

USE OF NON-MARKET VALUATION METHODS IN THE COURTROOM: RECENT AFFIRMATIVE PRECEDENTS IN NATURAL RESOURCE DAMAGE ASSESSMENTS

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INTRODUCTION

In the past two decades, the U.S. Congress has passed several major environmental statutes containing liability provisions that affirm and enhance common law principles of liability for injuries to public natural resources. One set of these statutes, including CERCLA (Superfund) and the Oil Pollution Act (OPA), focuses on oil and hazardous spills or long-term discharges and establishes prevention and response policies, in addition to the restoration and compensation requirements in the liability provisions. Another set, including the National Marine Sanctuary Act and the Park System Resource Act, establishes protected areas for special resources and mandates the development of resource management plans, which are complemented by liability provisions for injuries to the protected resources from any source.

These statutory liability provisions surmount the historical restrictions in the common law on who has standing to recover for damages to public natural resources, and on the types of damages that may be claimed. In particular, federal and state resource management agencies and tribal authorities are designated as trustees for the natural resources on behalf of the public, and are granted the authority to recover damages from responsible parties. Further, the statutes extend the measure of damages beyond strictly financial losses (an extremely limited concept for natural resources in the public domain): the measure of damages is defined as the cost of restoring the resources to baseline conditions plus the interim loss in value from the time of the incident until full recovery. Affirming the resource protection goals of the legislation, Congress mandated that trustees spend all recoveries on restoring or acquiring equivalent natural resources.

Although statutory authorities existed prior to the 1989 Exxon Valdez oil spill, the 11-million gallon spill in Alaska's pristine Prince William Sound was a signal event in the development of trustee natural resource

damage assessment (NRDA) programs. In the years following the Exxon Valdez oil spill, NRDA has been on the frontier of the use of natural resource valuation methods in litigation. The prospect of extensive use of non-market methods in NRDA generated extensive controversy, particularly among potentially responsible parties. The controversy has two facets – one pertains to the scope of the interim lost value component of the measure of damages, and the second pertains to the methods used to calculate damages.

The regulations promulgated to implement NRDA clearly define the measure of damages to include total lost value due to the injuries, including both direct use and passive use value. Direct use values may derive, for example, from recreational, commercial, cultural or historical, or other uses of resources; passive use values may derive from protecting a resource for its own sake (or for human uses that are difficult to quantify, such as critical life support functions), from use of the resource by others, or as a bequest to future generations.

The regulations also identify a non-exclusive list of valuation methods that may be used, including both revealed preference methods and stated preference methods. Economists calculate values from “revealed preference” studies, based on the assumption that an individual's preferences can be inferred from his actual behavior. Demand and supply estimates based on actual prices and sales data for marketed resources, such as water, timber, or fish, are examples of revealed preference methods. Analogous demand functions can be derived for non-market goods and services, such as the recreational use of resources (travel cost models) or the subsistence use of resources (hedonic models), by considering the opportunity costs individuals are willing to incur to obtain such services. In contrast, economists calculate values from stated preference studies, such as contingent valuation, based on the assumption that an individual's preferences can be inferred from statements about choices they would make among alternative

scenarios offered in a survey, where the scenarios describe a good or service and the context in which it will be provided, including price and method of payment. Stated preference methods are much more flexible than revealed preference methods, because the good does not have to be currently available; consequently, they can be used to calculate the total value (including direct use and passive use value) of goods. They also can be used to value changes in the quality or quantity of resources that are outside the range of current observation.¹²

In the years following the Exxon Valdez spill, industry has spent substantial resources challenging the inclusion of passive use value in the measure of damages, and the use of contingent valuation to measure it in the NRDA regulations implementing CERCLA and OPA. (See Hanemann, 1994, and Diamond and Hausman, 1994, for differing viewpoints on the reliability of contingent valuation.) In the last two years, however, the courts have affirmed several important precedents. In the recent challenges to the NRDA regulations, the District of Columbia Circuit Court, citing its decision on a prior regulatory challenge, has reaffirmed the legitimacy of recoveries for passive use value, and the potential trustworthiness of non-market valuation methods in general, and of contingent valuation in particular. In addition, NOAA was a party to three recent NRDA claims for damages that were litigated to conclusion in the last two years. (To my knowledge, no other NRDA cases were litigated to conclusion in 1997.) In all cases, the state or federal courts admitted economic studies and relied upon them in the determination of damages. Given the relatively small size of the claims, trustees did not perform site-specific valuation studies in any of the cases – simplified methods were used for reasons of cost-effectiveness.

