Mexico and offshore Ghana and a multimillion dollar study of the potential impacts of cooling water discharges from offshore deepwater platforms on ichthyoplankton populations in the Gulf of Mexico.

EXPERIENCE

April 2017 to Present: Marine Ventures International Inc. – Executive Vice President, Senior Scientist

- Developing and managing the MVI Subject Matter Expert (SME) Program. The SME program provides senior, experienced Oil & Gas consultants to support the oil and gas industry in marine environmental issues. This important service is designed to enhance the experience available to address issues for the offshore environment without increasing staff and passing knowledge to younger, less experienced staff.
- Serving as Executive Vice President and participating in the management of MVI.
- Serving as a marine environmental consultant to the marine energy industry.
- Providing ongoing scientific consultation and sales support to CSA Ocean Sciences Inc.
- Prepared a technical memorandum for Noble Energy Mediterranean Ltd. discussing potential impacts associated with installation of the Leviathan development pipeline using S-Lay Methodology.
- Provided consultation to ExxonMobil Exploration and Production Cyprus (Offshore) Ltd. on the sampling

design, sample collection, and analysis methodology for the Environmental Baseline survey for two deep-water exploration wells in Block 10, offshore Cyprus.

- Prepared a discussion for Noble Energy Mediterranean Ltd. to address the ecological vulnerability per the Israel Strategic Environmental Assessment (SEA) Guidelines for incorporation into the Leviathan Consolidated Habitat Report, Pipeline Route Upstream of the Leviathan Production Platform.
- Participated in CSA Ocean Science Inc. proposal efforts for various countries including U.S., Bulgaria, Cameroon, Congo, Cyprus, Ghana, Israel, Mauritania, Mexico, Qatar, Romania, South Africa, Suriname, Trinidad and Tobago.

February 1982 to April 2017: CSA Ocean Sciences Inc. – Executive Vice President, Science Director, Senior Scientist

- Provided scientific and management support, and scientific review of an study from Anadarko in New Zealand that required environmental baseline and post-drill monitoring surveys for two deepwater exploration wells offshore New Zealand. The purpose of the surveys were to collect and analyze samples for the detection of drill muds and cuttings around each well, and potential impacts to biological communities (benthic infauna).
- Provided scientific and management support to Noble Energy Mediterranean, Ltd. (Noble Energy) for the development and implementation of a study to characterize the environment encompassing the Leviathan Field development areas before any additional drilling or construction activities occur. This entailed developing a combined Scope of Work and Sampling and Analysis Plan for the Leviathan Field Development Background Monitoring Survey of the Leviathan Field, pipeline route, Pressure Reduction and Metering Platform (PRMP), and Floating Production Storage and Offloading (FPSO)
- Conducted a review of oil and gas license requirements for environmental monitoring for two oil and gas blocks, Fuerte Sur and Fuerte Norte, offshore Colombia, South America for Anadarko Petroleum Corporation. The review consisted of an analysis of general discharge regulations and potential impacts as well as the usage of synthetic-based drilling muds. Drilling mud dispersion modeling was also conducted. Reviewed the environmental monitoring requirements designed by the Colombian regulators for the purposes of implementation.
- Provided management and scientific advisory support in developing the Scope of Work and a Sampling and Analysis Plan for an environmental survey for Noble Energy's subsea gas production and transportation system connecting the deepwater Tamar Gas Field to the Tamar Offshore Receiving and Processing Platform (Tamar Platform). The survey was required by the Israel Ministry of Energy and Water Resources (MEWR) in order to develop and implement a survey of the field and pipeline routes to characterize the environment. The data were also used to assess potential impacts should an accidental event occur in the field or along the pipeline routes.
- Provided management and scientific advisory support for an environmental monitoring program required for an exploration well off the Israeli coast by Noble Energy. The purpose of the environmental monitoring program was to characterize the environmental conditions in the vicinity of the drillsite before and after drilling. The main objectives of the program were to determine the temporal and spatial variation of selected environmental components (i.e., chemical, geological, physical, and biological) within the study area and assess potential effects from drilling discharges on selected environmental components. Support included developing the Scope of Work and a detailed Sampling and Analysis Plan for the environmental monitoring. This document described the environment in the vicinity of the drillsite, parameters to be sampled, sampling methods, data processing and laboratory methods, and data analysis/reporting.
- Developed experimental design and scope of work for an environmental baseline survey for Anadarko's exploration activities offshore New Zealand. The scopof work provided a survey design that included the proposed sampling components, analytical parameters, station layout, and field methods as well as statistical justification for the proposed survey design and sampling parameters. Survey design

