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# Adversarial Science

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*ABSTRACT: Adversarial science—sometimes referred to as "litigation science" or "junk science"—has a bad name. It is often associated with the tobacco industry's relentless use of science to manufacture uncertainty and avoid liability. This Article challenges the traditional conception that adversarial science should be castigated simply because it was developed for litigation. Rather, this Article urges that adversarial science is an important informational asset that should, and indeed must, be embraced.*

*In the ecological context, adversarial science is vital to understanding the ecological effects of long-term toxic exposure. Government trustees and corporate defendants fund intensive scientific research following major ecological disasters like oil spills as part of a process known as natural resource damage assessment ("NRDA"). During this process, lawyers engage scientists to advance advocacy positions, either to support or to defeat claims for natural resource damages. The NRDA process presents an unparalleled opportunity to intensively study the effects of toxic exposure to ecosystems at the very moment those impacts are unfolding. At the same time, the science that emerges is adversarial; it suffers from the same conflicts of interests and perceptions of bias as other result-oriented science.*

*While scientists and legal scholars have written extensively about the conflicts of interest embedded in other forms of policy-relevant science, surprisingly little scholarly attention has been given to the influence of litigation on NRDA science or the implications of that influence on the broader scientific understanding of ecological harms. This Article casts a bright light on adversarial science, using the scientific literature to expose the influence of litigation on NRDA science. More importantly, this Article—while acknowledging the risks of adversarial science—urges policymakers to embrace it. Ultimately, this Article offers solutions that both release adversarial science from traditional clouds of suspicion and allow*

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*adversarial science to inform public policy on the long-term harm from toxic exposure.*



## I. INTRODUCTION

While no one hopes for environmental disasters, a great deal can be learned from them. In fact, much of what we know of long-term ecological exposure to toxins comes from studies undertaken in the wake of massive oil spills like the *Exxon Valdez* or the *Deepwater Horizon*. In many ways, these events—though unfortunate—present an unparalleled opportunity to intensely study the effects of toxic exposure to ecosystems. Laboratories, for instance, cannot replicate the conditions often needed to study the complex response of ecosystems to toxins. Though inordinately complicated, the ecological conditions created post-*Exxon Valdez* or post-*Deepwater Horizon* allow for real-time observation of the intricate and entangled ways that ecosystems are impacted by toxic exposure. The political support for intensive scientific inquiry is also piqued in the wake of mass-disaster events. Media attention and public outcry combine to create a demand for comprehensive study that may otherwise have less enthusiastic political support.

As an example of the informational opportunities created by mass-disaster events, consider the intense study of the Gulf of Mexico that is currently underway to determine the nature and magnitude of injuries caused by the 2010 *Deepwater Horizon* oil spill.[1] Technical working groups consisting of government, academic, and industry scientists have been assembled to study the ecological impacts of oil spills on a wide variety of species and their habitats, from mudflats to corral.[2] For each affected resource and habitat, the scientific inquiry is cumbersome and detailed. Some scientists are tasked with evaluating the impacts of oil and chemical dispersants on representative groups of aquatic species.[3] To do so, they must consider a range of exposure pathways, including "oil droplets . . . oiled sediment, and ingestion of contaminated prey [or] food."[4] Other studies are focused on enhancing knowledge of deepwater communities, which first requires "[m]apping soft- and hard-bottom habitats along the continental shelf and sea floor."[5] The amount of scientific data being generated from this collective research is massive,[6] so much that specialized support teams have been assembled to create and manage information databases.[7]

Importantly, the study in the wake of these disasters is not just short-lived. There is increasingly a focus on studying the long-term, chronic impacts. After the *Deepwater Horizon* spill, government trustees have declared their commitment "to a long-term assessment of the Gulf, recognizing that the

1. For a detailed discussion of the coordinated scientific research following the *Deepwater Horizon* oil spill, see generally NAT'L OCEANIC & ATMOSPHERIC ADMIN., NATURAL RESOURCE DAMAGE ASSESSMENT: APRIL 2012 STATUS UPDATE FOR THE *DEEPWATER HORIZON* OIL SPILL (2012) [hereinafter 2012 *DEEPWATER HORIZON* STATUS REPORT], *available at* http://www.gulfspill restoration.noaa.gov/wp-content/uploads/FINAL_NRDA_StatusUpdate_April2012.pdf.

2. *Id.* at 15; *see also id.* at 27–37 (providing additional information on the range of resources and habitats that are being studied in the wake of the *Deepwater Horizon* oil spill, including: deepwater communities, water column and invertebrates, marine fish, marine mammals, sea turtles, nearshore sediment and resources, submerged aquatic vegetation, oysters, shallow water coral, shorelines, birds, terrestrial species, and human use).

3. *Id.* at 29.

4. *Id.* at 30.

5. *Id.* at 32.

6. BP reports that

> [s]ince May 2010, BP has worked with state and federal trustees to develop and implement more than 240 initial and amended work plans to study wildlife, habitat and the recreational use of these resources. By the end of 2014, BP had spent approximately $1.3 billion to support the assessment process.

*Restoring the Environment*, BP, http://www.bp.com/en/global/corporate/gulf-of-mexico-restoration/restoring-the-environment.html (last visited Feb. 17, 2015).

7. 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 28 ("[T]he data management team has been working to collect, record and assimilate the thousands of environmental samples, analytical and observational records.").

*Deepwater Horizon* oil spill will affect the region's natural resources for years to come."[8] This is an area where deep study is historically lacking.

While certainly intensive, there may be an important caveat to the learning opportunities presented by events like the *Exxon Valdez* or *Deepwater Horizon* spills. Notably, these extensive scientific studies are undertaken through a process known as natural resource damage assessment ("NRDA").[9] Government trustees prepare NRDAs in the wake of oil spills and toxic-substance releases. Trustees use these assessments to identify the nature and extent of injuries resulting from the release so that the government can make claims for natural resource damages against the responsible party.[10] Ultimately, natural resource damage awards are used to fund restoration projects that will return injured public resources to baseline conditions.[11]

At its core, then, NRDA is an adversarial process. To be sure, because natural resource damages awards are used to restore injured public resources, the science developed to support NRDA claims may not reflexively conjure concerns of litigation science, at least not in any mass tort sense.[12] Nonetheless, both government trustees and corporate defendants, like BP and Exxon, are driven by political and economic, as well as scientific, agendas. Because of that, scientific studies undertaken during the NRDA process raise questions of conflicts of interest and bias that are inherent in litigation-generated science.[13] Indeed, while legal scholars have not examined NRDA

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8. *Id.* at 24.

9. For a primer on natural resource damage assessments and their regulatory context, see generally ADAM VANN & ROBERT MELTZ, CONG. RESEARCH SERV., R41972, THE 2010 *DEEPWATER HORIZON* OIL SPILL: NATURAL RESOURCE DAMAGE ASSESSMENT UNDER THE OIL POLLUTION ACT (2013).

10. Natural resource damages are a special category of congressionally created damages available for injuries caused from oil spills or hazardous substance releases. *See* Oil Pollution Act (OPA), 33 U.S.C. §§ 2701, 2706 (2012); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. §§ 9601–75 (2012); *see also id.* § 9607(f)(1).

11. 33 U.S.C. § 2706(f); 42 U.S.C. § 9607(f)(1).

12. Classic examples of mass toxic tort litigation include tobacco litigation, asbestos litigation, Agent Orange litigation, and Bendectin litigation. *See, e.g.*, United States v. Philip Morris USA, Inc., 449 F. Supp. 2d 1 (D.D.C. 2006), *aff'd in part, vacated in part*, 566 F.3d 1095 (D.C. Cir. 2009) (per curiam); *In re* Bendectin Prods. Liab. Litig., 732 F. Supp. 744 (E.D. Mich. 1990); *In re* Agent Orange Prod. Liab. Litig., 611 F. Supp. 1267 (E.D.N.Y. 1985), *aff'd*, 818 F.2d 187 (2d Cir. 1987). These mass tort litigation cases have been the subject of substantial study. *See generally* MARTHA A. DERTHICK, UP IN SMOKE: FROM LEGISLATION TO LITIGATION IN TOBACCO POLITICS (3d ed. 2012); JOSEPH SANDERS, BENDECTIN ON TRIAL: A STUDY OF MASS TORT LITIGATION (1998); PETER H. SCHUCK, AGENT ORANGE ON TRIAL: MASS TOXIC DISASTERS IN THE COURTS (1986); Michelle J. White, *Asbestos and the Future of Mass Torts* (Nat'l Bureau of Econ. Research, Working Paper No. 10,308, 2004), *available at* http://www.nber.org/papers/w10308.

13. For example discussions of conflicts of interest and bias concerns that arise with respect to adversarial science in the general tort context, see William L. Anderson et al., Daubert'*s Backwash: Litigation-Generated Science*, 34 U. MICH. J.L. REFORM 619 (2001); Leslie I. Boden & David Ozonoff, *Litigation-Generated Science: Why Should We Care?*, 116 ENVTL. HEALTH PERSP. 117 (2008); Gary Edmond, *Supersizing* Daubert *Science for Litigation and Its Implications for Legal Practice and Scientific Research*, 52 VILL. L. REV. 857 (2007); Susan Haack, *What's Wrong with Litigation-Driven Science? An Essay in Legal Epistemology*, 38 SETON HALL L. REV. 1053 (2008); David Michaels

science as a form of adversarial science, some scientists have outright questioned the advocacy embedded in NRDA studies.[14]

So what can be done when one of the most important sources of science on the complexity of ecological harms—at least in terms of volume and opportunity—is also born from litigation? The short answer is: use it. More specifically, NRDA science should be embraced as an immensely useful source of understanding ecological harms from both acute and chronic toxic exposure. But, only after its risks are understood and institutional controls have been developed to ensure its legitimacy.

Often the science-litigation interface evokes thoughts of *Daubert*, "junk science," and discussions about the competency of courts to fulfill their gatekeeping role.[15] Indeed, the term "litigation science" made its jurisprudential debut in Judge Kozinski's *Daubert* opinion.[16] Scholars and courts have since grappled with litigation science and its treatment under *Daubert*; some have cast doubt on its veracity as compared to other bodies of science.[17] By contrast, this Article critiques the discourse that diminishes scientific knowledge merely because it emerges in a litigation, or adversarial, context. The real story is much more complicated.

This Article starts with the idea that litigation science plays an important informational role in understanding long-term ecological injuries. In that sense, the questions raised here go beyond *Daubert*; they go beyond the issue of judging litigation science in the courtroom. The aim is not gatekeeping experts or sorting junk science from real science in any one case. Rather, the goal is to optimize the use of adversarial science in informing broader public

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& Celeste Monforton, *How Litigation Shapes the Scientific Literature: Asbestos and Disease Among Automobile Mechanics*, 15 J.L. & POL'Y 1137 (2007).

14. *See, e.g.*, John A. Wiens, *Applying Ecological Risk Assessment to Environmental Accidents: Harlequin Ducks and the* Exxon Valdez *Oil Spill*, 57 BIOSCIENCE 769, 769 (2007) ("When a large environmental accident occurs, we expect large ecological consequences. When the disruption is due to human activities, as is the case with an oil spill, we expect the worst. Emotions can override sound judgment, and litigation can polarize positions and foster advocacy. Hyperbole replaces hypotheses, and science suffers the consequences.").

15. *See, e.g.*, David E. Bernstein, *The Misbegotten Judicial Resistance to the* Daubert *Revolution*, 89 NOTRE DAME L. REV. 27 (2013) (tracing the history of *Daubert* and considering the role of judges in distinguishing between various types of science at the evidentiary level).

16. Daubert v. Merrill Dow Pharm., Inc., 43 F.3d 1311, 1317 (9th Cir. 1995) (asking "whether the experts are proposing to testify about matters growing naturally and directly out of research they have conducted independent of the litigation, or whether they have developed their opinions expressly for purposes of testifying").

17. *See, e.g.*, David Michaels & Celeste Monforton, *Manufacturing Uncertainty: Contested Science and the Protection of the Public's Health and Environment*, 95 AM. J. PUB. HEALTH S39, S43 (2005) (suggesting that scientific research sponsored by corporations is an affront to public health because of the purposeful uncertainty that it creates). *But cf.* Samuel L. Tarry, Jr., *Can Litigation-Generated Science Promote Public Health?*, 33 AM. J. TRIAL ADVOC. 315 (2009) (arguing that litigation science funded by corporate defendants has in some cases been instrumental in advancing understanding of public health concerns).

health and environmental policy choices well after litigation files have been closed.

To further the goal of filling the science gap with good science, Part II examines why adversarial science has an important role to play in understanding ecological injuries. Part II also surveys the literature and considers whether adversarial science is different from other forms of policy-relevant science.

After exploring why adversarial science should be permitted or even encouraged to fill the knowledge gap on toxic exposure, Part III takes a critical look at NRDA science as a product of advocacy. It uses the scientific literature in the wake of the *Exxon* spill to identify three fundamental ways in which litigation influences NRDA science. Part IV builds on these categories of influence by examining the particular structural challenges that arise when assessing long-term harms.

Ultimately, this Article is as much about promise as risk. To that end, Part V proposes solutions that optimize the ability of NRDA science to advance scientific understanding of long-term ecological injuries in the wake of chronic toxic exposure. It examines some ways in which regulatory controls can be used to harness NRDA science and legitimize it for use beyond the courtroom. In particular, these solutions encourage the development of long-term scientific study while ensuring that the science is reliable enough to shape policy and inform understanding outside the particular litigation context in which it was developed.

By using NRDA science to describe both the benefits and challenges of adversarial science, this Article shifts the discussion from one of mere castigation and skepticism to one of optimism. In particular, it opens the door to future discussions about how courtroom and litigation controls might be harnessed to enhance the legitimacy of adversarial science outside the courtroom.

## II. THE PROMISE OF ADVERSARIAL SCIENCE

Why is it desirable to encourage reliance on science that is developed in a litigation context? After all, one natural response to adversarial science might simply be to write it off as adversarial posturing. However, there are at least two problems with casting adversarial science aside. First, adversarial science may be necessary to advance understanding of ecological harms in under-studied areas like toxic exposure.[18] Second, adversarial science might

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18. Another reason, not examined here, might be the difficulty of separating litigation science from other forms of scientific inquiry. *See* Boden & Ozonoff, *supra* note 13, at 120 (noting why peer review is not necessarily a useful tool for exposing biased science because "peer-reviewed publication can be manipulated by the parties to litigation" and, in some cases, "factual questions critical to a legal case may be too narrow to warrant peer-reviewed publication"); William G. Childs, *The Overlapping Magisteria of Law and Science: When Litigation and Science Collide*, 85 NEB. L.

not be inherently biased (or at least not any more so than other forms of policy-oriented science), but instead, it might simply be perceived as such. If true, these would both be reasons to embrace adversarial science from NRDA proceedings.

### A. *THE NECESSITY OF LITIGATION SCIENCE*

When it comes to the effects of toxic exposure, there is a significant science gap on issues of whether toxins cause harm and, if so, in what form.[19] These science gaps have led some scholars to observe that there is a fundamental failure of regulatory regimes to encourage the systematic study of toxic exposure.[20]

The study of long-term toxic exposure presents even more challenges. Popular media and science literature readily recognize that questions of long-term injuries are inherently complicated because of chronic exposure to toxins in everyday life.[21] In some areas of research, like studies examining

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REV. 643, 654 (2007) (critiquing peer review and noting that "peer review in its current form is a relatively new concept and it is far from infallible").

19. Wendy E. Wagner, *Commons Ignorance: The Failure of Environmental Law to Produce Needed Information on Health and the Environment*, 53 DUKE L.J. 1619, 1619 (2004) ("One of the most significant problems facing environmental law is the dearth of scientific information available to assess the impact of industrial activities on public health and the environment.").

20. *Id.* These information failures are best thought of as regulatory failures because of the many environmental and public health laws aimed at regulating exposure to toxins and other pollutants. *See* Bradley C. Karkkainen, *Framing Rules: Breaking the Information Bottleneck*, 17 N.Y.U. ENVTL. L.J. 75, 75–79 (2008) (detailing the tens of thousands of regulatory mandates embodied in environmental laws). Consider, for example, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. § 136a (2012) (requiring pesticide manufacturers to obtain registration from the EPA before marketing new pesticides); Toxic Substances Control Act (TSCA), 15 U.S.C. § 2604 (2012) (regulating the manufacture of new chemicals); Food Quality Protection Act, 21 U.S.C. § 346a(b)(2) (2012) (requiring the EPA to set tolerance levels for pesticides on food residue, taking into account aggregate exposure); Clean Water Act, 33 U.S.C. § 1321 (2012 & Supp. I 2013) (prohibiting the discharge of pollutants into the waters of the United States without a permit); Resource Conservation and Recovery Act (RCRA) of 1976, 42 U.S.C. § 6922 (2012) (requiring the EPA to promulgate standards for handling and disposing hazardous waste); Clean Air Act, 42 U.S.C. § 7412 (prohibiting the emission of toxic pollutants without a permit); Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, 42 U.S.C. § 11002 (2012 & Supp. I 2013) (requiring covered facilities to prepare an emergency response plan and report their storage, use, and disposal of hazardous substances).

21. *See, e.g.*, James R. Roberts & Catherine J. Karr, *Technical Report: Pesticide Exposure in Children*, 130 PEDIATRICS e1765 (2012), *available at* http://pediatrics.aappublications.org/content/130/6/e1765.full.pdf+html (noting that although toxicity from pesticides is relatively uncommon in the United States, subacute and chronic, low-level exposure through foods, dust, agricultural use, and pet exposures is common and may contribute to a range of diseases and disabilities); *see also* Brad Heath & Blake Morrison, *EPA Study: 2.2M Live in Areas Where Air Poses Cancer Risk*, USA TODAY, (July 26, 2009, 10:52 PM), http://usatoday30.usatoday.com/news/nation/environment/2009-06-23-epa-study_N.htm (discussing the results of the National-Scale Air Toxics Assessment, or NATA, which is a study used by the EPA to identify parts of the country where residents could face the greatest health threats from ambient air pollution); Patricia Hunt, *Toxins All Around Us*, SCI. AM. (Sept. 20, 2011), http://www.scientificamerican.com/article/

impacts to marine ecosystems following oil spills, the scientific literature is starting to recognize that long-term harms can be even more significant than short-term acute injuries.[22] But, as with long-term injuries to humans from toxic exposure, time lags, synergistic effects, and complicated biological interdependencies make it difficult to understand long-term injury to ecosystems.[23] Tracing causal pathways and differentiating between multiple contributing stressors is a particularly difficult problem.[24] In the toxic torts area, these challenges have given rise to a rich body of legal literature discussing the problems of proof and examining alternate causal frameworks for latent injuries.[25]

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toxins-all-around-us ("Some of the chemicals that are all around us have the ability to interfere with our endocrine systems, which regulate the hormones that control our weight, our biorhythms and our reproduction.").

22. *See generally* Sanne H. Knudsen, *The Long-Term Tort: In Search of a New Causation Framework for Natural Resource Damages*, 108 NW. U. L. REV. 475 (2014) (assembling the literature and examining why long-term ecological harms are more substantial than previously thought).

23. *Id.* at 530–31 (discussing the similarities between long-term ecological injury and toxic tort claims). While in many non-toxic tort cases the effect almost immediately follows the cause, long latency periods are the primary reason that proving causation is so difficult in toxic tort cases. *See, e.g.*, RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 28 cmt. c (2010) ("[T]he causes of some diseases, especially those with significant latency periods, are generally much less well understood. Even known causes for certain diseases may explain only a fraction of the incidence of such diseases, with the remainder due to unknown causes."); *see also* ROBIN KUNDIS CRAIG ET AL., TOXIC AND ENVIRONMENTAL TORTS: CASES AND MATERIALS 159 (2011) ("With the rise of toxic torts . . . proof of causation has become one of the most complex and controversial aspects of tort liability."); Andrew R. Klein, *A Model for Enhanced Risk Recovery in Tort*, 56 WASH. & LEE L. REV. 1173, 1174–75 (1999) (discussing the problems that long latency periods create in proving causation for toxic torts); Susan R. Poulter, *Science and Toxic Torts: Is There a Rational Solution to the Problem of Causation?*, 7 HIGH TECH. L.J. 189, 234 (1992) (discussing the synergistic effects of toxic exposure and raising the example of smoking and asbestos as an example of complicated questions of causation); Robert L. Rabin, *Environmental Liability and the Tort System*, 24 HOUS. L. REV. 27, 27–32 (1987) (discussing the distinguishing characteristics of toxic tort and environmental harm cases).