In this paper I review the evolution of the controversy about the use of resource valuation methods in the development of the NRDA regulations, outline the affirmative precedents set forth in the DC Circuit cases, and discuss the findings in the individual NRDA claims. First, however, I briefly explore the elements of the US legal paradigm that contribute to the controversy over the use of welfare-theoretic measures of losses for non-market goods and of the valuation methods suitable for measuring them. Though the controversy about the validity and reliability of contingent valuation has generally dominated much of the discussion, I suggest below that the origin of the controversy is more deeply rooted in traditional legal concepts of damages and of evidentiary standards.

THE CONTROVERSY OVER THE MEASURE OF DAMAGES AND RESOURCE VALUATION METHODS: INSTITUTIONAL ORIGINS IN THE LAW

From an economist's perspective, the parties responsible for accidents should bear their full social costs, in order to provide adequate incentives to take precautions to prevent harm (Shavell, 1987). Full social costs include not only the cost of restoration or replacement (assuming costs are reasonably commensurate with the gains) but also compensation for all social losses incurred by individual members of the public from the time of the injury until full recovery of the resources. The interim loss measure would include the reduction in producer or consumer surplus for markets in which the change in environmental quality directly affects technology or appears directly in the utility function (Johansson, 1993).³ Producer surplus (or profit) refers to the excess income received by a firm above what it costs to produce a good; consumer surplus is the consumer analog to profits: it is the additional value received by consumers above what it costs them to acquire a good.

However, a fundamental culture clash exists between modern economic analysis and the historical legal concepts of who has standing to claim for damages, and of how to measure damages. In addition, though evidentiary standards have evolved to admit surveys and statistical models into the courtroom, pioneering their use in new areas of application remains a difficult process.

As noted above, the first element of the culture clash is that claims for damages to public natural resources historically required physical injuries to a private property interest. Consequently, if a spill contaminated a shoreline causing injury to an aquaculture facility as well as to a recreational fishery, the fish farmers could make claims for lost profits, but no one had standing to claim for injuries to the recreational anglers who were harmed.

Second, the fundamental component of damages has been financial losses, such as property losses, profit or wage losses, or (in some cases) replacement costs. Limiting recoveries to financial losses excluded a major portion of social losses, particularly for the context of public natural resources. First, natural resources generally are not privately owned but rather are in the public domain – and so are not typically bought and sold on markets. Consequently if an oil spill closed all the beaches in an urban area for several weeks, the individuals who would have visited those beaches during the closure period may not have incurred a *financial* loss – but most people would agree that they did incur a *real* loss.

A more basic problem with limiting damages to financial losses is also more subtle and complex. Financial loss is calculated as the change in price for a fixed quantity of goods and services – it cannot address the loss to consumers when large quantities of any good or service are lost or destroyed. For example, with the Exxon Valdez oil spill, important salmon fisheries supplying a large share of consumer markets on the Pacific Coast and in Japan were closed for most of a season and the retail price of canned salmon was substantially higher than it would have been without the spill. The concept of “financial loss” does not capture the losses borne by consumers who reduced their consumption or who dropped out of the market entirely because of the price increase. It follows that public claims by resource trustees on behalf of the public seeking compensation for consumer surplus losses are analogous to private claims by producers seeking compensation for lost profit.

However, the law has historically demonstrated limited recognition of the concepts of opportunity costs or revealed preferences, concepts that are fundamental to the measurement of value (or social costs) in modern economics. As a result, there are limited damage concepts in the law coincident with the economic concept of consumer surplus losses. One such coincident damage concept would be claims for an excess cost burden due to non-competitive practices (and consequently non-competitive prices). However, the claimants generally do not identify them as ‘consumer surplus’ losses; and the claims are generally not for losses borne by consumers who reduced their consumption or who dropped out of the market entirely because of the price increase (Finkelstein and Levenbach, 1983; Rubinfeld and Steiner, 1985).