justification—based on international best practices, applicable industry-related programs, and scientific literature—focused on the programmatic components within the proposed scope of work that were most germane to evaluating potential effects to the environment associated with the project activities. The scope of work document also included a discussion of operational requirements, such as survey vessel specifications, sampling equipment, navigation, staffing, and sample handling procedures.

- Provided scientific and management support for a study of the potential effects of seismic sound on selected fish species living in Lake Sakakawea. This Study was designed to assist in determining acceptable sound pressure levels to mitigate possible impacts of such studies, and specifically by the Stony Creek 3D seismic survey proposed by Hess. The Study provides the quantified and statistically reliable data needed to evaluate the possible risks associated with the use of the specific airgun array proposed for the Hess project, including the specific sound pressure levels from that array, on species of concern (pallid sturgeon, paddlefish, and walleye) in Lake Sakakawea.
- Provided scientific and management support for a 4-year (2010 to 2013) study for the Bureau of Ocean Energy Management (BOEM) entitled “Atlantic Deepwater Canyons.” This interagency study is sponsored by the National Oceanographic Partnership Program (NOPP) involving BOEM, the National Oceanic and Atmospheric Administration Office of Ocean Exploration and Research, and the U.S. Geological Survey. The study focused on the exploration and investigation of deepwater biological communities, oceanographic processes that may affect the composition and distribution and these biological communities, and archaeological sites (shipwreck sites and possible prehistoric sites) within and near four submarine canyons off Virginia and Maryland.
- Served as Project Manager and science advisor for the Offshore Operators Committee's Gulf of Mexico Cooling Water Intake Structure (CWIS) Entrainment Monitoring Study (EMS). This study was conducted to meet National Pollutant Discharge Elimination System (NPDES) regulations to fulfill requirements of Section 316(b) of the Clean Water Act. Sampling is being conducted over a 2-year period at 2-week intervals. The sampling design consisted of three vertically stratified plankton collections taken at dawn, mid-day, and dusk in the vicinity of four deepwater facilities in the central and western Gulf of Mexico. Samples were analyzed to determine the abundances of fish eggs and larvae, and the data were used to evaluate the impact of deepwater cooling water intakes on fish populations.
- Develop experimental design and provided statistical analysis and scientific advisory support for a study to assess the impacts of drill cuttings and associated non-aqueous drilling fluids on benthic and pelagic systems located in the Jubilee Field, Ghana. Two primary tasks were to 1) prepare a literature review summarizing the scientific and grey literature on drill cuttings discharge and related impacts as well as regulatory limits and accepted monitoring practices worldwide; and 2) conduct an OSPAR-compliant field survey to assess the impact of drill cuttings discharges on the marine environment in the Jubilee Project area, verifying modeling undertaken to date and documenting the potential recovery of affected sites. CSA also prepared a Final Report for submission to the Ghana EPA on drill cuttings impacts in the Jubilee Project area. The report placed the observed impacts into context and included recommendations for National Discharge guidelines of oil on cuttings concentrations based on the literature review and field survey results.
- Following the explosion and subsequent oil spill of the Deepwater Horizon drilling rig (Macondo) on April 22, 2010, provided scientific support Natural Resource Damage Assessment (NRDA). Participated in the design of offshore surveys to sample the water column, sediments, phytoplankton, zooplankton, ichthyoplankton, mesopelagic fishes, pelagic fishes, benthic fishes, and natural hydrocarbon seeps prior to and after exposure to oil from the Macondo well.
- Developed sampling design and conducted statistical analysis for an environmental survey in Ecuador at selected locations near the Noble Energy's offshore Amistad “A” platform and onshore gas production plant as well as at nearshore locations from Guayaquil to estuarine locations west of Puerto Bolivar. The purpose of the survey was to collect a series of samples to determine and map the relative concentrations of substances in seawater and seafloor sediments that may contribute to local nearshore red tide events and associated fish kills. The sampling design addressed the relative contributions of these substances from