24. BUREAU OF RECLAMATION, U.S. DEP'T OF INTERIOR, NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION FEDERAL ADVISORY COMMITTEE: FINAL REPORT TO THE SECRETARY 11 (2007), *available at* http://www.doi.gov/restoration/library/upload/faca_finalreport.pdf ("Quantifying natural resource injury in a manner that supports reliable restoration planning can be a highly complex technical issue. . . . Adverse impacts to habitat or organisms at a site may be caused by a combination of factors—such as development, pesticide use, and soil erosion—in addition to hazardous substance releases."); Knudsen, *supra* note 22, at 490–96 (detailing the factors that make long-term injuries difficult to prove in the natural resource damage context); *see also* Mark A. Harwell et al., *A Conceptual Model of Natural and Anthropogenic Drivers and Their Influence on the Prince William Sound, Alaska, Ecosystem*, 16 HUM. & ECOLOGICAL RISK ASSESSMENT 672 (2010) (examining the natural processes, anthropogenic drivers, and resultant stressors that have affected Prince William Sound following the *Exxon Valdez* oil spill).

25. *See, e.g.*, Margaret A. Berger, *Eliminating General Causation: Notes Towards a New Theory of Justice and Toxic Torts*, 97 COLUM. L. REV. 2117 (1997); David E. Bernstein, *Getting to Causation in Toxic Tort Cases*, 74 BROOK. L. REV. 51 (2008); Daniel A. Farber, *Toxic Causation*, 71 MINN. L. REV. 1219 (1987); Donald G. Gifford, *The Peculiar Challenges Posed by Latent Diseases Resulting from Mass Products*, 64 MD. L. REV. 613 (2005); Steve Gold, *Causation in Toxic Torts: Burdens of Proof, Standards of Persuasion, and Statistical Evidence*, 96 YALE L.J. 376 (1986); Gary E. Marchant, *Genetic Data in*

As long as the regulatory process creates or tolerates gaps in knowledge, logic dictates that adversarial science will be developed to offer proof of harm. The gap in scientific knowledge on issues of toxic exposure, and the potential of NRDA science to fill those gaps for ecological injuries, makes an active embrace of litigation science worth considering.[26] One area well-known for its science gap is long-term injury and toxic torts, where causal relationships between toxic exposure and human or ecological injury are poorly understood.[27] What are the consequences of chronic and sustained exposure to benzene in the workplace?[28] How might chronic use of anti-bacterial soap by children cause endocrine or hormonal problems later in life?[29] What are the long-term impacts of oil spills on the marine ecosystem?[30] How are

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*Toxic Tort Litigation*, 14 J.L. & POL'Y 7 (2006); Allen Rostron, *Beyond Market Share Liability: A Theory of Proportional Share Liability for Nonfungible Products*, 52 UCLA L. REV. 151 (2004).

26. *See* Sheila Jasanoff, *Transparency in Public Science: Purposes, Reasons, Limits*, 68 LAW & CONTEMP. PROBS. 21, 44 (2006).

27. *See* Poulter, *supra* note 23, at 195 (observing that "[m]uch of the movement toward the adoption of lenient standards of admissibility and proof of causation in toxic torts has been prompted by the recognition of the difficulties faced by plaintiffs in meeting the traditional requirement that they prove, by a preponderance of the evidence, that their injuries were caused by chronic, low-level chemical or radiation exposures that were remote in time from the manifestation of injury"); *see also* RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 cmt. c (2010); CRAIG ET AL., *supra* note 23, at 159.

28. For a primer on the health impacts of benzene exposure, see WORLD HEALTH ORG., EXPOSURE TO BENZENE: A MAJOR PUBLIC HEALTH CONCERN (n.d.), *available at* http://www.who.int/ipcs/features/benzene.pdf (providing a primer on the health impacts from acute and chronic exposure to benzene and noting the multiple sources of exposure); see also Steven H. Lamm et al., *Chronic Myelogenous Leukemia and Benzene Exposure: A Systematic Review and Meta-Analysis of the Case-Control Literature*, 182 CHEMICO-BIOLOGICAL INTERACTIONS 93, 94 (2009) (reviewing literature linking benzene exposure to a particular subset of leukemia types); A. Robert Schnatter et al., *Review of the Literature on Benzene Exposure and Leukemia Subtypes*, 153–54 CHEMICO-BIOLOGICAL INTERACTIONS 9, 12–15 (2005) (reviewing epidemiologic literature on benzene exposure and leukemia). For examples of benzene litigation and causation issues, see Knight v. Kirby Inland Marine, Inc., 363 F. Supp. 2d 859, 866 (N.D. Miss. 2005) (finding no evidence of general causation for Hodgkin's lymphoma because the studies relied upon by the expert categorized workers broadly and failed to provide specific exposure data); Daniels v. Lyondell-Citgo Ref. Co., 99 S.W.3d 722, 729 (Tex. App. 2003) (finding no evidence of general causation because the studies relied on by the experts did not show a statistically significant link between benzene and lung cancer). For examples of plaintiff law firms discussing benzene litigation and offering free case evaluations, see generally Jelle Vlaanderen et al., *Occupational Benzene Exposure and the Risk of Lymphoma Subtypes: A Meta-Analysis of Cohort Studies Incorporating Three Study Quality Dimensions*, 119 ENVTL. HEALTH PERSP. 159 (2011); *Benzene and Acute Lymphocytic Leukemia*, METZGER L. GROUP, http://www.toxictorts.com/index.php/toxic-chemicals/benzene/benzene-and-acute-lymphocytic-leukemia (last visited Feb. 17, 2015).

29. Safety and Effectiveness of Consumer Antiseptics, 78 Fed. Reg. 76,444 (Dec. 17, 2013) (proposing to add additional FDA safety restrictions to the use of over-the-counter antibacterial soap); Press Release, Food & Drug Admin., FDA Issues Proposed Rule to Determine Safety and Effectiveness of Antibacterial Soaps (Dec. 16, 2013), *available at* http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm378542.htm.

30. *See* Knudsen, *supra* note 22, at 484–90 (discussing evidence of long-term harm in the wake of the *Exxon Valdez* oil spill).

pesticides in groundwater impacting human endocrine systems?[31] These are questions that could benefit most from sustained research, but may never undergo systematic study as part of any coordinated regulatory regime.

The ad hoc nature of research on harms from chronic chemical or toxic exposure is at least partially responsible for the gaps in scientific knowledge. In her work, Professor Wendy Wagner examines the "dearth of research and basic information" available on how industrial activities affect health and the environment.[32] In doing so, she explains that "[v]irtually every prominent expert panel convened to consider the effects" have expressed alarm as to the lack of information.[33] This regulatory gap is one reason why litigation science exists and plays a key role in the development of scientific understanding of long-term toxic exposure. In fact, litigation and the potential for damage awards provide the financial incentive to undertake studies to fill in those gaps.

Wagner's work further suggests that the regulatory gap is not likely to go away simply because it has been identified. To that end, in suggesting some theories as to why the regulatory gap exists, Wagner explains that "when the stakes are high, actors not only will resist producing potentially incriminating information but [also] will invest in discrediting public research that suggests their activities are harmful."[34] Wagner's observation suggests that litigation might force the hand of chemical or other product manufacturers who might otherwise prefer control over access to potentially damaging information. Litigation and its tools of discovery can serve truth-seeking and information-forcing functions that current regulatory regimes may lack. In fact, Professor Sheila Jasanoff has recognized the promise of litigation science for testing knowledge: "[B]ecause litigation itself is such a powerful prod to producing

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31. Wissem Minf et al., *Effect of Endocrine Disruptor Pesticides: A Review*, 8 INT'L J. ENVTL. RES. & PUB. HEALTH 2265, 2291 (2011) (recognizing that "the combined actions of pesticides also need [ ]to be addressed in the risk assessment process because mixtures of these substances may cause higher toxic effects than those expected from the single compounds" and that "[f]urther studies are needed on the occurrence, fate and impact of such pesticides on the ecosystem and public health"); *cf.* Rachel Aviv, *A Valuable Reputation*, NEW YORKER (Feb. 10, 2014), http://www.newyorker.com/magazine/2014/02/10/a-valuable-reputation (telling the story of how Dr. Tyrone Hayes was targeted by Syngenta after uncovering the endocrine-disruptive effects of atrazine, a widely used herbicide).

32. *See* Wagner, *supra* note 19, at 1625; *id.* at 1628 ("Even if scientists had a strong theoretical understanding of how hazardous substances impact health and the environment, available information is insufficient to apply these theories to assess ecosystem and human health."); *see also* Christine H. Kim, *Piercing the Veil of Toxic Ignorance: Judicial Creation of Scientific Research*, 15 N.Y.U. ENVTL. L.J. 540, 548 n.44 (2007).

33. *See* Wagner, *supra* note 19, at 1625; *see also id.* at 1723 (noting that "even the most basic risks, like acute effects, have been quantified for only a fraction of all chemicals in commerce"). Similar claims regarding the lack of information relating to the public health impacts of everyday chemicals have been levied in testimony before Congress and in the popular media. *See, e.g.*, *Everyday Chemicals May Be Harming Kids, Panel Told*, CNN (Oct. 26, 2010, 1:21 PM), http://www.cnn.com/2010/HEALTH/10/26/senate.toxic.america.hearing.

34. *See* Wagner, *supra* note 19, at 1619.

new scientific evidence, adversarial legal processes sometimes provide the only significant testing ground for claims relevant to settling disputes."[35]

NRDA science might be especially valuable for reducing the regulatory and science gaps. NRDA science has made substantial contributions to understanding ecological injuries. In the wake of the *Exxon Valdez* oil spill, for instance, scientific studies regarding the lingering effects of the oil reveal that the long-term consequences of toxic exposure might be even more substantial than the acute, graphic injuries.[36] Similarly, the *Deepwater Horizon* spill presents unique opportunities for studying the ecosystem response to both acute and chronic toxic exposure.[37] Consider, for example, that researchers have suddenly found themselves in the middle of an intensive, coordinated, interdisciplinary and highly visible effort to study deepwater communities in the wake of the *Deepwater Horizon* spill. This is a resource for which there has historically been "limited knowledge."[38] Now researchers are doing everything from mapping the location of habitats on the sea floor, to assessing the potential toxicity for deepwater habitats exposed to oil, to studying impacts on community composition and reproductive responses.[39] For other resources as well, researchers are busy examining the toxicological responses of aquatic species in a wide range of habitats, from wetlands to coral.[40]

Some NRDA science, like mapping or other resource inventories, can be undertaken in the absence of an oil spill. After the *Deepwater Horizon* spill, for instance, researchers are surveying the sea floor to "confirm the presence of deepwater coral communities."[41] For this work, the oil spill creates a discrete need, but the research could be done any time there is sufficient desire and funding.[42] Notably, however, the desire to fund this type of inventorying or purely descriptive science may not exist absent an acute need for information, as evidenced by the *Deepwater Horizon* spill itself.

Other NRDA science, however, arises from the unique opportunity to examine impacts to an entire ecosystem as they unfold in the short and long term. After an oil spill, the entire affected ecosystem becomes a laboratory. In

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35. *Cf.* Jasanoff, *supra* note 26, at 39.

36. *See* Knudsen, *supra* note 22, at 485 (discussing studies showing lingering oil and its effects on the Prince William Sound ecosystem decades after the *Exxon* spill).

37. For descriptions of the NRDA process underway for the *Deepwater Horizon* spill, see 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 15 fig.3; see also BP, NATURAL RESOURCE DAMAGE ASSESSMENT OF THE GULF OF MEXICO DEEPWATER HORIZON ACCIDENT: ASSESSING, LEARNING, SHARING (2012) [hereinafter BP NRDA REPORT], *available at* http://www.thestateofthegulf.com/media/1257/Green_book_year_2_report_final.pdf.

38. 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 31.

39. *Id.* at 31–33.

40. *Id.* at 29.

41. *Id.* at 34.

42. See *infra* Part V.A for suggestions on how to encourage more coordinated research before disaster events; see also Usha Varanasi, *Frontloading the Science in Anticipation of Environmental Disasters*, 37 FISHERIES 233, 234 (2012).

this way, NRDA science provides a rare chance to study first-hand the resilience of marine ecosystems and to sort out the synergistic implications of multiple stressors that otherwise combine to affect change.[43] Moreover, the NRDA scientific programs are extensive and have the potential for systematic, coordinated, and multi-disciplinary studies of a single marine ecosystem.[44] Sometimes, the studies are undertaken over many decades and provide significant insight into the nature of long-term harms.[45] In these ways, NRDA science will necessarily make a substantial contribution to the collective scientific understanding of toxic exposure and marine ecosystems.[46] Indeed, the catastrophic nature of oil spills, public outcry, and inherently reactive nature of NRDA combine to create opportunities for scientific study that cannot be fully replicated outside of the crisis setting. The natural resource damage context is therefore one area where litigation science plays an information role that cannot simply be filled by regulatory regimes.

In the end, the value added from the NRDA process amounts to more than just arriving at a dollar figure for damages. In fact, it is destructive to think that the vast amount of science NRDA generates can be discarded simply because it emerges from an adversarial context. Doing so would undermine the broader public interest in understanding ecological effects from acute and chronic toxic exposure. A better approach is to assess how NRDA science is influenced by its adversarial context and propose solutions to legitimize the science or the perception of the science. This approach serves the dual goals of advancing the state of knowledge and ensuring the integrity of that knowledge.

### *B. COMPARING ADVERSARIAL SCIENCE TO OTHER POLICY-RELEVANT SCIENCE*

Just because adversarial science fills an information gap does not alone mean it should be embraced. Indeed, for information to be useful, it must also be reliable. To that end, we ought to pause for a moment to consider

43. In a report to the President, the National Oil Spill Commission lamented the lack of funding immediately following the *Deepwater Horizon* oil spill because of the unique opportunity presented by the spill to study deep ocean responses to oil spills. NAT'L COMM'N ON THE BP *DEEPWATER HORIZON* OIL SPILL & OFFSHORE DRILLING, DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING 184 (2011) [hereinafter NATIONAL OIL SPILL COMMISSION REPORT] ("But funding for academic and other scientists in the days and weeks immediately after the spill was limited. As a result, the nation lost a fleeting opportunity to maximize scientific understanding of how oil spills—particularly in the deep ocean—adversely affect individual organisms and the marine ecosystem." (citation omitted)).

44. *See, e.g.*, 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 15 fig.3 (showing the numerous NRDA Technical Working Groups that have been assembled to evaluate the impacts of the BP Gulf Oil Spill).

45. *Id.* at 24 ("Trustees remain committed to a long-term assessment of the Gulf, recognizing that the *Deepwater Horizon* oil spill will affect the region's natural resources for years to come.").

46. *See* BP NRDA REPORT, *supra* note 37, at 3 ("We know more about environmental conditions in the Gulf today because some of the best experts in the U.S. and the world have focused their attention and research on these resources.").

whether science born out of litigation is inherently more suspect than other forms of policy-relevant science. If we find the veracity of adversarial science particularly suspect, we might prefer to explore other mechanisms for generating the necessary information.

Importantly, many scholars have deeply considered the complicated intersections of policy and science.[47] In doing so, they have grappled with the legitimacy concerns that arise when science is used to advance a particular public policy or regulatory agenda, albeit outside the litigation context.[48] They have questioned whether science can in fact be separated from the policy judgments that are inextricably intertwined with risk management decisions.[49] They have examined uncertainty inherent in science, paying special attention to efforts by some stakeholders to use or manufacture uncertainty as a means of avoiding regulation.[50]

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47. *See, e.g.*, Eric Biber, *Which Science? Whose Science? How Scientific Disciplines Can Shape Environmental Law*, 79 U. CHI. L. REV. 471, 476 (2012) (examining how understanding the perspectives of various scientific disciplines might be useful in legal institutional design); Holly Doremus, *Scientific and Political Integrity in Environmental Policy*, 86 TEX. L. REV. 1601, 1652–53 (2008) (exploring complications at the science and policy interface and arguing that "[b]oth scientific and political integrity are essential to effective and legitimate environmental policy"); Sheila S. Jasanoff, *Contested Boundaries in Policy-Relevant Science*, 17 SOC. STUD. SCI. 195, 195 (1987) (explaining that the "deconstruction" and "reconstruction" of science during the regulatory decision-making process puts "unusual strains on science"); Wendy E. Wagner, *The Science Charade in Toxic Risk Regulation*, 95 COLUM. L. REV. 1613, 1617 (1995) (examining how "agencies exaggerate the contributions made by science in setting toxic standards in order to avoid accountability for the underlying policy decisions"). *See generally* Oliver Houck, *Tales from a Troubled Marriage: Science and Law in Environmental Policy*, 302 SCIENCE 1926 (2003) (describing the roles that science has played in setting environmental policy).

48. *See, e.g.*, Angus Macbeth & Gary Marchant, *Improving the Government's Environmental Science*, 17 N.Y.U. ENVTL. L.J. 134 (2008) (examining the many ways that science plays a role in shaping environmental regulation and suggesting methods for insulating scientific results from political influence).

49. *See* Cary Coglianese & Gary E. Marchant, *Shifting Sands: The Limits of Science in Setting Risk Standards*, 152 U. PA. L. REV. 1255, 1257–58 (2004) ("But even though science is valuable for what it can tell administrators about policy problems and their possible solutions, science alone cannot provide a complete rationale for a policy decision because it does not address the normative aspects of administrative policymaking.").

50. Holly Doremus, *Precaution, Science, and Learning While Doing in Natural Resource Management*, 82 WASH. L. REV. 547, 548 (2007) (remarking that "[u]ncertainty is the unifying hallmark of environmental and natural resource regulation"); Holly Doremus, *Science Plays Defense: Natural Resource Management in the Bush Administration*, 32 ECOLOGY L.Q. 249, 258 (2005) [hereinafter Doremus, *Science Plays Defense*] ("The combination of actual uncertainty and public expectations of certainty makes the rhetoric of science equally available to the regulatory offense and defense."); Michaels & Monforton, *supra* note 17; David Michaels & Celeste Monforton, *Scientific Evidence in the Regulatory System: Manufacturing Uncertainty and the Demise of the Formal Regulatory System*, 13 J.L. & POL'Y 17, 31–38 (2005) (describing and providing examples of "real" and "manufactured" uncertainty in science and how those uncertainties impact the regulatory process).

Even when popular audiences, scientists, and politicians have called for the revival of "sound science" in regulatory decision-making,[51] scholars have questioned whether any science that is used in setting public policy can really be deemed "pure science."[52] Indeed, well-known scholars like Professor Sheila Jasanoff have long argued that even the act of labeling science as "pure science" or "policy-relevant science" is a contested exercise shaped by institutional and political interests.[53]

In the area of natural resources law, Professor Holly Doremus has described the related phenomena where agencies make policy decisions in the name of science in order to avoid scrutiny.[54] She explains that "[t]he core of the problem is not the involvement of politics but its concealment behind a cloak of science."[55] Professor Wendy Wagner has made similar observations in the toxic regulation context, unveiling a "science charade" where "agencies exaggerate the contributions made by science in setting toxic standards in order to avoid accountability for the underlying policy decisions."[56] These observations are consistent with Jasanoff's assertion that labels matter in terms of public perception; for Doremus and Wagner, the desire to label policy decisions as scientific ones motivates agencies to shape their rationales around science.[57] This phenomenon has lead Doremus to call for greater

51. *See* Lewis M. Branscomb, *Science, Politics, and U.S. Democracy*, 21 ISSUES SCI. & TECH. 1, 53 (2004) (cautioning "that if either scientists or politicians so politicize their mutual engagement that they sacrifice the credibility of the scientists and the legitimacy of the government officials, the consequences to the nation's time-honored system of governance could be serious indeed"); Robert T. Lackey, *Science, Scientists, and Policy Advocacy*, 21 CONSERVATION BIOLOGY 12, 12 (2007) (cautioning other scientists against crossing the line from "participat[ing] in public policy deliberations" to "advocating for their policy preferences"); Jake C. Rice, *Food for Thought: Advocacy Science and Fisheries Decision-Making*, 68 ICES J. MARINE SCI. 10, 13–16 (2011) (urging other scientists to choose alternative ways of participating in policy debates without tainting the respected position of science); Daniel Sarewitz, *The Rightful Place of Science*, 25 ISSUES SCI. & TECH. 4, 89 (2009) (critiquing and providing context to President Obama's call to "restore science to its rightful place").