ongoing commercial shrimp farms, agriculture, and gold mining operations in the western Andes. Most of the nearshore sampling locations were positioned near local commercial shrimp farms and, in some areas, at the mouths of rivers along the border of Peru. Sampling parameters included hydrocarbons (total petroleum hydrocarbons [TPHs] and polynuclear aromatic hydrocarbons [PAHs]), metals, nutrients, coliform bacteria, sediment grain size, and benthic infauna. Additional samples (sediment) were collected for microtoxicity tests. The results of the analyses of collected samples, together with observations made during the field survey and a review of existing remote sensing imagery and pertinent literature, were presented in an interpretive report.

- Participated in a peer-review workshop of Shell's proposed Alaska Science Program for the Chukchi and Beaufort Seas. The review included ecological characterization (offshore, onshore, and nearshore), operations monitoring, technical surveys in support of feasibility engineering, and impact assessment (environmental, social and health).
- Provided scientific support and review to address issues regarding the 2007 and 2008 mercury dataset accumulated for an floating production, storage, and offloading (FPSO) vessel in offshore Indonesia. Scientific support included statistical analysis and interpretation of the 2007/2008 datasets and previously collected data at the FPSO and associated reference stations. A written report was prepared summarizing the statistical analysis and a presentation to the client.
- Provided Scientific and Management Support for a project to Anadarko MOÇAMBIQUE ÁREA 1, LDA – 2008 to 2009. CSA assisted in the production of an Environmental Impact Assessment (EIA) document for a proposed seismic survey program and subsequent exploration drilling operations in the Rovuma Offshore Area 1, offshore northeast Mozambique. The first phase of the project involved three studies: 1) an acoustic modeling study for the seismic survey program, which was conducted by Jasco, Ltd. as a subcontract to CSA, 2) an oil spill and discharge dispersal modeling study for exploration drilling activities, and 3) a review of scientific literature pertaining to the effects of seismic noise on marine fishes. Using the results from these studies, CSA prepared draft and final EIA sections (Impact Assessment and Mitigation) that addressed potential impacts from seismic noise and routine drilling activities to marine mammals, sea turtles, fishes, seabirds, and benthic invertebrates. Potential impacts from accidental events also were identified, along with appropriate mitigation methods. CSA assisted in the presentation of the EIA to the Mozambican permitting authorities. This project was conducted under subcontract to Impacto, Lda.
- Provided scientific review and management support for a Strategic Environmental Assessment (SEA) concerning hydrocarbon activities within the Exclusive Economic Zone (EEZ) of the Republic of Cyprus. The SEA established regional baseline conditions and assessed environmental effects associated with proposed hydrocarbon activities.
- Provided scientific support for a project to preparing the environmental permitting documentation for a U.S. Coast Guard (USCG) application for a Deepwater Port offshore Tampa, Florida. The project entailed collecting, analyzing, and documenting all biological environmental data used in developing the environmental permitting documentation in accordance with requirements of the USCG, Federal Energy Regulatory Commission, Department of Transportation, Environmental Protection Agency, Bureau of Ocean Energy Management (formerly MMS), and State agencies in compliance with the National Environmental Policy Act, Deepwater Port Act, Homeland Security Act, and other regulations.
- Served as Project Manager, developed experimental design and provided statistical analysis and reporting for a 403(c) monitoring program related to a National Pollutant Discharge Elimination System (NPDES) permit for a discharge from the Shell Chemical Yabucoa, Inc. (SCY) refinery into Yabucoa Bay, Puerto Rico. The 403(c) monitoring program required by the EPA consisted of two major elements: 1) whole effluent evaluation, which consisted of priority pollutant scans and biotoxicity tests, on a quarterly basis; and 2) analysis of sediment quality and the benthic community, which included the macroinfaunal community, coral reefs, and seagrass beds within Yabucoa Bay. Composited (whole) effluent samples were collected quarterly for toxicity testing and priority pollutant scans. Effluent samples also were tested annually for toxicity for a period of 3 years. A field survey was conducted for sampling and analysis of sediment quality

and the benthic community in the dry season.