52. *See* Jasanoff, *supra* note 47, at 200 (remarking that "[f]or science in the policy context, the age of innocence ended in the early 1970s" when a surge of environmental statutory schemes placed substantial pressure on science to predict and prevent future environmental harm).

53. *Id.* at 224 (stating that "scientists, private interest groups and members of the policy establishment all have a stake in the definition of science and non-science, and the vocabulary used by all of these parties remains subject to manipulation").

54. Doremus, *Science Plays Defense*, *supra* note 50, at 254 (explaining that "the political appeal of science has long encouraged overemphasis of the role of science in regulatory choices. Both regulators and their critics are tempted to scientize regulatory decisions, falsely claiming that science is or should be the determinative factor").

55. *Id.* at 253.

56. *See* Wagner, *supra* note 47, at 1617.

57. Doremus, *Science Plays Defense*, *supra* note 50, at 255–56 (describing why agencies are motivated to hide behind the specter of science when making what are at heart policy choices).

transparency in regulatory decisions in order to make clear when science stops and policy starts.[58]

Many solutions have been proposed, including increasing transparency in regulatory decisions,[59] allowing access to federally funded research data,[60] instituting greater regulatory peer review,[61] reexamining the reliance on scientific advisory committees,[62] and imposing *Daubert*-like review on agency decisions.[63]

In some ways, the challenges of litigation science are similar to science generated in the regulatory context. In neither context is the science "pure."[64] The science is undertaken with a particular purpose in mind, whether that purpose is setting policy at a regulatory level or providing evidence of injury.[65] There may also be a propensity to generate uncertainty as a way of manipulating the outcome.[66] In the regulatory sphere, scientific uncertainty is one tool for combatting additional regulatory oversight.[67] In the litigation

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58. *Id.* at 299 ("[I]n the regulatory context, transparency means revealing scientific judgments, so that they can be subjected to scientific evaluation, and also revealing political judgments so that they can be evaluated through the political process."); Doremus, *supra* note 47, at 1639–49 (suggesting ways of bringing more integrity and transparency to regulatory decisions).

59. Doremus, *supra* note 47, at 1646–48 (suggesting several ways to increase the political integrity of "science-laden policy decisions" by increasing the transparency); Jasanoff, *supra* note 26, at 21–35 (examining the benefits and perils of increased transparency).

60. *See generally* Richard Shelby, *Accountability and Transparency: Public Access to Federally Funded Research Data*, 37 HARV. J. ON LEGIS. 369 (2000) (discussing proposals in Congress to allow greater access to research data obtained with federal funds).

61. *See generally* J.B. Ruhl & James Salzman, *In Defense of Regulatory Peer Review*, 84 WASH. U. L. REV. 1 (2006); Ian Fein, Comment, *Reassessing the Role of the National Research Council: Peer Review, Political Tool, or Science Court?*, 99 CALIF. L. REV. 465 (2011) (exploring the use of the NRC committees as a means of institutionalizing regulatory peer review).

62. *See generally* Gregory N. Mandel & Gary E. Marchant, *The Living Regulatory Challenges of Synthetic Biology*, 100 IOWA L. REV. 155 (2014) (discussing several ways to legitimize synthetic biology regulation, including scientific advisory boards and private-public partnerships); Stephanie Tai, *Comparing Approaches Towards Governing Scientific Advisory Bodies on Food Safety in the United States and the European Union*, 2010 WIS. L. REV. 627 (exploring how the use of scientific advisory committees can help legitimize food safety regulation).

63. *See generally* Thomas O. McGarity, *On the Prospect of "Daubertizing" Judicial Review of Risk Assessment*, 66 LAW & CONTEMP. PROBS. 155 (2003). For further information, see Doremus, *Science Plays Defense*, *supra* note 50, at 291–92 (discussing the literature on imposing *Daubert* standards to agency decisions).

64. *See* Jasanoff, *supra* note 47, at 200.

65. Thomas McGarity and Wendy Wagner present various case studies that demonstrate ways in which science has been manipulated, including examples of manipulation in both the regulatory context and in litigation. *See, e.g.*, THOMAS O. MCGARITY & WENDY E. WAGNER, BENDING SCIENCE: HOW SPECIAL INTERESTS CORRUPT PUBLIC HEALTH RESEARCH 68 (2008) (noting that "[b]iased designs are also evident in some research prepared for litigation").

66. *See supra* note 50 (compiling scholarly literature discussing scientific uncertainty and incentives to generate uncertainty for a tactical advantage in policy-making).

67. *See* Doremus, *Science Plays Defense*, *supra* note 50, at 254–56; Wagner, *supra* note 47, at 1687 (explaining that there is little incentive for private research to fill scientific information

context, defendants have a particular incentive to generate uncertainty as a way of undermining the plaintiffs' ability to meet their burden of proof on issues like causation.[68] And finally, in both contexts, funding imbalances may affect the ability of certain stakeholders to generate more or high levels of science to advance their positions.[69] Regardless of whether empirical data would bear out those claims, there may at least be a perception that corporations have greater funding available to generate science to advance their desired outcomes. Those perceptions may matter.[70]

For all these reasons, science produced in the anticipation of litigation does not raise entirely unique concerns. Many influential scholars have observed the competing influences and agendas that shape policy-relevant science. Some of those observations apply to adversarial science as well. And yet, science produced in the adversarial context ought at least be examined on its own terms. To be sure, despite the general similarities between adversarial science and other forms of policy-relevant science, there are also differences. These differences are largely driven by the culture of litigation as an acceptable forum to battle with a narrow purpose—winning for individual gain. Plaintiffs who are able to prove injury through the help of science stand to gain greater monetary awards. Defendants, too, have immediate financial incentives.[71] Litigation is typically a private enterprise, with clear winners and losers, and set in a reactive frame where, ultimately, liability will be judged and damages awarded. By the very nature of its focused and reactive frame, litigation is less searching and less concerned with community outcomes. The parties are expected to advance their best positions and attempt to rebut

gaps given that "[t]he agencies' science-bias in prioritizing substances for regulation virtually guarantees that greater regulation will ultimately follow advancements in scientific information and knowledge").

68. *See* Heidi Li Feldman, *Science and Uncertainty in Mass Exposure Litigation*, 74 TEX. L. REV. 1, 41 (1995) ("[P]lacing the burden of proof on the plaintiff creates a perverse incentive for actors to foster strong uncertainty about general causation.").

69. *See* Sheldon Krimsky, *The Funding Effect in Science and Its Implications for the Judiciary*, 13 J.L. & POL'Y 43, 61–62 (2005) (discussing the influence of funding on science and noting that "there is no evidence that pre-litigation research is more dependable or objective than post-litigation research"); *see also* MCGARITY & WAGNER, *supra* note 65, at 96 (suggesting that privately-funded research "too often dominates the highly contested and poorly supervised arena of policy-relevant science"); Boden & Ozonoff, *supra* note 13, at 119 (asserting that "[w]ell-financed industries have the resources to seed the literature with strategic science" and that by comparison, few plaintiffs have the means to do so).

70. *See* Macbeth & Marchant, *supra* note 48, at 148 (differentiating "*sound science*" from "*trusted science*" and discussing the importance of basing regulatory decisions on science that is perceived as credible).

71. *See* Douglas G. Smith, *Resolution of Mass Tort Claims in the Bankruptcy System*, 41 U.C. DAVIS L. REV. 1613, 1622 (2008) ("Beginning in the 1980s, companies that manufactured asbestos-containing materials such as Johns-Manville and Raybestos were forced into Chapter 11 bankruptcy after being deluged with waves of asbestos-related claims.").

contradictory evidence.[72] The parties are not expected to objectively examine the evidence and present a measured view of their case.

By contrast, regulatory science is generated to advance a public policy or public health objective. Notwithstanding differing opinions on what public policy decision might be preferable, and notwithstanding the self-interest that nonetheless drives some decisions (e.g., getting a new drug approved by the FDA), the regulatory conversation is framed from the perspective of advancing a public purpose.

In the end, these differences may do more to shape perception than anything else. In fact, there are reasons to think that adversarial science, though different in some respects, might not be vastly more prone to manipulation than other forms of policy-relevant science.[73] After all, adversarial science is subject to controls that are not part of the regulatory process. For example, experts advancing adversarial science are subject to cross-examination and evidentiary rules.[74] Science developed outside the litigation context provides no guarantee of purity or lack of bias.[75] If that is true, adversarial science may not be worth dismissing out of hand. In other words, if litigation science is not uniquely plagued by self-interest, it cannot fairly be dismissed on that basis unless all policy-oriented science undergoes similar castigation.

72. *See* Bernstein, *supra* note 15, at 32 (observing that "attorneys seeking expert witnesses" have no incentive to uncover the truth, but to choose witnesses who advance their position); *id.* at 32 n.34 (assembling literature providing similar observations about a litigant's incentives to skew the selection of science or experts presented during litigation).

73. For additional discussion of whether litigation-science is more inherently biased than other forms of policy-relevant science, see Boden & Ozonoff, *supra* note 13, at 117 (arguing that litigation-generated science should not be treated differently); see also Haack, *supra* note 13, at 1077 (arguing that litigation-generated science is "likely to be biased"); Janet Raloff, *Judging Science: Courts May Be Too Skeptical of Research Done with Juries in Mind*, 173 SCI. NEWS 42 (2008). *See generally* Edmond, *supra* note 13 (reviewing and challenging the perception of "science for litigation").

74. *See* Boden & Ozonoff, *supra* note 13, at 120 ("Few, if any, journal peer-review processes are as stringent or as probing as the usual cross-examination performed in an adversarial setting."); *see also* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 595 (1993) ("Expert evidence can be both powerful and quite misleading because of the difficulty in evaluating it. Because of this risk, the judge in weighing possible prejudice against probative force under Rule 403 of the present rules exercises more control over experts than over lay witnesses." (quoting Jack B. Weinstein, *Rule 702 of the Federal Rules of Evidence Is Sound; It Should Not Be Amended*, 138 F.R.D. 631, 632 (1991))).

75. *See, e.g.*, Boden & Ozonoff, *supra* note 13, at 118 (noting that "[a] growing body of scholarship has consistently raised concerns about bias generated by conflicts of interest outside of [litigation-generated science]"); Mark R. Patterson, *Conflicts of Interest in Scientific Expert Testimony*, 40 WM. & MARY L. REV. 1313, 1322 (1999) ("Even when such research is conducted independent of 'litigation,' it is not necessarily conducted free of conflicts of interest."); Wendy Wagner & David Michaels, *Equal Treatment for Regulatory Science: Extending the Controls Governing the Quality of Public Research to Private Research*, 30 AM. J.L. & MED. 119, 122 (2004) (explaining that for certain kinds of policy-relevant research, funders "face strong incentives to design and report research in ways most favorable to their interests and to suppress adverse results provided they can do so without detection").

This claim may be especially true for NRDA science, which is a bit of a hybrid between what is typically thought of as litigation science and regulatory science. Natural resource damage trustees are driven by a mandate to restore injured public resources and charged by regulation to act "on behalf of the public."[76] Indeed, natural resource damage awards are earmarked for restoration and do not get folded into the coffers of any agency budget.[77] The private emphasis of NRDA litigation, therefore, may be less pronounced than classic product liability cases.

Of course, the ability of adversarial science to play a useful role in public policy will turn on perceptions as much as empirics. To that end, litigation science has carried the stigma of bias since the term was first introduced by Judge Kozinski in the *Daubert* litigation.[78] This perception of bias, whether or not there is actual bias, could prevent litigation science from serving the useful function of informing public policy decisions or shaping broader scientific conversations.[79] At a minimum, examining adversarial science on its own terms and shaping institutional controls to address identified risks might go a long way towards lessening the perceived or actual bias. In doing so, the science can more readily fulfill its promise as an informational asset to the broader scientific community.

Up until now, little work has been done in this area. Outside the *Daubert* context, few scholars have considered the implications of litigation science for science writ large.[80] Certainly in the area of environmental and natural

76. *See* 15 C.F.R. § 990.11 (2014) (providing the OPA regulations governing NRDA).

77. *See* 42 U.S.C. § 9607(f)(1) (2012) ("Sums recovered by the United States Government as trustee under this subsection shall be retained by the trustee, without further appropriation, for use only to restore, replace, or acquire the equivalent of such natural resources.").

78. *See* Daubert v. Merrill Dow Pharm., Inc., 43 F.3d 1311, 1317 (9th Cir. 1995).

79. *See, e.g.*, Childs, *supra* note 18, at 668 (quoting Anderson et al., *supra* note 13, at 624 (noting that "[t]he reliability and accuracy of litigation-based research is likely to be viewed with suspicion because of the potential bias arising from the source of funding for the research and the relationship between the researchers and the lawyers")).

80. For examples of detailed consideration of science used in the litigation context, see Sheila Jasanoff, *Just Evidence: The Limits of Science in the Legal Process*, 34 J.L. MED. & ETHICS 328, 329 (2006) ("This article examines points in the transition from scientific observation to proffered legal evidence at which problems may creep into the production of science for legal uses."); see also Childs, *supra* note 18, at 646 (discussing *Daubert*'s spillover effects into the peer-review process and influence on litigation-generated science and concluding "that it is far from self-evident that the 'contamination' of science by law (e.g., lawyers meddling in peer review) or of law by science (e.g., litigation-driven scholarship showing up in litigation) necessarily weakens either science or law"). For discussion not of litigation-science, but of how science is used in the courtroom, see Sheila Jasanoff, *Representation and Re-Presentation in Litigation Science*, 116 ENVTL. HEALTH PERSP. 123, 129 (2008) ("By looking at science as a form of persuasive representation, and by importing the ideas of impartiality and symmetry from the sociology of scientific knowledge, we can radically reconceptualize the judicial role in relation to scientific evidence: from gatekeeping to refereeing."). For an example of scholarship discussing *Daubert* issues with respect to natural resources and environmental issues, see Susan R. Poulter, *Science and Pseudo-Science: Will* Daubert *Make a Difference?*, 40 ROCKY MTN. MIN. L. INST. 7-1 (1994). For an example

resource regulation, the litigation science literature is devoid of the rich treatment and analysis that other forms of policy-relevant science have enjoyed.[81] Occasionally, in the context of their broader work on science and the law, some scholars have uncovered case studies relevant to litigation-generated science.[82] Very few commenters, however, have focused outwardly on whether adversarial science poses a threat to scientific understanding writ large.[83] This Article takes up that task and does so in the NRDA context. In doing so, this Article brings issues of litigation-generated science into the broader science and law dialogue and considers how litigation influences science beyond the courtroom.[84]

## III. DIAGNOSING THE PROBLEMS OF NRDA SCIENCE

If we agree that adversarial science can fill an information need, and if we agree that adversarial science may not be any more susceptible to bias than other forms of policy-relevant science, we might begin to see why adversarial science should not be reflexively cast aside. But the degree to which adversarial science will and should be actively embraced—and can serve a

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of literature discussing junk science, see Gary Edmond & David Mercer, *Trashing "Junk Science,"* 1998 STAN. TECH. L. REV. 3.

81. One student-written Note raises the litigation-science issue in the context of complex environmental torts. Keum J. Park, Note, *Judicial Utilization of Scientific Evidence in Complex Environmental Torts: Redefining Litigation Driven Research*, 7 FORDHAM ENVTL. L. REV. 483, 487 (1996). Another student-written Note, in discussing how Kepone and the *Exxon Valdez* oil spill have changed NRDA regulations and valuation methods, raises the issue of litigation-science post-*Exxon*. Danielle Marie Stager, Note, *From Kepone to* Exxon Valdez *Oil and Beyond: An Overview of Natural Resource Damage Assessment*, 29 U. RICH. L. REV. 751, 753 (1995).

82. *See generally* Michaels & Monforton, *supra* note 50 (discussing popcorn lung disease and considering the impacts of both litigation and regulation on OHSA's response to workplace hazards); James M. Wood & Roxanne M. Gariby, *Hoarding Away Science: Towards a More Transparent View of Health and Online Registries for Independent Postmarket Drug Research*, 60 FOOD & DRUG L.J. 547 (2005) (focusing primarily on the need for greater transparency with post-market drug research and the use of the Internet, but giving some examples of litigation-generated science that was rejected by courts).

83. *See* Anderson et al., *supra* note 13, at 622 (observing that "[l]itigation-driven science may ultimately provide a useful contribution to the scientific literature, but not until there are processes in place to ensure its scientific reliability"); Michaels & Monforton, *supra* note 13, at 1165 (using an asbestos case study to show how parties involved in toxic tort litigation "seed the scientific literature" and therefore, generate external consequences for public health); *see also* Tarry, *supra* note 17, at 316 (arguing that, in a practitioner-oriented work, "scientific research sponsored by corporations defending civil lawsuits can, in fact, not only assist in the adjudication of civil disputes, but also advance scientific understanding and help improve health outcomes across populations").

84. Professor Stephanie Tai has considered how future scientific funding is shaped by litigation, but not whether the science generated through environmental litigation is itself influencing the broader understanding of ecological harms. *See generally* Stephanie Tai, *Science Policy Through the Lens of U.S. Domestic Climate Change Litigation*, 27 WIS. INT'L L.J. 462 (2010) (examining how climate change litigation is shaping regulatory research agendas and affecting decisions to fund future scientific research, but not discussing whether science generated during litigation is impacting the broader understanding of climate change).

greater informational role in the scientific community—requires a more detailed understanding of how adversarial contexts actually shape science. In other words, what are the ramifications of generating science within an adversarial frame? In particular, what are the risks of letting litigation shape the scientific study of harm from oil spills? Are there signs that the science is influenced by the incentives of the parties to litigation? Does the government's role as trustee for natural resources temper the typical private and narrow-minded focus of litigation?

This Part begins by examining how the adversarial nature of NRDA shapes science agendas and science. In doing so, it identifies three basic categories of influence. First, NRDA science is influenced by the conflicting goals of lawyers and scientists. In many ways, science becomes subservient to litigation. Second, when government-generated science and privately generated science are held to different standards of transparency, problems of parity and asymmetrical science emerge. Finally, as with other forms of policy-relevant science, NRDA provides an overt incentive to generate uncertainty in the science. By unpacking the influences of litigation on NRDA science, this Part sets the foundation for assessing potential solutions.

### A. *LITIGATION SCIENCE AS SUBSERVIENT SCIENCE*

Setting the seedy underbelly of litigation aside for the moment, NRDA's adversarial context influences science in a couple of practical ways. To start, litigation and lawyers may simply distract scientists from their science. At its core, science is an exercise of exploration and discovery. Scientific discovery takes time to unfold and is an iterative process of learning through experimentation.[85] Litigation, on the other hand, is a time-pressured and calculated exercise in separating relevant from irrelevant information, where relevance and importance is largely determined by what can be proved and valued for the purpose of eliciting a remedy.[86] These differences in law and science, in combination with the limited resources with which trustees must initially assess natural resource damages, create tensions between two agendas—those driven by science and those driven by litigation posturing. Notably, these tensions arise even though NRDA has a more public focus than traditional tort litigation.

85. *See* David Goodstein, *How Science Works*, *in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 37, 52 (3d ed. 2011) (explaining that law and justice require decisions to be made within a reasonable amount of time but that science is under no such time pressure).

86. *Id.* ("[S]cience and the law differ fundamentally in their objectives. The objective of the law is justice; that of science is truth."); Jasanoff, *supra* note 47, at 197 ("Both science and regulation seek to establish facts. But the adversarial processes of rule-making employed in the United States presume that 'truth' emerges from an open and ritualized clash of conflicting opinions rather than from the delicate and informal negotiations that characterize fact-finding in science.").