- Provided Scientific and Management Support for a Minerals Management Service study to examine and evaluate potential biological and physical effects of offshore dredging within ridge and swale features on the Federal Outer Continental Shelf and to suggest engineering options and mitigation measures that can be implemented to avoid potential deleterious impacts while allowing for the selective removal of needed volumes of sand for nearby beach replenishment projects.
- Project Manager, Lead Scientist, statistical analyst, and contribution author for a oil and gas industry consortium study to assess the fate and effects (physical, chemical, and biological) of discharged cuttings drilled with synthetic based drilling mud (SBM cuttings) at continental shelf (40 to 300 m) and deepwater (>300 m) sites in the Gulf of Mexico sites. The study provided the U.S. Environmental Protection Agency with scientific data upon which to base effluent limitations for the discharge of SBM cuttings and provided the oil and gas industry with scientifically valid data for the environmental assessment of the discharge of SBM cuttings.
- Project Manager of a project to characterize northern Gulf of Mexico deepwater hard bottom communities with emphasis on the deepwater coral *Lophelia*. This was a 3-year study sponsored by the MMS. It involved 2 years of field work utilizing the Johnson SeaLink submersible and coordination of multiple subcontractors from University of Oregon, Pennsylvania State University, Dauphin Island Marine Laboratory, Florida State University, and the Smithsonian Institution.
- Scientific Analyst preparing a study for Palau Pacific Energy to estimate the risk of a crude oil or diesel spill from two proposed wellsites offshore Palau (Pacific Micronesia) reaching landfall and to estimate the time to potential landfall.
- Deputy Project Manager for a major MMS-sponsored interdisciplinary study of environmental effects from cuttings discharges for synthetic-based drilling muds systems of selected sites on the continental slope of the Gulf of Mexico.
- Project Manager and responsible for experimental design, data analysis, data interpretation, and reporting for a major study of the environmental fate and effects of drill cuttings discharged in association with synthetic-based drilling muds systems. This study is jointly sponsored by industry and government (MMS and DOE).
- Chief Project Scientist and Data Manager for an environmental monitoring program for the Offshore Operators Committee (OOC) titled the Gulf of Mexico Produced Water Bioaccumulation Study. The objectives of the program were to determine whether statistically significant bioaccumulation of produced water related organics and inorganics occurs in the edible tissue of resident fishes and invertebrates in the immediate vicinity of representative Gulf of Mexico offshore platforms that discharge more than 4,600 barrels per day of produced water, and to evaluate the environmental significance of any statistically significant increases observed due to produced water related bioaccumulation in edible tissue. Produced water, ambient water, and fish and invertebrate tissue samples were collected for analyses of volatile and semivolatile organic compounds, metals, and radionuclides. Dr. Hart finalized Post-Survey Reports and Data Reports submitted after each of the three cruises. Final Reports and a Bioaccumulation Literature Review were prepared as separate deliverables. Dr. Hart also presented final results orally at a technical conference and in a paper published in a peer reviewed scientific journal (Offshore Operators Committee, 1994 to 1997).
- Chief Project Scientist and Data Manager for a 3 year, multimillion dollar study of the potential environmental, economic, and health impacts associated with produced water, produced sand, and other discharges from oil and gas operations in the Gulf of Mexico. Dr. Hart coordinated CSA's role as the prime contractor for the study, managing a seven company team of experts, and organizing and coordinating a Scientific Review Committee. The primary project goal was to increase the base of scientific knowledge concerning the 1) fate and environmental effects of organics, trace metals, and naturally occurring radioactive materials (NORM) in water, sediment, and biota near several offshore oil and gas facilities; 2)

characteristics of produced water and produced sand discharges as they pertain to organics, trace metals, and NORM variably found in association with the discharges; 3) recovery of four terminated produced water discharge sites located in wetland and high energy open bay sites of coastal Louisiana and Texas; 4) economic and energy supply impacts of existing and anticipated Federal and State offshore and coastal discharge regulations; and 5) catch, consumption, and human use patterns of seafood species collected from coastal and offshore waters (U.S. Department of Energy, 1992 to 1997).

- Experimental design for fate-effects study of exploratory drilling effort conducted offshore Sakhalin Island, Russia by Exxon Ventures CIS in 1996. Sampling design, data analyses, and reports contribution for two major baseline sampling efforts conducted in 1995 and 1996 in the Piltun Astokhskoye Field offshore Sakhalin Island, Russia for Marathon Upstream Sakhalin Services, Ltd.
- Experimental design, data management, data analysis, and interpretation for over 20 oil and gas related monitoring programs in the Gulf of Mexico. Locations included the Florida Big Bend Area, shallow waters off the Texas coast, Alabama State waters, and the Flower Garden Banks and other offshore hard banks (Various oil and gas clients, 1982 to Present).
- Conducted an analysis of the Marine Industry Response Group/S. L. Ross Spill Impact Assessment Model was conducted in two phases. Phase I included training on the model as well as a review process with State and Federal agency representatives. This review process included identifying proper agencies and personnel, preparing appropriate discussion issues with those individuals, and finally conducting those discussions. Phase II included a peer review of the model to the extent of addressing the concerns of the Phase I discussions with the State and Federal agencies (Marine Industry Response Group, 1991 to 1993).
- Study design, field data collection, data analysis, and interpretation for a study of ichthyoplankton assemblages off Cape Hatteras, North Carolina (Minerals Management Service, 1990 to 1991).
- Experimental design, data management, and statistical analyses for a 3-year ocean dredged material disposal site monitoring program for Tampa Bay, Florida. The program included tracking dredged material deposition and transport using analyses of sediment grain size samples, analyses of selected metals in sediment trap and surficial sediment samples, and long-term current monitoring data (U.S. Environmental Protection Agency, 1984 to 1987).
- Data Manager/Biostatistician for CSA's portions of the MMS Southwest Florida Shelf Ecosystems Study, a major multidisciplinary environmental study. Data were from sediment grain size, trace metal, and hydrocarbon samples; macroinfaunal samples; dredge and trawl samples; and bottom photographs (Minerals Management Service, 1982 to 1987).
- Data Manager/Biostatistician for a biological survey of four California State oil and gas lease tracts in the Santa Barbara Channel (California State Lands Commission, 1984).
- Primary author and statistician/data analyst of several environmental studies to monitor the effects of drilling fluid discharges on corals and benthic biota living on topographic highs in the northwestern Gulf of Mexico, including the East and West Flower Garden Banks, Alderdice Bank and Baker Bank.
- Primary author and statistician/data analyst for an environmental monitor study of the effects of discharged drilling effluents from an exploration well in the Florida Big Bend on deep seagrass beds.

REPRESENTATIVE PUBLICATIONS

Hart, A.D., D.B. Snyder, K.D. Spring, and R.M. Hammer. 2006. Application of Scientific Experimental Design in Monitoring Hard Bottom Habitats Associated with Areas of Beach Nourishment. Proceedings of the 19th Annual National Conference on Beach Preservation Technology February 1-3, 2006, Sarasota, Florida.

Neff, J.M., A.D. Hart, J.P. Ray, J.M. Limia, and T.W. Purcell. 2005. An Assessment of Seabed Impacts of Synthetic-Based-Drilling-Mud Cuttings in the Gulf of Mexico, SPE 94086. SPE/EPA/DOE Exploration and Production Environmental Conference, 7-9 March 2005, Galveston, Texas

Gettleson, D.A., A.D. Hart, S.T. Viada, and N.W. Phillips. 2004. Effects of Oil and Gas Exploration and

Development at Selected Continental Slope Sites in the Gulf of Mexico, SPE 86773. SPE International Conference on Health, Safety, and Environment in Oil and Gas Exploration and Production, 29-31 March 2004, Calgary, Alberta, Canada

Hart, A.D. 2003. Effects of oil and gas exploration and development at selected continental slope sites in the Gulf of Mexico. In: McKay, M. and J. Nides (eds.), Proceedings: Twenty-First Annual Gulf of Mexico Information Transfer Meeting, January 2002. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2003-005. 748 pp.

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Hart, A.D., B. Graham, and D.A. Gettleson. 1993. Concentrations of naturally occurring radioactive materials associated with produced water discharges from production platforms in the northwestern Gulf of Mexico. Presentation at the 14th Meeting of the Society of Environmental Toxicology and Chemistry, Houston, TX.

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