Take the NRDA process in the wake of the *Exxon Valdez* oil spill as an example. In recounting that process, Joe Hunt described the tension between scientists and lawyers:

> [L]awyers were seen as calling the shots based on legal strategies rather than biological need. At least, that's the way many scientists perceived it. . . . Attorneys and researchers—minds of different disciplines and objectives—struggled to speak the same language and often broke down in frustration and anger. Researchers felt it was inappropriate for attorneys to be shaping the scientific approach to assessing damage. The legal team felt it was their role to adhere to the law while obtaining the best possible results for their litigation against Exxon.[87]

Hunt, a former communications director of the *Exxon Valdez* Oil Spill Trustee Council, further emphasized that while the quality of the science did not suffer, the legal process did "dictate what would be studied."[88] NRDA regulations governing the pre-assessment process require trustees to undertake a cost-benefit analysis to "ensure that there is a reasonable probability of making a successful claim before monies and efforts are expended in carrying out an assessment."[89]

Contingent valuation studies provide a poignant example of how evaluating injuries is driven as much by litigation strategy as it is by the desire for scientific understanding.[90] By way of background, contingent valuation is a method for evaluating the nonuse or passive use loss suffered by society when public resources are injured.[91] Though controversial, the method for valuing passive use loss for NRDA has been upheld by courts.[92] After the *Exxon*

87. JOE HUNT, *EXXON VALDEZ* OIL SPILL TR. COUNCIL, MISSION WITHOUT A MAP: THE POLITICS AND POLICIES OF RESTORATION FOLLOWING THE EXXON VALDEZ OIL SPILL 57–58 (n.d.), *available at* http://www.nmfs.noaa.gov/ocs/mafac/meetings/2010_06/docs/mission_without_map_evos.pdf.

88. *Id.* at 58.

89. 43 C.F.R. § 11.23 (2014) (requiring a pre-assessment screen for ensuring that the NRDA process will bear fruit).

90. For a detailed account of the development and use of the contingent valuation study in the *Exxon* spill, see HUNT, *supra* note 87, at 60–61; see also Richard T. Carson et al., *Contingent Valuation and Lost Passive Use: Damages from the* Exxon Valdez *Oil Spill*, 25 ENVTL. & RESOURCE ECON. 257, 258 (2003).

91. *See* Carson et al., *supra* note 90, at 258 ("Contingent valuation is a survey approach designed to create the missing market for public goods by determining what people would be willing to pay (WTP) for specified changes in the quantity or quality of such goods or, more rarely, what they would be willing to accept (WTA) in compensation for well-specified degradations in the provision of these goods.").

92. Kennecott Utah Copper Co. v. U.S. Dep't of the Interior, 88 F.3d 1191 (D.C. Cir. 1996) (leaving DOI regulations on contingent valuation undisturbed); Ohio v. U.S. Dep't of the Interior, 880 F.2d 432, 474–81 (D.C. Cir. 1989) (upholding portions of DOI regulations that permitted the use of contingent valuation); Natural Resources Damage Assessments, 59 Fed. Reg. 1062, 1182–83 (Jan. 7, 1994) (to be codified at 15 C.F.R. § 990.78(b)(5)) (codifying post-*Exxon* regulations under OPA that validate contingent valuation as an appropriate method for

spill, when the use of this method was still hotly contested, trustees spent $3 million dollars on a contingent valuation household survey to determine what the average American household would be willing to pay to prevent another *Exxon*-like disaster.[93] Early reports rumored the results were somewhere between $3 billion and $8 billion.[94] The Los Angeles Times reported a figure of $10 billion.[95]

For lawyers, contingent valuation generates settlement leverage, especially where—as in *Exxon*—the results are suspected to return a large damage figure. From that perspective, contingent valuation studies are worth the price tag. From the perspective of science, however, contingent valuation has little to do with the assessment of harm to the ecosystem. Contingent valuation aides lawyers in leveraging a sizeable settlement from defendants, but it does not advance the understanding of harm to the ecosystem in any scientific sense.

Litigation agendas also affect choices of what to focus on among two equally valid scientific projects. Some commenters have posited that the relative worth of sea otters and sea stars may have influenced the decision to study one and not the other. For example, oiled sea otters, popular and charismatic mammals, are valued at $81,000 each (based on the cost of cleaning and rehabilitating them).[96] By contrast, oiled sea stars are "worth barely a buck and a quarter"[97] and were not studied as part of the NRDA process after *Exxon*. David Irons, an expert on seabirds with the U.S. Fish and Wildlife Service, once remarked that "[s]ea stars might be driving the entire ecosystem. . . . But we would never know that because we weren't able to study it. It wouldn't pay for itself in court."[98]

To be sure, the idea that not all worthy scientific inquiries can be funded and that hard choices have to be made is not unique to the litigation context. Scientists often compete for limited funding.[99] But funding-driven tradeoffs

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measuring passive use values); *see also* Jeffrey C. Dobbins, *The Pain and Suffering of Environmental Loss: Using Contingent Valuation to Estimate Nonuse Damages*, 43 DUKE L.J. 879 (1994) (examining contingent valuation methods and arguing for the measurement and compensation of nonpecuniary losses).

93. HUNT, *supra* note 87, at 60.

94. *Id.* (noting that the original estimates were in the range of $2.8 million and $8 million).

95. *Id.*

96. *Id.* at 55.

97. *Id.*

98. *Id.* (internal quotation marks omitted).

99. *See* ROBERT GOLDBORT, WRITING FOR SCIENCE 271 (2006) ("Government agencies—including the National Science Foundation, the National Institutes of Health, the US Department of Agriculture, and NASA—collectively grant billions of dollars annually for scientific research, but the statistical truth is that many more proposals are submitted than can possibly be funded."). Trustees are often constrained by funding when working through the NRDA process. *See, e.g.*, Patrick E. Tolan, Jr., *Natural Resource Damages Under CERCLA: Failures, Lessons Learned, and Alternatives*, 38 N.M. L. REV. 409, 447–48 (2008) ("Natural resource trustees are generally understaffed and under-funded."). For a discussion of the financial risks posed to the federal

in the NRDA context go beyond garden-variety funding decisions, where research dollars are allocated by weighing the relative scientific strength of the proposed projects.[100]

These litigation-driven tradeoffs may result in lost opportunities to better understand the long-term harms of toxic exposure. In other words, some harm will go undetected simply because it was never studied.[101] Again, sea stars are one example. Similarly, other important forage fish, like the sand lance, were not studied at all, leaving some scientists to lament missed opportunities: "One of the biggest missed opportunities in NRDA was not looking at sand lance."[102] The study of sand lance is now thought to have been particularly informative given that these fish burrow daily in the sands of intertidal regions where most of the oil was later found to have accumulated.[103] In this way, research choices made during the NRDA process directly impact downstream understanding of long-term harm. By recognizing that, we might begin to consider how the NRDA process can be harnessed to fill knowledge gaps, rather than perpetuate them.

When science is subservient, litigation not only influences what science to fund, but it can also inadvertently influence the quality of science. For example, while assessing injuries in the wake of the *Exxon* spill, trustee scientists were under a gag order to keep Exxon from gaining insight to the

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government for oil spills like the BP Gulf Oil Spill and how funding mechanisms work, see generally U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-12-86, *DEEPWATER HORIZON* OIL SPILL: ACTIONS NEEDED TO REDUCE EVOLVING BUT UNCERTAIN FEDERAL FINANCIAL RISKS (2011), *available at* http://www.gao.gov/assets/590/585875.pdf; see also HUNT, *supra* note 87, at 20 (reporting that after the Alaska legislature appropriated $35 million, $20 million was reserved for litigation, while the rest was left for NRDA studies and oil spill response efforts); Sanne H. Knudsen, *Remedying the Misuse of Nature*, 2012 UTAH L. REV. 141, 192–93 (discussing the funding problems faced by government trustees and assembling the literature).

100. *See, e.g.*, 42 C.F.R. § 52h.8 (2014) (setting merit-based criteria for evaluating proposed research grants). Consider also that the National Institute of Health evaluates all research proposals through a two-tier peer-review process, mandated by regulation and intended to allocate funding without bias. *See* NAT'L INST. OF HEALTH, U.S. DEP'T OF HEALTH & HUMAN SERVS., PEER REVIEW: GRANTS AND COOPERATIVE AGREEMENTS 3 (2014), *available at* http://grants.nih.gov/grants/PeerReview22713webv2.pdf ("The two levels of NIH peer review help ensure that the assessment of scientific and technical merit is separate from the funding decision.").

101. Even when resources are studied, the drive to recover damages might overshadow research more seriously focused on understanding ecosystem function and harm. For example, initial studies of Pacific herring after the *Exxon* spill focused on the economic losses to the commercial fishing industry, as opposed to the importance of herring to the food chain. *See* HUNT, *supra* note 87, at 55.

102. *Id.* (citation omitted).

103. *Id.* For general discussion of the sand lance and its potential importance and links to the marine ecosystem, see U.S. DEP'T OF AGRIC., SAND LANCE: A REVIEW OF BIOLOGY AND PREDATOR RELATIONS AND ANNOTATED BIBLIOGRAPHY 24 (Martin D. Robards et al. eds., 1999), *available at* http://www.fs.fed.us/pnw/pubs/rp_521a.pdf ("Links between decreased abundance of suitable forage fish and marine predators' reproductive success or population size have been suggested or reported from many regions of the world . . . .").

trustees' settlement strategy.[104] This gag order impeded collaboration between scientists and hampered efforts to build on evolving knowledge.[105] Though the gag orders did not direct the outcome of science in any nefarious sense, it is an example of how litigation's dominant role in NRDA can undermine the ability of scientists to assess the injuries caused by the spill.

Notably, some of the failures of communication between scientists that plagued early NRDA efforts after *Exxon* have not been as prominent in the wake of the *Deepwater Horizon* oil spill. Deepwater Trustees have placed deliberate emphasis on coordinating across resource disciplines and implementing effective information management strategies.[106] In addition, those trustees were able to negotiate for an early restoration fund that would help alleviate some of the funding issues facing trustees following the *Exxon* spill.[107] With additional funding options, the science agenda in the case of the *Deepwater Horizon* oil spill could face fewer monetary constraints, and compete less overtly with litigation strategies.

And yet, criticisms of litigation's influence on science in the wake of the *Deepwater Horizon* disaster are already emerging. For example, the Chair of the Coastal Protection and Restoration Authority, a Louisiana state agency serving as a NRDA trustee, has criticized BP's ability to influence the scientific studies undertaken during cooperative assessment.[108] Namely, the trustees have to

104. For detailed discussion of the gag order during early phases of the *Exxon Valdez* oil spill NRDA process, see HUNT, *supra* note 87, at 58–60.

105. *Id.* at 59 ("An unintended consequence of this secrecy was that researchers often did not know they had data or questions in common because they simply did not talk about their research openly.").

106. *See* 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 15 (explaining the various technical working groups and their efforts at cross resource collaboration); *see also National Resource Damage Assessment (NRDA)*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://www.noaa.gov/deepwaterhorizon/data/nrda.html (last visited Feb. 18, 2015) (making available pre-assessment data and noting that "Releasing NRDA 'Pre-assessment' science data is rarely done in the NRDA process, but it was decided in the interest of transparency, and because of the heightened interest in this particular spill, that this information would be made public"); *NRDA Workplans and Data*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., http://www.gulfspillrestoration.noaa.gov/oil-spill/gulf-spill-data/ (last visited Feb. 18, 2015) (containing workplans and data for various NRDA studies).

107. *See* Press Release, Nat'l Oceanic & Atmospheric Admin., NRDA Trustees Announce $1 Billion Agreement to Fund Early Gulf Coast Restoration Projects (Apr. 21, 2011), *available at* http://www.noaanews.noaa.gov/stories2011/20110421_nrdarestoration.html. Even without creative settlements like the Early Restoration Fund, government trustees can take advantage of funding available through the OPA Trust Liability Fund, which was created through legislation to address some of the funding issues highlighted during the *Exxon* spill. For a general discussion of funding for the BP Gulf Oil Spill response, see VANN & MELTZ, *supra* note 9, at 14–15.

108. *See Status of the* Deepwater Horizon *Natural Resources Damage Assessment: Hearing Before the Subcomm. on Water & Wildlife of the S. Comm. on Env't & Pub. Works*, 112th Cong. (2011) [hereinafter *Deepwater Horizon* Hearing] (prepared statement of Garret Graves, Chair, Coastal Protection and Restoration Authority of Louisiana), *available at* http://www.epw.senate.gov/public/index.cfm?FuseAction=Hearings.Testimony&Hearing_ID=b9947fce-802a-23ad-4fcb-a42cc

wait for BP to sign off on assessment projects in order for those projects to be funded by BP.[109] In that way, BP influences the science through delay or by refusing to fund certain studies that are "contrary to their legal interests."[110]

This example, and those drawn from the *Exxon Valdez* spill, serve as important reminders of the kind of influence that litigation can play during the NRDA process, even absent affirmative efforts to increase transparency or structurally insulate science from litigation.

### B. *THE FUNDING EFFECT AND ADVANTAGE OF UNCERTAINTY*

Science funded by government trustees is not the only science influenced by the adversarial posture of NRDA. In a parallel effort, defendants carry out their own scientific agendas. In the case of the *Exxon* spill, Exxon Corporation was a major player in the generation of science. It privately funded at least 400 studies in the 20 years after the spill,[111] and was notorious for keeping hundreds of private and university scientists on its payroll.[112]

Even in the aftermath of the *Deepwater Horizon* spill, where there is great emphasis on cooperative assessment,[113] BP and the trustees are also

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54a8196&Witness_ID=of4c8bcd-f297-4ba3-9b08-c74d3c0615a2 (levying criticism and providing examples of BP's leverage).

109. *See id.*

110. *Id.* at 5.

111. As of May 2013, Exxon Corporation's bibliography of research related to the *Exxon* spill contained citations to over 500 scientific journal articles on research funded by Exxon. *See* VALDEZSCIENCES, BIBLIOGRAPHY OF EXXONMOBIL-SPONSORED *EXXON VALDEZ* OIL SPILL RESEARCH (2013), *available at* http://www.valdezsciences.com/docs/ExxonMobil-Sponsored%20Publications%20Bibliography%20for%20www.valdezsciences.com.pdf.

112. *See* HUNT, *supra* note 87, at 20 (describing the competition between state trustees, federal trustees, and Exxon to lock in experts in the wake of the *Exxon* spill); *id.* ("[T]he state also locked in many nationally recognized experts to help document injury, conduct economic studies, testify in court, and serve as peer reviewers of damage assessment science. Federal attorneys also hired experts to guide them, and the two governments found themselves racing each other and Exxon when it came to hiring Nobel prize winning economists and other world-renowned scientists."); *see also* KRISTINA ALEXANDER, CONG. RESEARCH SERV., R41396, THE 2010 OIL SPILL: NATURAL RESOURCE DAMAGE ASSESSMENT UNDER THE OIL POLLUTION ACT 15 (2010), *available at* https://www.fas.org/sgp/crs/misc/R41396.pdf (noting that one of the NRDA issues that was considered by Congress in the wake of the BP Gulf Oil Spill was "prohibiting responsible parties from 'buying up' experts" (citing Mark Tran, *BP Denies 'Buying Silence' of Oil Spill Scientists*, GUARDIAN (July 23, 2010, 5:27 AM), http://www.theguardian.com/environment/2010/jul/23/bp-oil-spill-scientists-silence)); Marc Caputo, *BP Wasted No Time Preparing for Oil Spill Lawsuits*, MCCLATCHYDC (July 3, 2010), http://www.mcclatchydc.com/2010/07/03/96989/bp-wasted-no-time-preparing-for.html ("BP swiftly signed up experts who otherwise would work for plaintiffs.").

113. *See, e.g.*, 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 9 (explaining the benefits of the cooperative assessment process); *id.* at 20 (discussing efforts since "the earliest days" to approach the BP NRDA process cooperatively); *see also* BP NRDA REPORT, *supra* note 37, at 7 (emphasizing that "[m]ore than 160 initial and amended work plans" have been developed cooperatively).

undertaking independent research to support their respective positions.[114] Moreover, BP is the only one of the responsible parties that has elected to participate in the cooperative assessment.[115] And, even though BP is willing to engage in cooperative assessment for some resources, BP and government trustees are not working cooperatively to assess all resources. With respect to lost human services, for example, trustees have explained that conflicting conclusions are possible:

> The lost human use assessment for the *Deepwater Horizon* oil spill is not a cooperative assessment. While some data are being collected cooperatively (e.g., counts of beach visitation from aerial overflights), the trustees and BP are analyzing the collected datasets individually. Each party will use its data to arrive at separate conclusions about the value of the lost use injury. Therefore, the data being collected by both sides are not being made public at this time because it may eventually be used in litigation if the two parties cannot reach agreement.[116]

The degree to which conflicting views of science emerge from the NRDA process is beautifully illustrated by research published in the aftermath of the *Exxon* spill. On the merits, Exxon's studies often clashed with work by trustee scientists. For each study that suggests a connection between the *Exxon* spill and long-term injuries, there are counter-studies and accusations of faulty study design.[117] Indeed, decades after the *Exxon* spill, "[d]ebate continues

114. BP describes four categories of data: NRDA Cooperative, BP NRDA Independent, Trustee Independent, and Response. *Gulf Science Data*, BP, http://gulfsciencedata.bp.com/go/doc/6145/1942258/ (last visited Feb. 18, 2015).

115. VANN & MELTZ, *supra* note 9, at 11 ("For the 2010 *Deepwater Horizon* oil spill, the responsible parties identified are BP Exploration and Production, Inc., Transocean Holdings Inc., Triton Asset Leasing GmbH, Transocean Offshore Deepwater Drilling Inc., Transocean Deepwater Inc., Anadarko Petroleum, Anadarko E&P Company LP, and MOEX Offshore 2007 LLC. As of April 2012, BP was the only responsible party participating in the cooperative NRDA process.").

116. 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 87.

117. *See, e.g.*, Mark A. Harwell & John H. Gentile, *Ecological Significance of Residual Exposures and Effects from the* Exxon Valdez *Oil Spill*, 2 INTEGRATED ENVTL. ASSESSMENT & MGMT. 204, 220–36 (2006) (presenting Exxon-funded research assessing the ongoing effects of the *Exxon* spill on 20 "valued ecosystem components" and, in doing so, illustrating the debate that persists within the scientific literature). For a specific example of counter-studies, compare Stanley D. Rice et al., *Impacts to Pink Salmon Following the* Exxon Valdez *Oil Spill: Persistence, Toxicity, Sensitivity, and Controversy*, 9 REVS. FISHERIES SCI. 165 (2001) (presenting trustee-funded research suggesting long-term impacts from the oil spill), with E.L. Brannon et al., *Review of the* Exxon Valdez *Oil Spill Effects on Pink Salmon in Prince William Sound, Alaska*, 20 REVS. FISHERIES SCI. 20, 57 (2012) (presenting Exxon-funded research critiquing trustee-funded studies and concluding that "pink salmon were not measurably damaged by the *Exxon Valdez* oil spill"). Also, compare Richard E. Thorne & Gary L. Thomas, *Herring and the "*Exxon Valdez*" Oil Spill: An Investigation into Historical Data Conflicts*, 65 ICES J. MARINE SCI. 44, 48–49 (2008) (presenting government-funded research proposing a new theory to explain the interrelationship between the Pacific herring fishery collapse and the *Valdez* oil spill), with Gary D. Marty et al., *Role of Disease in Abundance of a Pacific Herring (*Clupea pallasi*) Population*, 60 CANADIAN J. FISHERIES & AQUATIC SCI. 1258, 1258–59

about the amount of oil, its availability to organisms, and its possible effects on ecological systems in the sound."[118] How much of this debate is genuine? How much of this debate is part of a larger litigation strategy to manufacture doubt and emphasize scientific uncertainty?

While delineating distinctions between intellectual and strategic debate is difficult, a careful review of the post-*Exxon* scientific literature reveals some striking patterns. First, government-sponsored research tends to openly recognize the long-term impacts of oil spills, while corporate-sponsored research tends to minimize impacts and offer alternative explanations for the harm. Some studies, generally those funded by the *Exxon Valdez* Trustee Council, conclude that "chronic, delayed, and indirect effects of oil spills appear to have much longer and larger consequences on wildlife populations and communities than previously assumed."[119] These studies examine the lingering effects of the spill on a range of resources (from sea otters to harlequin ducks) and a range of issues (from presence of oil to bioavailability to long-term demographics).[120] Other studies, generally those funded by Exxon, declare that Prince William Sound has "effectively recovered" from the *Exxon* spill and that "the physical stressors from [the spill] are completely gone."[121] These studies commonly assert that any resources remaining on the

(2003) (presenting Exxon-funded research questioning the role of the *Exxon* spill on the 1993 Pacific herring fishery collapse).

118. Wiens, *supra* note 14, at 770.

119. Daniel Esler et al., *Cytochrome P4501A Biomarker Indication of Oil Exposure in Harlequin Ducks up to 20 Years After the* Exxon Valdez *Oil Spill*, 29 ENVTL. TOXICOLOGY & CHEMISTRY 1138, 1138 (2010) [hereinafter Esler et al., *Harlequin Ducks*]; *see also* Daniel Esler et al., *Cytochrome P4501A Biomarker Indication of the Timeline of Chronic Exposure of Barrow's Goldeneyes to Residual* Exxon Valdez *Oil*, 62 MARINE POLLUTION BULL. 609, 610 (2011) [hereinafter Esler et al., *Goldeneyes*] ("This work adds to a body of literature describing the timelines over which vertebrates were exposed to residual *Exxon Valdez* oil and indicates that, for Barrow's goldeneyes in Prince William Sound, exposure persisted for many years with evidence of substantially reduced exposure by 2 decades after the spill."); Daniel H. Monson et al., *Could Residual Oil from the* Exxon Valdez *Spill Create a Long-Term Population "Sink" for Sea Otters in Alaska?*, 21 ECOLOGICAL APPLICATIONS 2917, 2917 (2011) ("Our results suggest that residual oil can affect wildlife populations on time scales much longer than previously believed and that cumulative chronic effects can be as significant as acute effects."); Charles H. Peterson et al., *Long-Term Ecosystem Response to the* Exxon Valdez *Oil Spill*, 302 SCIENCE 2082, 2082 (2003) ("[I]n the Alaskan coastal ecosystem, unexpected persistence of toxic subsurface oil and chronic exposures, even at sublethal levels, have continued to affect wildlife."); Robert E. Thomas et al., *Induction of DNA Strand Breaks in the Mussel (*Mytilus trossulus*) and Clam (*Protothaca staminea*) Following Chronic Field Exposure to Polycyclic Aromatic Hydrocarbons from the* Exxon Valdez *Spill*, 54 MARINE POLLUTION BULL. 726, 726 (2007) ("[I]t is generally accepted that long-term effects can result in serious impacts at both the population and ecosystem level.").

120. *See, e.g.*, Esler et al., *Goldeneyes*, *supra* note 119, at 610 (providing examples of research discussing biomarkers studies used to detect ongoing exposure to oil); Jeffrey W. Short et al., *Estimate of Oil Persisting on the Beaches of Prince William Sound 12 Years After the* Exxon Valdez *Oil Spill*, 38 ENVTL. SCI. & TECH. 19, 19 (2004) (providing examples of research on the lingering amount of oil more than a decade after the spill).

121. Harwell & Gentile, *supra* note 117, at 239.

Trustee Council's injured list "are responding to other natural [or] anthropogenic stressors that have nothing to do with [the *Exxon* spill] or its cleanup activities."[122] They argue that the long-term influence of the *Exxon* spill pales in comparison to the global climatic shifts and natural processes: "Following the spill-aftermath period, [Prince William Sound] also essentially recovered from [the *Exxon Valdez* oil spill], and anthropogenic factors again have considerably less influence on the [Prince William Sound] ecosystem than do natural processes."[123]

Together, this literature suggests that NRDA science is susceptible to the same kind of "funding effect" that scholars have observed outside the NRDA context.[124] The funding effect is the phenomenon where "privately funded research biases the results toward the financial interests of the sponsors."[125] The most infamous example of the conflicts of interest that arise between science and its funders is the tobacco industry's well-documented efforts to manufacture science.[126] There are other examples as well in the areas of pharmaceutical and chemical toxicity research.[127]

Given the high stakes tied directly to scientific findings, it is not surprising that NRDA science is susceptible to the funding effect. Some scientists studying the impacts of the *Exxon Valdez* oil spill appear to recognize the funding effect in NRDA science—or they at least accept that funding sources can create perceptions of bias.[128] To that end, in response to controversy and debate over the causal link between the *Exxon* spill and the collapse of the

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122. *Id.*

123. Harwell et al., *supra* note 24, at 716; *see also* Harwell & Gentile, *supra* note 117, at 238–39 (describing "habitat alteration, climate change, overexploitation of living resources, and invasive species as the most important environmental stressors affecting the nation's environment").

124. *See* Krimsky, *supra* note 69, at 46 (discussing "the effects of the academic funding structure and financial conflicts of interest on the integrity of scientific research"); *see also* Wagner & Michaels, *supra* note 75, at 122 (discussing how sponsors in high-stakes cases "face strong incentives to design and report research in ways most favorable to their interests and to suppress adverse results provided they can do so without detection").

125. Sheldon Krimsky, *Publication Bias, Data Ownership, and the Funding Effect in Science: Threats to the Integrity of Biomedical Research*, *in* RESCUING SCIENCE FROM POLITICS: REGULATION AND THE DISTORTION OF SCIENTIFIC RESEARCH 61, 73 (Wendy Wagner & Rena Steinzor eds. 2006).

126. *See* Krimsky, *supra* note 69, at 55–57 (describing the various strands of "tobacco science" that have been documented as products of self-interest); Elizabeth Laposata et al., *Tobacco Industry Influence on the American Law Institute's Restatements of Torts and Implications for Its Conflict of Interest Policies*, 98 IOWA L. REV. 1 (2012) (describing the tobacco industry's effect on the Restatement (3d) of Torts).

127. *See* Sheldon Krimsky, *Do Financial Conflicts of Interest Bias Research? An Inquiry into the "Funding Effect" Hypothesis*, 38 SCI. TECH. & HUM. VALUES 566, 569 (2013) (discussing various case studies where the funding effect has been documented outside of the tobacco context in "pharmacoeconomic[] and chemical toxicity research").

128. Professor Krimsky has certainly recognized that there is at the very least a perception of bias when research outcomes align with the interests of the funding party. Krimsky, *supra* note 69, at 57 ("Financial interest by scientists undoubtedly affects the popular culture's perception of scientific reliability.").

Pacific herring fishery, a government scientist teamed up with an Exxon scientist to critically review the state of the literature and provide an objective analysis. In their paper, the scientists openly acknowledge the need for cross-party research in order to advance scientific understanding: "These objectives were undertaken from the broadest perspective possible, as evidenced by the differing affiliation and support of the 2 authors. We believe this review is urgently needed to provide a clearer and more logical interpretation of the data than has been done to date."[129]

The post-*Exxon* research also suggests that responsible parties have a particular incentive to emphasize (or generate) scientific uncertainty within the literature.[130] Some Exxon-funded research emphasizes the difficulty of sorting out "noise" from actual causes: "The problem is how to distinguish the signal of an ecological effect from the noise of natural variability and how to distinguish reductions in a population caused by [the *Exxon Valdez* oil spill] from reductions caused by other stressors."[131]

Of course, for responsible parties, the uncertainty is beneficial. In fact, generating debate within the scientific literature has direct and predictable consequences on the outcome of cases. Because the plaintiff bears the burden of proof, scientific uncertainty on issues like causation will almost always benefit the defendant. This is true in the toxic-tort context as well, where some courts have seen fit to shift the burden of proof to the defendant in order to rectify the imbalance.[132] Similarly, in the NRDA context, the uncertainty, or "noise," makes the task of filtering out actual causes from background stressors more difficult and undermines the plaintiff's ability to meet her burden of proof. In this way, it is in Exxon's best interests to explore and

129. Ralph A. Elston & Theodore R. Meyers, *Effect of Viral Hemorrhagic Septicemia Virus on Pacific Herring in Prince William Sound, Alaska, from 1989 to 2005*, 83 DISEASES AQUATIC ORGANISMS 223, 224 (2009).

130. *Cf.* Michaels & Monforton, *supra* note 50, at 17 ("Polluters and manufacturers of dangerous products have waged sophisticated campaigns to manufacture uncertainty about the scientific evidence used to support public health protection and victim compensation.").

131. Harwell & Gentile, *supra* note 117, at 238.

132. *See, e.g.*, Sindell v. Abbott Labs., 607 P.2d 924, 928 (Cal. 1980) (shifting the burden to DES manufacturers to prove that they could not have produced the injury-causing product); Summers v. Tice, 199 P.2d 1, 3–4 (Cal. 1948) (en banc) (allowing burden-shifting when two defendants, both before the court, negligently shot plaintiff and plaintiff could not prove which defendant actually caused the injury). Scholars have also proposed burden-shifting when there are extraordinary challenges preventing plaintiffs from proving causation. *See* Alexandra B. Klass, *Pesticides, Children's Health Policy, and Common Law Tort Claims*, 7 MINN. J.L. SCI. & TECH. 89, 92, 136 (2005) (arguing that burden-shifting would be appropriate in cases where the plaintiff can prove the pesticide manufacturer "failed to conduct reasonably available testing to gather currently unavailable scientific evidence on the issue of causation"). Other scholars have advocated for relaxed causal tests in recognition of the systematic disadvantage of plaintiffs seeking to prove complex toxic tort injuries while bearing the burden of proof. *See, e.g.*, Berger, *supra* note 25; Gold, *supra* note 25; Rostron, *supra* note 25.

emphasize the many stressors that could be causing long-term perturbations in the Prince William Sound ecosystem.[133]

Offering up counter-studies or counter-explanations for ecosystem harm is one way to deflect liability and undermine the government's ability to prove causation. Another strategy for deflecting liability is to directly attack the credibility of government science.[134] There is evidence of this too in the post-*Exxon* scientific literature. In one study, which examined the viability of research on long-term impacts of the *Exxon* spill on pink salmon, the authors suggested that the *Exxon Valdez* Trustee Council's "conclusions about oil effects on pink salmon were influenced by the need for litigation to identify damages and recover monetary compensation for the injuries to natural resources."[135] The authors went on to caution that "[a]ccurate information is the key in establishing confidence that we understand the ecological impact of the *Exxon Valdez* . . . spill and that such understanding is founded on reliable science."[136] Exxon funded that study, whose purpose was to reconcile conflicting pink salmon research. This is not the first time that Exxon-funded research has cast doubt on government science—either indirectly by producing counter-studies or directly by questioning biased motivations of government researchers.[137]

Many of these examples come from scientific literature published after government trustees settled claims for natural resource damages in 1991. One might wonder why incentives remain to cast doubt on the science even when the parties settled damage claims. The incentive comes from the reopener provision that government trustees negotiated to include in the natural

133. For an example of Exxon-funded research attempting to model the relative importance of the *Exxon Valdez* oil spill versus other natural or anthropogenic stressors on the Prince William Sound ecosystem, see generally Harwell et al., *supra* note 24.

134. *See* MCGARITY & WAGNER, *supra* note 65, at 128.

135. Brannon et al., *supra* note 117, at 57.

136. *Id.*

137. *See* Wayne G. Landis, *The* Exxon Valdez *Oil Spill Revisited and the Dangers of Normative Science*, 3 INTEGRATED ENVTL. ASSESSMENT & MGMT. 439, 439 (2007) ("Examination of the environmental risk assessment and toxicology literature reveals that the symptoms of normative science are common and the implications widespread."); Wiens, *supra* note 14, at 769 ("When a large environmental accident occurs, we expect large ecological consequences. When the disruption is due to human activities, as is the case with an oil spill, we expect the worst. Emotions can override sound judgment, and litigation can polarize positions and foster advocacy. Hyperbole replaces hypotheses, and science suffers the consequences."); John A. Wiens, *Oil, Seabirds, and Science: The Effects of the* Exxon Valdez *Oil Spill*, 46 BIOSCIENCE 587, 588 (1996) (discussing the scientific research in the wake of the *Exxon* spill and remarking that "[t]he studies also provide some insights into how the scientific process itself may be affected by such well-publicized environmental accidents and into the relationships among preconceptions, advocacy, and science"); *see also* Wagner, *supra* note 19, at 1654 ("Individual companies or trade associations engaged in the production of oil, lead, asbestos, and beryllium have all actively worked to discredit research that, if widely understood and accepted, would likely result in substantial liability, regulation, and market costs." (citations omitted)); *id.* at 1655 (using Exxon's attempts to discredit government researchers after the *Exxon* spill).

resource damage settlement agreement for the *Exxon Valdez* oil spill. By creating an opportunity to make a $100 million, one-time demand for unanticipated injuries discovered after settlement, the reopener clause single-handedly keeps long-term injuries relevant in terms that matter most: litigation, liability, and money.[138] This third important observation is taken up in greater detail in Part IV.

In the end, it may well be that truly unmasking the injuries caused by oil spills and toxic releases is difficult not only because the science is hard, but also because of the byproduct of uncertainty created when government science competes with private science. In that way, the uncertainty generated by competing scientific studies makes sorting out root causes even more difficult and interferes with public policy assessments of risk of certain types of activities. Dampening the noise will be critical to the tasks of optimizing the utility of NRDA science outside the courtroom.

### *C. PROBLEMS OF PARITY AND ASYMMETRICAL TRANSPARENCY*

One final aspect of litigation's influence on NRDA science is worth considering: There are asymmetrical standards of transparency that apply to government science and private science.[139] This asymmetry skews the knowledge base and makes more difficult the task of discerning root causes. It does so by forcing trustees and the public to assess injuries based on the scientific information that is available, rather than based on the sum total of scientific information that exists.

Consider the relative standards of access and transparency that govern private and government science. On the government side, NRDA science is rooted in a legal framework that invites public scrutiny and transparency. Most obviously, the NRDA process itself is conducted in accordance with regulations from the Oil Protection Act of 1990 ("OPA") that have undergone public notice and comment rulemaking.[140] The OPA regulations establish protocols that govern all aspects of damage assessment, including activities such as coordination with responsible parties,[141] data collection,[142] and developing restoration alternatives.[143] Trustees have an added incentive to

138. For more detailed discussion of how reopener clauses have shaped incentives to generate uncertainty in the scientific literature post-*Exxon*, see *infra* Part V.B.

139. *See* Jasanoff, *supra* note 26, at 30 (noting "that codes of scientific openness are not uniformly observed or enforced in practice, thereby creating asymmetries in the standards applied to privately and publicly sponsored research").

140. *See* 15 C.F.R. §§ 990.10–.66 (2014) (National Oceanic and Atmospheric Association regulations governing NRDA); 43 C.F.R. §§ 11.10–.93 (2014) (Department of Interior regulations governing NRDA).

141. *See* 15 C.F.R. § 990.14.

142. *See id.* § 990.43.

143. *See id.* § 990.54.

adhere to the regulatory protocols because doing so creates a rebuttable presumption in favor of the trustees' ultimate assessment.[144]

At a minimum, these regulations telegraph how injury assessment and restoration planning will take place. In addition, the regulations and other governing statutes ensure that certain information will be available to public scrutiny. In these ways, the NRDA framework for transparency is part of a larger governmental effort towards achieving legitimacy through transparency in agency decision-making.[145] The OPA regulations, for instance, require trustees to assemble and make publicly available an administrative record that "document[s] the basis for their decisions pertaining to restoration."[146] That record must include "[a]ny relevant data, investigation reports, scientific studies, work plans, quality assurance plans, and literature" that was used to develop restoration plans.[147] In addition, the process of developing restoration plans (which includes identifying injured resources) is subject to the National Environmental Policy Act ("NEPA").[148] Through the NEPA process, information and analysis regarding alternatives are subject to public review and comment. Given that one of the fundamental tenets of NEPA is public participation,[149] the NEPA process ensures a certain degree of transparency.

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144. *See id.* § 990.13 ("Any determination or assessment of damages to natural resources made by a Federal, State, or Indian trustee in accordance with this part shall have the force and effect of a rebuttable presumption on behalf of the trustee in any administrative or judicial proceeding under OPA.").

145. *See, e.g.*, Jasanoff, *supra* note 26, at 21 ("With the passage of the federal Administrative Procedure Act in 1946, the U.S. government recognized the right of citizens to participate in agency rulemaking and an associated right to receive information, including scientific and technical information, in order to effectuate the goal of informed participation. Later U.S. statutes have consistently expanded the public's right to know and to assess the information underlying governmental decisions." (citing Administrative Procedure Act, Pub. L. No. 109-41, 60 Stat. 237 (1946) (codified as amended in scattered sections of 5 U.S.C.)).

146. 15 C.F.R. § 990.45; *see, e.g.*, *Administrative Record Index*, U.S. DEP'T INTERIOR, http://www.doi.gov/deepwaterhorizon/adminrecord/index.cfm (last visited Feb. 18, 2015).

147. 15 C.F.R. § 990.45(a)(2).

148. *See id.* § 990.23 (making NEPA applicable to NRDA restoration actions); *see also* National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4347 (2012). To comply with NEPA obligations, trustees for the *Deepwater Horizon* oil spill have begun work on a draft programmatic environmental impact statement that considers "alternatives to restore natural resources, ecological services, and recreational use services injured or lost as a result of the *Deepwater Horizon* oil spill." *See* Deepwater Horizon Oil Spill; Draft Programmatic and Phase III Early Restoration Plan and Draft Early Restoration Programmatic Environmental Impact Statement, 78 Fed. Reg. 73,555, 73,555 (Dec. 6, 2013).

149. *See* Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 349 (1989) ("[NEPA] ensures that the agency, in reaching its decision, will have available, and will carefully consider, detailed information concerning significant environmental impacts; it also guarantees that the relevant information will be made available to the larger audience that may also play a role in both the decisionmaking process and the implementation of that decision.").

Many of the transparency protocols that are now part of the NRDA process are reactions to lessons learned after the *Exxon Valdez* oil spill.[150] In fact, government trustees that are managing the NRDA process for the *Deepwater Horizon* oil spill have deliberately made transparency a priority: "One of the key actions the trustees have taken to ensure enhanced transparency is the public distribution of cooperative assessment work plans and data during the NRDA process."[151] Trustees have also developed several websites to compile and disseminate information on the development of the NRDA process.[152] Some of the data released to the public through these websites is ordinarily kept confidential until the parties have settled their NRDA claims.[153] In addition, as part of the NEPA process, trustees have held public meetings and solicited public comments regarding restoration planning efforts.[154]

In contrast to the openness and formalized processes that govern NRDA science funded by trustees, there is relatively little oversight of private science agendas. Only if the NRDA process proceeds to active litigation will private science be subject to discovery. Otherwise, there is no regulatory mechanism or statute that requires access to privately generated NRDA science.[155] This leaves defendants with the ability to selectively release private science and skew information available to the greater scientific community.[156]

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150. *Deepwater Horizon* Hearing, *supra* note 108 (statement of Cynthia Dohner, Regional Director, Southeast Region, United States Fish & Wildlife Service, United States Department of the Interior), *available at* http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=57df5ffc-d62d-4fc0-944f-491bb98873fb ("The NRDAR process is built upon many of the lessons learned from the 1989 *Exxon Valdez* spill in Alaska.").

151. *Deepwater Horizon* Hearing, *supra* note 108 (statement of Tony Penn, Deputy Chief, Assessment and Restoration Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration, United States Department of Commerce), *available at* http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=c1e77ed9-c1be-4a2d-8b87-65e1717e1518.

152. *Id.*; *see also Gulf Spill Restoration*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. http://www.gulfspillrestoration.noaa.gov (last visited Feb. 18, 2015) (providing information regarding the NRDA process, including access to over 100 pre-assessment work plans).

153. *Deepwater Horizon* Hearing, *supra* note 108 (statement of Tony Penn, Deputy Chief, Assessment and Restoration Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration, United States Department of Commerce), *available at* http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=c1e77ed9-c1be-4a2d-8b87-65e1717e1518.

154. *Id.* at 4.

155. *Cf.* Wagner, *supra* note 19, at 1664 (describing the paucity of laws in the toxics regulatory context, requiring production of "vital information on the externalities" created by private actions); *id.* at 1699–1711 (discussing the various laws that private actors can used to shield science from public disclosure).

156. *Id.* at 1645 (noting that private actors have an "informational advantage" because they can "use several legal protections to actively exclude others from accessing the basic information and physical data needed to assess externalities"); *cf.* Mary L. Lyndon, *Information Economics and Chemical Toxicity: Designing Laws to Produce and Use Data*, 87 MICH. L. REV. 1795, 1813 (1989) ("As

Some of the problems of access and asymmetry within NRDA are addressed by cooperative assessment. The regulations adopted by the National Oceanic and Atmospheric Association ("NOAA") under the Oil Pollution Act of 1990[157] are sensitive to the informational issues that arise when government scientists and corporate-funded scientists are working on parallel, competing scientific agendas. In particular, NOAA's implementing regulations encourage cooperation between trustees and corporate defendants during the NRDA assessment process.[158] Trustees and BP work along-side one another to advance a similar scientific agenda. In theory, this cooperation generates a single body of science that is open to public access.[159] Despite the cooperative assessment process, however, problems of information parity persist. For one thing, the cooperative assessment process is voluntary. The trustees are required to invite all the responsible parties to participate in the NRDA process, but the parties are not obliged to accept the invitation.[160] In the case of the *Deepwater Horizon* spill, BP is the only responsible party participating in the cooperative assessment process.[161] This means there is still the potential for litigation noise and information asymmetry from science generated by non-participating parties.[162] In fact, despite efforts of trustees to remain as transparent as possible, trustees are also acutely aware that "NRDA is a legal process, designed to resolve liability through restoration for the American public. The legal nature of damage assessment requires a degree of confidentiality to preserve the government's ability to make the strongest damage claim possible on behalf of the public in settlement negotiations and litigation."[163] Given that NRDA is fundamentally

long as no way exists for buyers to identify the toxic effects of specific chemicals, there is no commercial incentive for chemical producers to identify and publicize them.").

157. Oil Pollution Act of 1990, Pub. L. No. 101-380, 104 Stat. 484 (codified as amended in scattered sections of 33 U.S.C., 43 U.S.C., & 46 U.S.C.).

158. *See* VALERIE ANN LEE ET AL., THE NATURAL RESOURCE DAMAGE ASSESSMENT DESKBOOK 402 (2002); *see also* 15 C.F.R. § 990.14(c) (2014).

159. *See* 2012 *DEEPWATER HORIZON* STATUS REPORT, *supra* note 1, at 21 (explaining that "[o]nce they have undergone a comprehensive quality control check, all data obtained through the cooperative process is publicly available at http://www.gulfspillrestoration.noaa.gov/oil-spill/gulf-spill-data/").

160. *See* 15 C.F.R. § 990.14(c)(1) ("Trustees must invite the responsible parties to participate in the natural resource damage assessment . . . .").

161. Potentially responsible parties identified thus far are BP Exploration and Production Inc., Transocean Holdings Inc., Triton Asset Leasing GmbH, Transocean Offshore Deepwater Drilling Inc., Transocean Deepwater Inc., Anadarko Petroleum, Anadarko E&P Company LP, and MOEX Offshore 2007 LLC. Discharge of Oil from Deepwater Horizon/Macondo Well, Gulf of Mexico; Intent to Conduct Restoration Planning, 75 Fed. Reg. 60,800, 60,800–01 (Oct. 1, 2010).

162. For an example of where trustees anticipate conflicting science to emerge after the *Deepwater Horizon* oil spill, see *supra* note 117 and accompanying text.

163. *Deepwater Horizon* Hearing, *supra* note 108 (statement of Tony Penn, Deputy Chief, Assessment and Restoration Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration, United States Department of Commerce), *available at* http://www.epw.senate.gov/public/index.cfm?FuseAction=Files.View&FileStore_id=c1e77ed9-c1be-4a2d-8b

an adversarial process, cooperative assessment neither completely changes the adversarial nature of the NRDA process, nor ensures that trustees and defendants speak with a single voice.[164]

Setting cooperative assessments aside, the asymmetry between government science and private science puts corporate defendants like Exxon or BP at a distinct informational advantage—defendants are privy to the government science through public access channels while at the same time allowed to shield their private findings from scrutiny. In this way, the information asymmetry created by the adversarial context of the NRDA process generates additional litigation noise. Professor Sheldon Krimsky, well-known for his work on conflicts of interest in policy-relevant science, has made similar observations in the pharmaceutical context:

> Conflicts of interest in producing research are exacerbated by the fact that the pharmaceutical industry is in control of vast amounts of information, much of which remains secret or is shared as privileged business information with regulatory agencies. The practice of suppressing data unfavorable to industry's bottom line is not prima facie illegal, but it delays the science and can cost lives. Science is self-correcting, but it may take years for that correction. The cost in lives that may result from sequestered data must be weighed against the rights of companies to their confidential business information.[165]

Like other types of policy-relevant science, NRDA science is potentially undermined by structural asymmetries that shield access to private science. In particular, asymmetrical transparency adds to the litigation noise and impedes the ability of scientists to separate real impacts from those created by the distractions of litigation posturing.[166] In examining "sequestration" in the realm of public science, Professor Sheila Jasanoff has aptly observed that "[t]o be useful, scientific information has to be available to those in a position to appraise and use it."[167]

And while Professor Krimsky is hopeful that the "self-correcting" nature of science will eventually uncover the truth,[168] his optimism might not apply

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87-65e1717e1518; *see also id.* ("[T]rustees have developed new public information sharing protocols to address the American public's unprecedented request for NRDA information, while at the same time, preserving the trustees' responsibility to ensure a strong legal case.").

164. *Cf. supra* notes 108–10 and accompanying text (discussing testimony explaining that the cooperative assessment process still leaves corporate defendants like BP with dominant leverage in setting the scientific agenda since they are ultimately the source of the funding).

165. *See* Krimsky, *supra* note 125, at 74.

166. *Cf.* Jasanoff, *supra* note 26, at 29–30 (discussing research on the widely used pesticide atrazine as an example of how asymmetry facilitates the manufacture of uncertainty); Wagner, *supra* note 19, at 1650 (noting that in the toxics regulatory context, the "easiest approach" for private actors to obscure adverse scientific research is "simply to publicize only the positive information about a product or activity, while keeping potentially damaging information private").

167. Jasanoff, *supra* note 26, at 26.

168. Krimsky, *supra* note 125, at 74.

in the NRDA context. Unlike laboratory research or human studies research that can be replicated given enough time and funding, scientific discovery is borne out of crisis moments and opportunities to learn from ecosystems as injuries unfold in real time and place. The observation of nature's reaction to acute toxic exposure cannot necessarily be replicated, and indeed, hopefully will not occur again. In that way, the stakes of asymmetrical access and litigation noise in NRDA may well be higher than in situations where research takes place in the laboratory.

## IV. STRUCTURAL COMPLICATIONS OF LONG-TERM INJURIES

At first glance, many of the practical problems that adversarial science creates might seem to be resolved if the parties can simply get past the unpleasantries of litigation. After all, quick settlements would necessarily diminish the stakes that responsible parties have in scientific outcomes and therefore dampen undue influence and uncertainty-generating agendas. At the same time, if trustees can focus on restoration instead of litigation, the scientific agenda would no longer be subservient to litigation concerns or settlement posturing. This was, in fact, a welcome byproduct of the relatively early natural resource damage settlement following the *Exxon Valdez* oil spill. In that case, the spill occurred in March 1989 and natural resource damage claims were settled less than three years later in October 1991. Because the settlement released tensions between lawyers and scientists, at least one member of the Trustee Council was quoted as saying that the science program "never got really good until after the [natural resource damage] settlement."[169]

In the end, however, early settlements are not the complete solution. The most fundamental problem with early settlements is that long-term injuries take time to manifest. The close study of the *Exxon* spill, for example, has shown that oil can linger in the marine ecosystem and subject multiple levels of species to toxic exposure for decades after the spill.[170] An examination of the scientific literature also demonstrates that determining long-term impacts is a complex issue that takes more time than is available.[171] This timing issue is not unique to the *Exxon Valdez* oil spill—long latency periods are

169. HUNT, *supra* note 87, at 65 (quoting Stan Senner, a restoration planner) (internal quotation marks omitted).

170. *See* Knudsen, *supra* note 22, at 484–90 (assembling the scientific literature in the long-term wake of the *Exxon* spill and discussing the paradigm shift that recognizes long-term injuries after oil spills are more substantial than previously thought); *see also supra* note 119 and accompanying text.

171. *See* Harwell & Gentile, *supra* note 117, at 208 ("If one requires precise answers before making judgments about ecological significance in a complex environmental issue, then one may have to wait a very long time . . . .").

characteristically problematic for injuries resulting from chronic toxic exposure.[172]

Because long-term harms do not manifest on a litigation timeline, early settlements run the risk of underestimating the magnitude and extent of long-term injuries.[173] In addition, early settlements may mean cutting short scientific study. In that sense, some science, even adversarial science, may be preferable to no science on issues like long-term harm.[174]

If early settlements pose structural problems for long-term injuries, the question is whether trustees have tools to address those problems. One way that trustees have traditionally addressed the structural problem of long-term injuries has been through reopener clauses. In fact, government trustees responding to the *Exxon Valdez* oil spill approached the NRDA settlement with long-term injuries in mind and included a "reopener provision" to offset the risk of settling in the face of incomplete knowledge.[175] The reopener allowed the government trustees to make a one-time claim of up to an additional $100 million for natural resource damages that were "unanticipated" at the time of the settlement, September 25, 1991.[176] The trustees were given a window of time between 2002 and 2006 to make a reopener demand:

> Notwithstanding any other provision of this Agreement, between September 1, 2002, and September 1, 2006, Exxon shall pay to the Governments such additional sums as are required for the performance of restoration projects in Prince William Sound and other areas affected by the Oil Spill to restore one or more populations, habitats, or species which, as a result of the Oil Spill, have suffered a substantial loss or substantial decline in the areas affected by the Oil Spill; provided, however, that for a restoration

172. *See supra* notes 23–27 and accompanying text.

173. Government trustees for the *Exxon* spill, for example, settled the NRDA claims in 1991, less than three years after the spill. *See* Agreement and Consent Decree, United States v. Exxon Corp., No. A91-082 CIV (D. Alaska Oct. 9, 1991), *available at* http://www.arlis.org/docs/vol1/A/42964164.pdf. At the time, they did not know what long-term injuries would manifest in the long-term wake of the spill. Certainly at the time of settlement, the trustees could not even have speculated as to whether the complete collapse of the Pacific herring fishery was caused by the *Exxon* spill—that collapse did not happen until 1993 and now is the center of debate over its causal connection to the spill. *See generally* Sanne Knudsen, *A Precautionary Tale: Assessing Ecological Damages After the* Exxon Valdez *Oil Spill*, 7 U. ST. THOMAS L.J. 95 (2009) (assembling scientific literature on the herring collapse).

174. *Cf.* Jasanoff, *supra* note 26, at 40 ("In civil cases, early settlement may deter follow-up studies of affected populations, thereby rendering invisible the longer term health and environmental effects that might have come to light through continued research." (footnote omitted)).

175. For a detailed history of the *Exxon* Reopener, see generally HUNT, *supra* note 87, at 248–50; William H. Rodgers, Jr. et al., *The* Exxon Valdez *Reopener: Natural Resources Damage Settlements and Roads Not Taken*, 22 ALASKA L. REV. 135 (2005).

176. Agreement and Consent Decree, *supra* note 173, ¶ 18.

> project to qualify for payment under this paragraph the project must meet the following requirements:
>
> (a) the cost of a restoration project must not be grossly disproportionate to the magnitude of the benefits anticipated from the remediation; and
>
> (b) the injury to the affected population, habitat, or species could not reasonably have been known nor could it reasonably have been anticipated by any Trustee from any information in the possession of or reasonably available to any Trustee on the Effective Date.[177]

This provision gave government trustees the assurances they desired regarding unanticipated future harms, and secured the blessing of the public and Judge Holland on the proposed consent decree.[178] Notably, such reopener provisions are fairly common in other natural resource damage settlements as well.[179]

In theory, a reopener provision is a promising approach to NRDA settlements. Indeed, reopener clauses are useful precisely because they leave open the possibility for further liability for future, unknown harms. In this way, reopeners preserve the relevance of adversarial posturing with respect to the long-term, ongoing study of the oiled ecosystem. Corporate defendants like Exxon have incentives to fund research aimed at minimizing the long-term impacts of the oil spill. At the same time, trustees have an incentive to fund research that links the oil spill to long-term adverse changes to the ecosystem. For each party, there are financial incentives to either seek out or stamp out patterns of long-term harm.

While reopeners could be celebrated for their encouragement of ongoing research on chronic toxic exposure, patterns within the scientific literature after the *Exxon* spill suggest that reopeners may be extending the adversarial nature of NRDA science beyond settlement. In particular, the

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177. *Id.* ¶ 17.

178. *See* Rodgers et al., *supra* note 175, at 138 ("The Reopener helped seal the settlement. The governments told Judge Holland that it was an important hedge against miscalculations or excessive optimism, fueled by the desire to settle quickly."). The trustees were not the only ones who seemed to appreciate the potential for long-term injuries. As Professor Bill Rodgers highlighted in his original examination of the *Exxon* Reopener, the reopener clause "was opposed by Exxon executives from the start." *Id.* at 139. In fact, settlement negotiations nearly ended because of the EPA's insistence from the start that such a clause be included in the consent decree. *Id.* The $100 million reopener figure was a compromise from the original $300 million proposed by the EPA. *Id.*

179. *See* HUNT, *supra* note 87, at 31 (noting that "reopeners had become a routine part of restoration settlements"). *But see* Government's Memorandum in Support of Agreement and Consent Decree at 12, United States v. Exxon Corp., Nos. A91-082 CIV, A91-083 CIV (D. Alaska Oct. 8, 1991), *available at* http://www.arlis.org/docs/vol1/A/294858686.pdf (explaining that the *Exxon* Reopener is "novel" because, unlike reopeners typically included in other NRDA settlements, "Exxon commits to pay up to $100 million for restoration of unanticipated environmental harm, without any need for the Governments to establish Exxon's liability").

science produced in the wake of the *Exxon* spill settlement suggests litigation science may be outliving the settlement precisely because the reopener provision leaves incentives for future claims on the table. Ultimately, there may be some reason for approaching the allure of reopener provisions skeptically.

To start, one indication of enduring litigation incentives is the sizeable number of Exxon-funded studies devoted to critiquing or combating claims of long-term impacts.[180] The result is a body of internally divisive and competing strands of scientific literature discussing long-term harms.[181] One strand points to the growing body of evidence of long-term impacts;[182] the other strand concludes that factors other than oil are at play.[183] Though the competing strands are not equally balanced in every case, the scientific exchange in the (long-term) wake of the *Exxon* spill poignantly demonstrates a pattern and practice of refuting causal links between the spill and long-term

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180. *See supra* notes 121–23 and accompanying text (discussing Exxon-funded studies that offer an alternative explanation of harm).

181. *See* HUNT, *supra* note 87, at 177–78 (noting that contrasting studies between Exxon and trustees are the norm); Harwell & Gentile, *supra* note 117, at 205 (acknowledging that the literature concerning the ecological significance of the *Exxon* spill is "often highly diverse"). See *supra* note 117 for examples of divisive research on the long-term impacts to pink salmon and Pacific herring in Prince William Sound. For an example of divisive literature on the impacts to sea otters at Northern Knight Island, compare James L. Bodkin et al., *Long-Term Effects of the* 'Exxon Valdez' *Oil Spill: Sea Otter Foraging in the Intertidal as a Pathway of Exposure to Lingering Oil*, 447 MARINE ECOLOGY PROGRESS SERIES 273, 284 (2012) ("The overlap of lingering oil in the intertidal with intertidal foraging by sea otters provides a reasonable explanation for their slow population recovery."), and James L. Bodkin et al., *Sea Otter Population Status and the Process of Recovery from the 1989* 'Exxon Valdez' *Oil Spill*, 241 MARINE ECOLOGY PROGRESS SERIES 237, 242 (2002) (attributing population-level effects on Northern Knight Island otters to subsurface oil residues), with Mark A. Harwell et al., *A Quantitative Ecological Risk Assessment of the Toxicological Risks from* Exxon Valdez *Subsurface Oil Residues to Sea Otters at Northern Knight Island, Prince William Sound, Alaska*, 16 HUM. & ECOLOGICAL RISK ASSESSMENT 727, 727 (2010) ("[N]o plausible toxicological risk exists from [subsurface oil residues] to the sea otter subpopulation at [Northern Knight Island]."). For an example of divisive literature on the long-term impacts to harlequin ducks, compare John A. Wiens et al., *Assessing Cause–Effect Relationships in Environmental Accidents: Harlequin Ducks and the* Exxon Valdez *Oil Spill*, 17 CURRENT ORNITHOLOGY 131, 151–53 (2010) (concluding that there is no evidence of ongoing population level impacts to harlequin ducks from the *Exxon* spill), with Daniel Esler & Samuel A. Iverson, *Female Harlequin Duck Winter Survival 11 to 14 Years After the* Exxon Valdez *Oil Spill*, 74 J. WILDLIFE MGMT. 471 (2010). For an example of the literature on the lingering presence of oil, see Paul D. Boehm, *Distribution and Weathering of Crude Oil Residues on Shorelines 18 Years After the* Exxon Valdez *Spill*, 42 ENVTL. SCI. & TECH. 9210, 9210 (2008) (concluding that "[m]ost of the [*Exxon Valdez*] oil in [Prince William Sound] has been eliminated due to natural weathering"). For a summary of Exxon-funded research highlighting the ongoing debates regarding the long-term impacts to sea otters and harlequin ducks, see Mark A. Harwell et al., *Quantifying Population-Level Risks Using an Individual-Based Model: Sea Otters, Harlequin Ducks, and the* Exxon Valdez *Oil Spill*, 8 INTEGRATED ENVTL. ASSESSMENT & MGMT. 503, 504–05 (2012).

182. *See supra* note 119 (assembling the literature purporting to be part of a growing body of research demonstrating substantial long-term harms in the wake of the *Exxon* spill).

183. *See, e.g.*, Harwell et al., *supra* note 24; *see also supra* notes 121–23 and accompanying text (discussing other Exxon-funded studies that offer an alternative explanation of harm).

injury. Indeed, many of the examples provided in Part III.B to illustrate the funding effect in NRDA science involve scientific studies undertaken after settlement. In other words, the reopener provision appears to have been driving incentives for generating ongoing uncertainty in the science.

One could of course argue that scientific debate over long-term harm is expected given the difficulty of sorting out causation in complex ecosystems and over a long time span. But there are also other, more obvious, signs that the *Exxon* reopener provision is encouraging ongoing advocacy within the science. Most notably, some of the language in the scientific literature tracks the language of the reopener itself. On the one hand, Exxon-funded science is more apt to focus on alternative causes to explain ongoing harm in Prince William Sound, describe ongoing harm as "anticipated," or diminish the significance of ongoing effects.[184] On the other hand, science funded by trustees is more apt to describe scientific findings as "unanticipated," speak in terms of "shifting paradigms" of knowledge, or conclude that long-term effects are more severe than "previously believed."[185] Recall that the reopener allows for additional damage awards in the event that trustees discover future injuries that could not "reasonably have been anticipated" from the information that the trustees had in their possession at the time of settlement. By discussing long-term harms as either "anticipated" or "unanticipated," expected or unexpected, the scientists are adopting precisely the reopener provision's operative language and frame. One synthetic study on the impact

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184. *See, e.g.*, Brannon et al., *supra* note 117, at 57 (framing the story of the pink salmon to underscore that some long-term losses were anticipated at the time of the spill, but then going on to conclude that "[t]here is no evidence supporting the projected losses to the [Prince William Sound] pink salmon that were *anticipated* at the time of the spill" (emphasis added)); Harwell & Gentile, *supra* note 117, at 223 (discussing and assembling literature on long-term impacts to harlequin ducks and emphasizing that, "even in the absence of residual [*Exxon Valdez* oil]," researchers have long "*expected [recovery] to be slow*" because of breeding patterns (emphasis added)); *id.* at 220–36 (assembling the literature for 16 different species and evaluating whether the *Exxon Valdez* oil spill caused an "ecologically significant" effect on each); *cf.* Landis, *supra* note 137, at 440 (criticizing Harwell's work on ecological significance as little more than a policy statement rather than a scientific investigation).

185. DAN ESLER, *EXXON VALDEZ* OIL SPILL TR. COUNCIL, RESTORATION PROJECT FINAL REPORT: QUANTIFYING TEMPORAL VARIATION IN HARLEQUIN DUCK CYTOCHROME P4501A INDUCTION 2 (2008), *available at* http://www.arlis.org/docs/vol1/A/427557357.pdf ("Results of the [Nearshore Vertebrate Project] included the *unanticipated* finding that harlequin ducks had elevated CYP1A induction in areas receiving oil from the *Exxon Valdez* spill." (emphasis added)); *see also* Esler et al., *Harlequin Ducks*, *supra* note 119, at 1138 ("One of the more remarkable and *unanticipated* findings from this body of work was the length of time (at least a decade) over which animals were exposed to residual oil and showed depression of various population demographic attributes." (emphasis added)); Samuel A. Iverson & Daniel Esler, *Harlequin Duck Population Injury and Recovery Dynamics Following the 1989* Exxon Valdez *Oil Spill*, 20 ECOLOGICAL APPLICATIONS 1993, 2004 (2010) ("Our findings confirm assertions that effects of oil spills on wildlife populations are expressed over *much longer time frames than previously assumed*." (emphasis added)); Monson et al., *supra* note 119, at 2917 ("[O]ur results suggest that residual oil can affect wildlife populations on time scales *much longer than previously believed* . . . ." (emphasis added)).

of the *Exxon* spill on Pacific herring even discusses the significance of certain findings in terms of their implications for the reopener clause.[186]

The ongoing influence of litigation in the post-settlement studies is even obvious from the ways in which some scientists differentiate themselves and refer to one another as either "agency scientists" or "non-agency scientists."[187] By drawing these distinctions, the scientists signal to readers that who conducts the science may be relevant to what conclusions were drawn. One team of scientists, in a post-article disclaimer regarding funding, gave a lengthy explanation as to why their work should not be discredited simply because it was funded by Exxon.[188]

In these ways, the reopener appears to be driving scientific research and opening that research up to a more stealth form of adversarial science. The influence of litigation is "stealth" because it infiltrates the science at a time when the broader community might expect the adversarial phase of the NRDA process to have concluded. Though this Article does not purport to measure the magnitude of the reopener's influence on the quality of the science, the awareness of scientists of the legal import of their findings suggests an influence of litigation incentives on science that is plenty clear. At the very least, the ongoing litigation posture is a distraction to the goal of science—uncovering truth. Indeed, the perception of bias in the science is particularly high when the outcome tracks the incentives of the sponsor and the language tracks the legal standard set out in the reopener.

Because reopeners generate incentives to engage in advocacy science beyond settlement, alternative approaches to long-term injury recovery might be preferable. Any alternative solution for addressing long-term injuries should consider the desire to preserve efforts at studying long-term impacts of oil spills. Indeed, reopeners are successful in at least that respect—they generate an incentive to continue to research long-term effects of chronic exposure, long after the media hype has died down. So there is a silver lining.

186. S.D. RICE & M.G. CARLS, *EXXON VALDEZ* OIL SPILL TR. COUNCIL, RESTORATION PROJECT FINAL REPORT: PRINCE WILLIAM SOUND HERRING: AN UPDATED SYNTHESIS OF POPULATION DECLINES AND LACK OF RECOVERY 15 (2007), *available at* http://www.evostc.state.ak.us/Store/FinalReports/2005-050794-Final.pdf (noting that if the "present day depressed population levels are related to the oil spill and *unexpected* damages, a key criterion of the re-opener clause, would be satisfied" (emphasis added)).

187. *See, e.g.*, Brannon et al., *supra* note 117, at 22 (describing who belongs to the camp of agency verses nonagency scientist).

188. Harwell & Gentile, *supra* note 117, at 239 (noting that funding was provided by Exxon and then going on to explain that "[i]f anything, we began with a bias toward expecting to find evidence of continuing ecological effects on [Prince William Sound] based on our cursory reading of the popular science and public literature. We also felt, perhaps, an inherent bias, derived from our collective 60 y[ears] of experience working in or for the government, toward government-funded science rather than industry-funded science").

## V. PROPOSED SOLUTIONS

The NRDA process, though it is fundamentally adversarial, focuses attention on scientific research that might not otherwise be a priority. In that way, NRDA science is an asset. But, it is an asset that is vulnerable to bias. The key to capitalizing on NRDA science as an asset is to recognize its advocacy-based origins and situate it in a framework that systematically dampens the litigation noise and scientific in-fighting. Professor Sheila Jasanoff made a similar observation related to public science in general: "Once we recognize, moreover, that litigation is an indispensable aid to knowledge production, procedures aimed at increased transparency . . . could be devised to improve the quality and reliability of the science that lawsuits help generate."[189]

In that effort, this Part offers three possibilities for harnessing the promise of adversarial science in the NRDA context. The first solution considers using permit fees to establish baseline data funds for developing science in advance of disasters and outside the adversarial context. The second solution addresses the structural challenges of long-term injuries and proposes the use of a multiplier to resolve claims for long-term harms earlier in the NRDA process while at the same time ensuring ongoing study of long-term impacts. The third solution takes on the problems of adversarial science a bit more directly—it proposes the use of a rebuttable presumption to encourage greater transparency in the science produced by non-government interest.

Each of these solutions, which could operate independently or together, offers ways of supporting NRDA science so that at least part of the research can take place outside the advocacy context. Crafted with funding problems in mind, these solutions provide ways of putting better information and more funds into the hands of trustees early in the NRDA process. The aim is to dampen litigation noise and create a structure where there is greater ability to separate actual causes of harm from noise. Notably, both of these solutions recognize the importance of NRDA science as an informational tool and are designed to encourage ongoing scientific research in the area.

### A. *FUNDING THE BASELINE*

One way to dampen litigation noise is to take science out of the adversarial context. At first blush, such a suggestion may seem at odds with the NRDA process itself, which is triggered only after a spill has occurred. While it is true that the NRDA process is reactive by nature, not all of the science has to be. In fact, there is a category of data—called baseline data—that measures pre-spill conditions and that scientists need to prepare NRDA assessments.[190] In theory, this data could be collected in areas of oil

189. *See* Jasanoff, *supra* note 26, at 44.

190. Natural resource damage statutes and regulations define injury and measure recovery by deviations from pre-spill or pre-release conditions. *See, e.g.*, Oil Pollution Act (OPA), 33 U.S.C.

development or areas at risk for oil spills before a spill occurs.[191] In fact, establishing a more robust understanding of baseline conditions would help the NRDA process immensely. Often, one of the challenges to identifying the extent and magnitude of natural resource injuries is the lack of baseline data.[192] After the *Exxon* spill, for instance, injury to certain species was difficult to assess because the size of populations before the spill were unknown.[193] In addition, systematic information regarding baseline levels of hydrocarbon and other toxic stressors in areas like the Prince William Sound were unavailable.[194] Trustees responding to the *Deepwater Horizon* oil spill are facing similar challenges given that the Gulf of Mexico was not exactly pristine before the spill.[195]

Lack of baseline data forces the science into a reactive posture and makes the process of assessing and restoring injuries in the wake of disasters more challenging. It exacerbates the risks of adversarial science by generating uncertainty and debate about even pre-spill conditions. To that end, establishing causal links between an oil spill and subsequent population

§ 2706 (2012); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9607(f) (2012). OPA regulations define "recovery" as "the return of injured natural resources and services to baseline." 15 C.F.R. § 990.30 (2014). "Baseline means the condition of the natural resources and services that would have existed had the incident not occurred." *Id.*; *see also id.* (allowing trustees to use "historical data, reference data, control data, or data on incremental changes" to establish the baseline).

191. Usha Varanasi, *Making Science Useful in Complex Political and Legal Arenas: A Case for Frontloading Science in Anticipation of Environmental Changes to Support Natural Resource Laws and Policies*, 3 WASH. J. ENVTL. L. & POL'Y 238, 256–57 (2013).

192. NATIONAL OIL SPILL COMMISSION REPORT, *supra* note 43, at 183–84 ("Two sets of determinations—one concerning the baseline conditions against which damages to each species or habitat will be assessed and another concerning the quantification of those damages—are particularly difficult and consequential in terms of the overall results."); *id.* at 184 ("Because long-term historical data are often nonexistent or discontinuous, natural resource trustees are likely to be disadvantaged by a lack of sufficient information to fully characterize the condition of relevant ecosystems prior to the incident in question.").

193. *See, e.g.*, *EXXON VALDEZ* OIL SPILL TR. COUNCIL, 2010 UPDATE: INJURED RESOURCES AND SERVICES 6 (2010), *available at* http://www.evostc.state.ak.us/universal/documents/publications/2010IRSUpdate.pdf ("For many of the resources affected by the spill there was limited or no recent data on their status in 1989."); Harwell & Gentile, *supra* note 117, at 222 (acknowledging that cormorants have not recovered after the *Exxon* spill but concluding that the lack of baseline data makes it difficult to assess whether depressed populations are a result of the spill).

194. *See* Harwell & Gentile, *supra* note 117, at 208.

195. NATIONAL OIL SPILL COMMISSION REPORT, *supra* note 43, at 184 ("As OPA regulations indicate, 'baseline' for purposes of damage assessment is generally considered to be the condition of the resource just prior to the spill. The precise application of this definition has particular importance in the Gulf of Mexico context, where many coastal habitats have been substantially degraded over decades—even centuries—under the pressure of ever-expanding industrial, commercial, and residential development."); *see also* Varanasi, *supra* note 191, at 240 ("With its disastrous impact on the Gulf Coast's ecology and economy, this spill has presented a great challenge, especially to scientists who frantically gather thousands of samples from impacted areas and, under dynamic conditions, try to generate numerous data reports to inform a concerned public." (citations omitted)).

decline is obviously more difficult when baseline information regarding toxicity, exposure pathways, or pre-spill population numbers is unavailable.[196] Deficient baseline data also forces trustees to quickly measure the baseline in the adversarial context of NRDA, which is more rushed and contentious.[197]

At least one prominent scientist and professor, Dr. Usha Varanasi, has observed that "conducting strategic and comprehensive scientific inquiry, including hypothesis testing, is not possible during an intense crisis because scientists are often faced with having to answer fragmented 'questions of the day' and answers often managed as a public relations issue by diverse parties."[198] Based on her experience with major environmental disasters like the *Exxon* spill and the *Deepwater Horizon* spill, Dr. Varanasi laments that scientists must often make significant decisions regarding "human safety, seafood contamination, damage to marine life, and economic losses" without sufficient information.[199]

One possibility for addressing data gaps is to investigate potential impacts of oil spills and toxic substance releases on human health and the environment before a crisis happens. This would require a sustained, nationwide, and systematic approach to understanding and responding to toxic releases. Dr. Varanasi calls this "frontloading the science."[200] Such a science program would do more than gather population data in areas at risk for oil spills or toxic releases. It would develop protocols and accepted methods for assessing injuries before the adversarial posture of NRDA arises:

> Scenario building and development of a long-term strategy of remediation (if the disaster does happen) should be studied and debated in the open, and relevant, new methods should be developed and validated beforehand so they can be standardized

196. *See, e.g.*, Harwell & Gentile, *supra* note 117, at 214 (explaining that assessing the long-term impacts of an oil spill on ecosystem resources requires that there is "sufficient information about pre-spill conditions confidently to understand recovery, or else recovery status can never be determined").

197. NATIONAL OIL SPILL COMMISSION REPORT, *supra* note 43, at 176 ("Americans watched as the oil eventually came to rest along intermittent stretches of the Gulf coast. Before it arrived, scientists rushed to collect crucial baseline data on coastal and water-column conditions.").

198. Varanasi, *supra* note 42, at 234; *see also* Rebecca M. Bratspies, *A Regulatory Wake-Up Call: Lessons from BP's* Deepwater Horizon *Disaster*, 5 GOLDEN GATE U. ENVTL. L.J. 7, 28–30 (2011) (describing the regulatory requirements for determining environmental effects); Varanasi, *supra* note 191, at 241 ("After each major crisis, there is a general consensus that a robust scientific basis (or underpinning) and baseline data should be available beforehand."(citations omitted)).

199. Varanasi, *supra* note 42, at 234.

200. *See* Varanasi, *supra* note 191, at 240–41 (stating that the *Deepwater* spill "demonstrates *once more* that the assessment of injury to natural resources can be seriously hampered by lack of knowledge about the prior state of the affected ecosystem" (emphasis added) (citations omitted)). *See generally* Varanasi, *supra* note 42.

and used confidently to measure contamination of seafood and to assess biological effects of toxic contaminants from a spill.[201]

While Dr. Varanasi urges the frontloading of science as a means of putting much needed information in the hands of scientists working on post-disaster response, this Article suggests an additional rationale—it would dampen litigation noise. To that end, encouraging science to take place outside an overtly litigious setting may be more likely to foster coordination and outcome-neutral study. At the very least, gathering baseline data outside the NRDA context reduces the likelihood that baseline data will be the subject of dispute, since there may be less perception of bias.

Better baseline data would also help make the NRDA process more efficient. With baseline data available, trustees can focus their time and resources on assessing the injuries, rather than scrambling to gather baseline information. Indeed, for long-term injuries, baseline data may assist trustees in separating resources that are in fact suffering from prolonged harm from those whose populations exhibit natural variability.[202] In addition, if scientists have a foundational understanding of what species and other resources are the driving elements of the ecosystem, trustees can develop post-spill science agendas that focus on keystone elements and gather data for resources that are known indicators of greater ecosystem health.

Even if frontloading science is a good idea, scientific study requires funding. It is possible that the government could fund baseline research in areas where oil drilling and transport take place. Given that government agencies already face budget constraints, however, expecting agencies to allocate limited funds towards research that might one day be necessary for assembling an NRDA claim is not realistic.[203] Indeed, government funding for ongoing baseline data collection wanes despite congressional efforts. To that end, when Congress passed the Oil Pollution Act of 1990 in the aftermath of the *Exxon Valdez* oil spill, it naturally recognized the value of undertaking "a comprehensive program of oil pollution research."[204] As part of that effort, Congress created a 13-member Interagency Coordinating Committee and tasked it with developing a research and technology plan that would, among other things, "identify significant oil pollution research gaps."[205] Developing baseline data for use in decision-making was among the long wish list of research efforts that Congress required the Committee to consider.[206] Indeed,

201. Varanasi, *supra* note 42, at 233.

202. *See* Rodgers et al., *supra* note 175, at 189–91 (stating that understanding the baseline will aid in determining when there are ongoing injuries worthy of further damages under a reopener provision).

203. *See* Varanasi, *supra* note 191, at 257 (noting the funding limitations to frontloading science); *cf.* Tolan, *supra* note 99, at 422–26 (describing funding challenges for NRDA).

204. 33 U.S.C. § 2761(a)(2) (2012).

205. *Id.* § 2761(b)(1)(C).

206. *Id.* § 2671(c)(2)(E).

Congress directed the Committee to establish a research program that includes "[t]he collection of environmental baseline data in ecologically sensitive areas at particular risk to oil discharges where such data are insufficient."[207] In theory, these mandates are precisely in line with Dr. Varanasi's call for frontloading science.

In reality, the Committee appears to have focused largely on research related to oil pollution prevention and response technologies.[208] For example, the plan sets priorities in areas like testing of chemical dispersants and alternative cleanup technologies, or facilities inspection and spill detection technologies.[209] To be sure, the plan also recognizes the need for long-term monitoring programs in the wake of oil spills,[210] but does not specifically address Congress's vision of acquiring baseline data before a spill occurs. The plan makes only one reference to pre-spill baseline data, and that is in the context of efforts by the State of California to gather baseline data for marine mammal and bird populations.[211] The Committee is currently working on a new plan.[212]

If the Committee continues to prioritize research other than baseline studies, there are other levers that might be available to achieve a similar end. One possibility is to use oil and gas leases as an ex ante lever for acquiring baseline data collection. To that end, government agencies have the ability to include various conditions in oil and gas leases or other regulatory permits associated with offshore oil drilling activities.[213] As a condition of their permits, developers might be required to undertake the ongoing study of the marine ecosystems in which they seek to do business.

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207. *Id.* § 2761(c)(4)(A)(iv).

208. *See* INTERAGENCY COORDINATING COMM. ON OIL POLLUTION RESEARCH, OIL POLLUTION RESEARCH AND TECHNOLOGY PLAN, at iii (1997), *available at* http://www.uscg.mil/iccopr/files/Oil%20Pollution%20Research%20and%20Technology%20Plan%201997.pdf.

209. *Id.* at iv.

210. *Id.* at 64.

211. *Id.* at 17.

212. *See* Interagency Coordinating Comm. on Oil Pollution Research, *Oil Pollution Research and Technology Plan*, U.S. COAST GUARD, http://www.uscg.mil/iccopr/Documents_ResearchAndTechnologyPlan.asp (last visited Feb. 18, 2015).

213. *See* 43 U.S.C. § 1334(a) (2012) (giving the Secretary of the Interior the authority to "at any time prescribe and amend such rules and regulations as he determines to be necessary and proper in order to provide for the prevention of waste and conservation of the natural resources of the outer Continental Shelf"); *id.* § 1337(a)(1)(I) (giving the Secretary the authority to subject leasing bids to any conditions that "the Secretary determines to be useful to accomplish the purposes and policies of" the Outer Continental Shelf Leasing Act); *cf.* 30 U.S.C. § 226(g) (2012) (requiring, in the context of surface oil and gas leasing, the Secretary to determine "reclamation and other actions as required in the interest of conservation of surface resources"); *id.* § 226(m) (giving the Secretary of the Interior the authority to prescribe contract conditions "in his discretion, the conservation of natural products or the public convenience or necessity may require it or the interests of the United States may be best subserved thereby").

Some of the oil and gas leasing statutes already require federal agencies to engage in ongoing research on monitoring. The Outer Continental Shelf Lands Act, for example, requires the Secretary of the Interior to engage in an ongoing collection of baseline information that can be used to detect changes to the quality of areas where leasing has been permitted:

> Subsequent to the leasing and developing of any area or region, the Secretary shall . . . monitor the human, marine, and coastal environments of such area or region in a manner designed to provide time-series and data trend information which can be used for comparison with any previously collected data for the purpose of identifying any significant changes in the quality and productivity of such environments, for establishing trends in the areas studied and monitored, and for designing experiments to identify the causes of such changes.[214]

The inclusion of information-gathering obligations in permit leases would be consistent with and further the existing data collection requirements that are already contained in statutes like the Outer Continental Shelf Act.

In fact, these types of conditions are already being utilized in some cases. For example, as a precondition to offshore oil exploration activities in the Artic, "Shell was required to undertake extensive environmental monitoring efforts in order to comply with a broad range of environmental protection requirements—for example, the terms of EPA Clean Air Act and Clean Water Act permits, as well as [National Oceanic and Atmospheric Administration's] marine mammal take authorizations."[215] In part, Shell undertook efforts to understand the physical and ecological characteristics in the area around the proposed drill sites.[216] The research included monitoring physical oceanographic conditions, assessing water chemistry, and sampling biological elements from phytoplankton to fishes.[217] The purpose was to gain "an understanding of pre-existing conditions and inter-annual variability."[218] In a report to the Secretary of the Interior, the Department of the Interior anticipated that the "[i]nformation derived from these efforts is expected to further the understanding of the local environment and help inform future decision-making."[219] If the investigative work and sampling performed by

214. 43 U.S.C. § 1346(b); *see also id.* § 1346(a)(3) ("In addition to developing environmental information, any study of an area or region, to the extent practicable, shall be designed to predict impacts on the marine biota which may result from chronic low level pollution or large spills associated with outer Continental Shelf production.").

215. *See* U.S. DEP'T OF THE INTERIOR, REPORT TO THE SECRETARY OF THE INTERIOR: REVIEW OF SHELL'S 2012 ALASKA OFFSHORE OIL AND GAS EXPLORATION PROGRAM 27 (2013), *available at* http://www.doi.gov/news/pressreleases/upload/Shell-report-3-8-13-Final.pdf.

216. *Id.*

217. *Id.*

218. *Id.*

219. *Id.*

Shell were systemized over all offshore drilling activities and expanded to continue throughout the duration of the projects, the knowledge of baseline conditions of these areas might be greatly enhanced. Oil transport is obviously a broader and more problematic geographic scope, but strategic study of the most sensitive or nearshore ecosystems, as contemplated by Congress in OPA, might be feasible.

As an alternative to requiring permit applicants like Shell to undertake scientific study, another approach is simply to charge permit applicants a fee that would be earmarked for government study of baseline conditions in areas where oil drilling and transport take place. Such fees are not unprecedented. Leaseholders under the Outer Continental Shelf Act, for example, already pay fees into the Fishermen's Contingency Fund as a condition of their lease.[220] That fund was "to compensate U.S. fishermen whose vessels or fishing gear have been lost, damaged, or destroyed by oil and gas obstructions on the U.S. Outer Continental Shelf."[221]

Using permit fees to fund government science programs and establish baseline knowledge for at-risk marine ecosystems is an approach offered by scholars who have more broadly examined this problem in other contexts. For example, Professor Wendy Wagner has examined the "significant deficiencies in scientific knowledge" that result from environmental laws that impose elaborate licensing requirements but fail to hold private actors accountable for producing basic scientific research necessary to understanding the external social costs of their activities.[222] To address this deficit of knowledge, Professor Wagner has suggested that actors could be asked to pay a modest fee to support government research regarding externalities generated by the actor's work. Wagner explains "[t]he underlying logic of this suggestion is that if actors are creating at least some of the need for environmental research, they should assist it financially."[223]

Recently, President Obama announced plans to support long-term research for fostering innovation in energy development through the creation of an Energy Security Trust. That fund would use revenues from federal oil and gas development to provide $2 billion for advanced energy

220. 43 U.S.C. § 1842 (2012) (establishing the Fishermen's Contingency Fund); 30 C.F.R. § 1218.152 (2014) (administering the Fishermen's Contingency Fund).

221. OFFICE OF INSPECTOR GEN., U.S. DEP'T OF COMMERCE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION: NMFS'S FISHERMEN'S CONTINGENCY FUND SHOULD BE REEXAMINED 2 (1999), *available at* http://www.oig.doc.gov/OIGPublications/NOAA-STD-11484-08-1999.pdf.

222. Wagner, *supra* note 19, at 1624; *see id.* at 1632 ("Although it is rarely noticed, ignorance regarding the harm that private actors are causing health and the environment is just another external cost of their activities that they are able to pass on to society.").

223. *Id.* at 1744; *see also id.* at 1632, n.31 (recommending "that 'public research costs' of testing hazardous chemicals should be linked to their 'private economic origins'" (citing Lyndon, *supra* note 156, at 1799)).

research designed to reduce U.S. dependence on foreign oil.[224] Others have noted that the Energy Trust, which would use small user fees on current energy production to meet larger government research and development needs, has been successfully modeled before.[225] In particular, the national Highway Trust Fund levies "a small gas tax paid by current users of the highway system" to raise necessary funds for maintaining the current system and invest in the future infrastructure.[226] States like New York have implemented similar charges on electricity usage to generate additional funds for research and development of advanced power generation, storage, transmission, and demand-response technologies.[227]

Like the Energy Trust Fund, the Fishermen's Contingency Fund, or the Highway Trust Fund, fees collected through oil and gas leasing permits could be used to create a "Baseline Data Fund." Such a fund, and the data collected because of it, would benefit private industries as well as public entities. Industries would benefit from the research because the aim is ultimately to achieve a more complete understanding of long-term injuries. More complete knowledge would encourage viable claims while making it easier to defeat more speculative assertions of harm. Ideally, the funds would be aggregated and made available to all sectors—government and private—to advance science related to injury identification and disaster response before it happens. A competitive application process aimed at coordinated study and managed by an independent coalition of interdisciplinary scientists would further aid the efficient and non-biased allocation of the funding resources.

In sum, whether through the establishment of a baseline data fund or some other regulatory mechanism, filling the data gap regarding the baseline scientific knowledge in the marine ecosystems in the heart of oil exploration and drilling activities would alleviate some obstacles to understanding long-term harms. This knowledge would separate an entire category of scientific assessment from the grips of the litigious NRDA process. It would also result in the more efficient assessment of injuries following oil spills and provide a basis for understanding the extent of long-term harms caused by oil spills, as opposed to continuations of historic trends.

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224. Colleen Curtis, *What You Need to Know About the Energy Security Trust*, WHITE HOUSE BLOG (Mar. 15, 2013, 11:35 AM), http://www.whitehouse.gov/blog/2013/03/15/what-you-need-know-about-energy-security-trust; *see also* Andrew C. Revkin, *A Closer Look at Obama's Plan to Pay for Energy Research with Drilling Fees*, N.Y. TIMES (Mar. 19, 2013, 2:04 PM), http://dotearth.blogs.nytimes.com/2013/03/19/a-closer-look-at-obamas-plan-to-pay-for-energy-research-with-drilling-fees/.

225. Jesse Jenkins, *How Serious Are President Obama and Congressional Republicans About an Energy Security Trust Fund?*, ENERGY COLLECTIVE (Mar. 19, 2013), http://theenergycollective.com/jessejenkins/200436/how-serious-are-president-obama-and-congressional-republicans-about-energy-secur.

226. *Id.*

227. *Id.*

### B. A LONG-TERM MULTIPLIER

The creation of a baseline data fund and the coordinated collection of baseline data is one possible way of supporting NRDA science and dampening litigation noise. A second approach, the one discussed here, similarly recommends separating some NRDA science from the adversarial context. This solution, however, focuses on the particular challenges of long-term injuries.

Recall that reopeners, while theoretically promising, may simply extend the adversarial context of NRDA beyond settlement. In addition, the inherent difficulty of proving long-term injury, combined with the narrowness of some reopeners, may not provide trustees with any real opportunities for recovering damages for long-term harms. And yet, one clear benefit of reopeners is that they provide incentives to engage in the ongoing study of long-term injuries. Reopeners also provide a sense of security for trustees pursuing early settlement, which has the benefit of putting funds in the hands of trustees to begin restoration. It is with these drawbacks and benefits in my mind that the second proposed solution is crafted.

As noted, long-term injuries are notoriously difficult to prove and their study in the NRDA context creates a divisive (almost toxic) schism within the scientific literature. One way to avoid those problems would be to jettison the reopener, and instead, invoke a multiplier to settle claims for long-term injuries. Trustees, in other words, would be free to make natural resource damage claims for acute injuries, following the normal NRDA process. For long-term injuries—for example, those that are expected to extend beyond settlement or litigation—the trustees collect some percentage of the original settlement as compensation for future, unknown harms.

The magnitude of the multiplier might depend on a variety of factors—like the amount of oil spilled, the type of oil spilled, a rating of the pristineness of the ecosystem before the spill (Prince William Sound would score higher, and Gulf of Mexico lower), and the length of time between spill and settlement (longer time with less multiplier because presumably more injuries identified). At first, the multiplier might be fairly rough-cut given the nascent state of information on long-term injuries. But, over time, as understanding of long-term harms is refined, the matrix governing the multiplier would be similarly refined. Multiplier tables would begin to resemble something like actuarial tables.

Though admittedly a blunt instrument, a multiplier would avoid ongoing litigation over long-term injuries. For trustees, it avoids the problems of proving causation for harms with long-latency periods. For defendants, it allows a real opportunity for closure and provides a basis for early settlement without resort to a reopener provision.

Of course, one of the premises of this Article is that NRDA science is useful and necessary to understanding the effects of chronic toxic exposure on marine ecosystems. To the extent a multiplier removes the incentive to engage in ongoing, long-term scientific research, it may not be desirable from a knowledge-enhancing perspective. The goal here is not to jettison the science, but to create structures to free science from litigation. To best address these concerns, multipliers should be coupled with an earmarking provision—one that requires the additional funds created by the multiplier to be used for funding long-term research and restoration efforts. In this way, the multiplier is less as a penalty for unknown harms and more as an obligation to fund future research of long-term harm in the spill area.

Multipliers are not new concepts. They are used in antitrust and RICO statutes,[228] and have been proposed by scholars in other contexts to ensure that liability frameworks are properly reflecting and compensating the actual injuries likely suffered by plaintiffs.[229] To be sure, a multiplier for long-term NRDA damages is not meant to impose a form of treble or extra-compensatory damages. Rather, a multiplier would simply reflect, albeit in a crude way, the actual long-term damages resulting from oil spills.

In my own work, I have previously suggested the use of multipliers to remedy long-term ecological injuries, both because long-term injuries are more substantial than previously thought, and because long-term injuries are difficult to prove and not likely to be redressed if handled under the traditional tort framework.[230] This Article revives the notion of multipliers as a simple way of avoiding the risk of setting scientific agendas in the shadow of reopener provisions. In doing so, this Article offers an additional rationale for adopting a multiplier, provides refinements to the multiplier solution, and cautions that a multiplier should be coupled with an earmarking provision, so that long-term research is undertaken in the wake of oil spills and other toxic releases.

### C. *EXPANDING REBUTTABLE PRESUMPTIONS AND RULE 11 CERTIFICATIONS*

So far, the solutions discussed offer ways of dampening the influence of litigation by taking science outside the adversarial context. Through methods of avoidance, these solutions help legitimize NRDA science by decoupling the scientific inquiry from at least part of the litigation frame. But avoiding the influence of litigation on science is not always possible. And, if we accept that

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228. *See* 15 U.S.C. § 15(a) (2012); 18 U.S.C. § 1964(c) (2012).

229. A. Mitchell Polinsky & Steven Shavell, *Punitive Damages: An Economic Analysis*, 111 HARV. L. REV. 869, 874 (1998) ("When an injurer has a chance of escaping liability, the proper level of *total damages* to impose on him, if he is found liable, is the harm caused multiplied by the reciprocal of the probability of being found liable."); Catherine M. Sharkey, *Punitive Damages as Societal Damages*, 113 YALE L.J. 347 (2003) (urging the use of extra-compensatory societal damages as a means of achieving optimal deterrence); *see also* Ciraolo v. City of New York, 216 F.3d 236, 245 (2d. Cir. 2000) (Calabresi, J., concurring) (recognizing that a multiplier concept of punitive damages is "not new"). *See generally* Anthony J. Sebok, *Deterrence or Disgorgement?: Reading* Ciraolo *After* Campbell, 64 MD. L. REV. 541 (2005) (assembling literature on proposals for multipliers).

230. Knudsen, *supra* note 22, at 496–99; Knudsen, *supra* note 173, at 125–27.

adversarial science is no more prone to abuse than other forms of regulatory science, or if we agree that adversarial science is an important informational asset, then devising solutions that simply avoid adversarial science may not be desired or necessary.

Because the goal is to increase the quality of adversarial science and neutralize perceptions of bias, solutions that use litigation controls to directly address legitimacy concerns should also be considered. In particular, such solutions would provide direct structural reform by developing procedures that address the issues of transparency or manufactured uncertainty described in Part III. At least two possibilities come to mind—expanding the use of rebuttable presumptions and tailoring Rule 11 certifications to science.

In the NRDA process, rebuttable presumptions already exist. The OPA regulations give a rebuttable presumption of validity to any damage assessment made by government trustees that is prepared in accordance with procedures set out in the regulations.[231] To address the problems of transparency and asymmetry identified in Part III.C, regulators could expand this already existing presumption to private science. Namely, they could make a rebuttable presumption of credibility available to privately-funded science if the funding party—usually the corporate defendant or other potentially responsible party ("PRP")—makes certain disclosures and certifications. Conversely, a presumption against validity might be imposed absent such a disclosure statement. For example, the funding party might be required to certify that the complete portfolio of relevant science undertaken in response to the incident has been released. The use of a presumption to encourage full disclosure even absent formal discovery would help address problems associated with the selective release of scientific studies that exclusively support the PRP's litigation position. The broader body of science emerging from the NRDA process would benefit from the full range of information undertaken in response to the toxic release.

To be perfectly symmetrical, a similar disclosure statement should also be required of government-funded science, though there are at least public information laws like the Freedom of Information Act[232] that make public disclosure of government science less problematic.[233] Nonetheless, in the

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231. *See* 15 C.F.R. § 990.13 (2014) ("Any determination or assessment of damages to natural resources made by a Federal, State, or Indian trustee in accordance with this part shall have the force and effect of a rebuttable presumption.").

232. 5 U.S.C. § 552 (2012).

233. For more information on the availability of government-funded science through public disclosure laws, see ERIC A. FISCHER, CONG. RESEARCH SERV., R42983, PUBLIC ACCESS TO DATA FROM FEDERALLY FUNDED RESEARCH: PROVISIONS IN OMB CIRCULAR A-110 (2013). According to the Congressional Research Service Report on government-funded science: "Before 1999, academic and nonprofit performers of such research were permitted but not required to make their data available to the public through provisions of the Freedom of Information Act .... In October 1998, a provision in P.L. 105-277 changed that, requiring that such data be made publicly available." *Id.* at 1. The particular litigation context of NRDA proceedings may alter the

adversarial context, given the goal of decreasing perceptions of bias and self-interest, applying disclosure requirements to both parties would be advisable. In this way, the presumption and disclosure proposed here would resemble Federal Rule of Civil Procedure 26(a). Ultimately, the goal is to create incentives of transparency, which aids scientific discovery.[234]

One can imagine complementary requirements as well. For example, for any science withheld from the disclosure process, perhaps for reasons that the studies are incomplete or have not produced credible results, could be listed on a science log much in the same way that the Federal Rules of Civil Procedure require litigating parties to produce privilege logs detailing discovery documents that have been withheld for reasons of attorney–client privilege or the work product doctrine.[235]

Rebuttable presumptions, of course, might also be used in other creative ways, not limited to issues of disclosure. For example, presumptions of validity could attach to scientific studies submitted for third-party peer review. Again, this type of presumption might attach to both government-funded and privately-funded science. This type of presumption would track the *Daubert* factors applied to expert scientific testimony proferred at trial.[236]

In addition to rebuttable presumptions, there are other litigation controls that could clarify the science that emerges from adversarial contexts. Rule 11 certifications and sanctions, for example, might be expanded or tailored to address issues of adversarial science. Consider the incentives that defendants have to generate uncertainty on scientific issues—the greater the perceived uncertainty, the less likely the injured party is able to prove their claims. As described in Part III.C, these incentives to generate uncertainty can unnecessarily lead to confusion in the scientific literature and result in damaging personal attacks on the credibility of scientists. Of course, one of the tenets of scientific discovery is questioning existing discourse on matters of health, biology, and ecology. The ability to question science in the pursuit of truth should undoubtedly be safeguarded. At the same time, attacks on science for political or litigious gain are damaging to the pursuit of knowledge and ought to be discouraged.

In the litigation context, unwanted and damaging behaviors can be discouraged through the threat of sanctions. Rule 11 of the Federal Rules of Civil Procedure discourages frivolous litigation and unduly oppressive litigation tactics by requiring attorneys to certify that any motions or pleadings

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requirements. In the NRDA context, not all science may be obtainable through FOIA requests if the government trustees chose to invoke a FOIA exemption for "information compiled for law enforcement purposes," the disclosure of which "could reasonably be expected to interfere with enforcement proceedings." 5 U.S.C. § 552(b)(7).

234. *See supra* notes 58–63 and accompanying text.

235. FED. R. CIV. P. 26(b)(5)(A).

236. *See* Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 593–94 (1993).

presented to the court are not advanced for an "improper purpose."[237] Attorneys further certify that their "factual contentions have evidentiary support."[238] By certifying their written papers, attorneys and their clients are subject to sanctions for advancing unfounded certifications.[239]

While these general certifications would certainly cover factual contentions rooted in science, it is worth considering whether a rule expanded or tailored specifically to science could prove useful. In particular, consider that the perception of bias in adversarial science can undermine its usefulness outside the courtroom. To that end, litigation controls that are particularly aimed at holding scientists to a type of fiduciary duty might be useful in neutralizing perceptions of bias. One might imagine the expansion of penalties for unfounded attacks on science or particular Rule 11-like certifications for arguments attacking scientific veracity. One could also imagine particular certifications to accompany affidavits, declarations, or expert testimony offered by scientists—reminding these experts of their primary role as scientists, not advocates.

Given that science produced or attacked in the courtroom could have ramifications for scientific understanding outside the courtroom, we might even hold lawyers or scientists to a greater degree of accountability when certifying that science created or questioned in the litigation context is being done so in good faith. In other words, in the realm of science, we might wish to extend that expectation to be clear that scientific claims and attacks on science are more than simply nonfrivolous—they are well-founded. An obvious downside to these certifications or targeted sanctions would be a chilling effect. Nonetheless, the idea would simply be to give added weight to the already existing expectation that factual arguments are nonfrivolous.

## VI. CONCLUSION

Adversarial science conjures images of bias, agenda-driven outcomes, and the funding effect. And though adversarial science may not be more prone to manipulation than other forms of policy-relevant science, it bears a special branding and evokes a particular skepticism by scholars and courts. But it does not have to be this way.

With the right support, adversarial science can be embraced. Indeed it needs to be embraced, at least so long as existing regulatory regimes systematically fail to study long-term toxic exposure. For some toxic releases, like oil spills, the NRDA process offers a unique and important chance to study ecosystems and long-term impacts of toxic exposure. Casting NRDA science aside simply because of its adversarial origins, therefore, would be a mistake.

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237. FED. R. CIV. P. 11(b)(1).

238. *Id.* R. 11(b)(3).

239. *Id.* R. 11(c).

While this Article examines the nuances of adversarial science in the NRDA context, the opportunities of adversarial science go beyond NRDA. In any area where adversarial science fills an informational void, that science has the potential to inform public policy outside the narrow confines of the courtroom. The utility of adversarial science, however, depends on whether the science is perceived as legitimate. If the science is laden with bias, or even if it is assumed to be unreliable, opportunities for learning will be missed.

Fortunately, adversarial science, more so than other forms of policy-relevant science, exists within a tightly-controlled structure and amidst evidentiary and discovery rules designed to achieve just outcomes. In this way, legitimizing adversarial science may be an easier task than regulating policy-relevant science in the regulatory context. Discovery tools, for instance, can smooth transparency problems between private science and government science. In addition, cross-examination or active engagement of scientific issues through briefing provides a confrontational form of peer review that the academic or regulatory process does not.

If used in the right way, these and other litigation tools can be used to harness the promise of adversarial science. For instance, courts might consider allowing rebuttable presumptions in favor of reliability if a party certifies that all relevant science has been released, or if a party conducts its studies using methods that reduce bias, like double-blind studies and funding. In this way, the use of traditional litigation controls like presumptions could especially help smooth out imbalances in transparency between government-funded and privately-funded science. Uniformly imposing these kinds of procedural controls would be possible through amendments to rules of evidence. For NRDA or other statutory causes of action, agency regulations can also impose controls.

Whether or not the ideas explored in this Article lead to reform in the courtroom, the rules of evidence, or NRDA regulations, the issues this Article raises certainly have implications for the ongoing NRDA process in the wake of the *Deepwater Horizon* oil spill. For government trustees, the exploration of reopener provisions in this Article ought to influence how the trustees structure settlements for long-term injuries and whether they choose to include a reopener provision. In addition, this Article's demonstration of funding effect and other conflicts of interest in NRDA science ought to encourage BP and other private parties to self-impose structural tools, like voluntary disclosure, to overcome perceptions of bias. If these perceptions can be overcome, the credibility of the science will be strengthened and lawyers can better leverage it to influence the settlement process.