Another damage construct that overlaps with consumer surplus is “pain and suffering.” Though only allowed in some types of claims, such as for wrongful death and personal injury, it can be a significant portion of the award where allowed. Pain and suffering appears to be a fairly elastic construct that may include, along with pain from physical injuries, pain from emotional distress due to loss enjoyment of life (“hedonic injury”), or loss of love and companionship. It is noteworthy, however, that a current treatise on legal remedies suggests that pain and suffering is generally construed to be an incommensurable value, for which there is almost no standard for measurement or even a conception of those damages or what they represent (Dobbs, 1993). Legal scholars have identified the analogy between the legal concept of pain and suffering and the economic concept of passive use losses (Dobbins, 1994). However, passive use loss is only one component of consumer surplus losses not captured by financial loss concept.

Other institutional factors, reinforcing the difficulties with non-market valuation, are the traditional evidentiary concepts that discriminate against evidence not based on direct observation, as “hearsay.” The judicial process for evaluating evidence, however, has built-in safeguards. Consideration of evidence is a two-step process in the courts. First a court must determine whether the evidence is suitable for presentation in the court. (We briefly note below how the criteria for making this determination of “admissibility” have evolved through time.) Once evidence is admitted, the trier of fact, which may be a judge or jury, must evaluate the evidence to determine how much weight to accord it in deliberations.

Beyond the second-hand nature of survey evidence, the legal paradigm is uncomfortable with statistical analysis of data to make inferences about causation or to project to future events based on past experiences, and with the inherent uncertainty in statistical analysis. As a result, there is an attitude of skepticism toward surveys and models.

Notwithstanding these issues, opinion polls and surveys have been admitted since the 1960s (*Zippo, 1963*), and are now standard operating procedure in trademark and false advertising lawsuits. And statistical analysis of survey data is regularly employed, particularly in race and sex discrimination and antitrust cases. (Fienberg, 1991; Rubinfeld, 1985) Yet, it is jarring to economists that these methods are admitted under the ‘necessity’ exception to the hearsay rule. And the reference to surveys as the “black arts” by Judge Richard A. Posner, a prominent law and economics theorist and judge for the 7th U.S. Circuit Court of Appeals, suggests a skepticism of such methods, even among judges with a sophisticated appreciation of social science

The Federal Rules of Evidence, set forth in 1976, moved beyond the hearsay construct to develop an alternative basis for admissibility of evidence. Rules 702 and 703, pertaining to the qualification of experts and the evidence they may offer, focus more on the validity of the techniques employed than on whether the information was directly observed. In the 1993 decision in *Daubert*, the U.S. Supreme Court affirmed the current two-prong test for admissibility of “novel scientific evidence” of scientific *reliability* (in the sense of trustworthiness) and *relevance* outlined in the Federal Rules of Evidence, overturning the longstanding “Frye” criterion that evidence had to be “generally acceptable” within the scientific community. The opinion offered the following criteria for evaluating reliability: has the theory or technique been subject to peer review or publication? do standards exist for the technique? has the method or

technique achieved a *particular degree of acceptance* within the relevant community?

Important precedents for the admissibility of contingent valuation, a technique that has definitely generated its share of controversy within the economics profession, were established in a subsequent case examining the meaning of a “particular degree of acceptance” (Kopp and Pease, 1997). In the context of a challenge to DNA tests, *U.S. v. Chiscilly* (1994) upheld the admissibility of the tests, concluding that “evidence of opposing academic camps arrayed in virtual scholarly equipoise is scarcely an indication of ‘minimal support within a community’ that would give a trial court cause to view a known technique with skepticism under Daubert...” (Daily App.Rept. 10316, 10321 9th Cir. July 25, 1994). The court further asserted that vigorous cross examination, presentation of contrary evidence and careful instruction of the jury on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence - not exclusion.

As noted earlier, litigation experience with resource valuation methods has been limited. Experience with common law litigation, however, reinforces the idea that there are deeper issues imbedded in the controversy over non-market methods than the reliability of contingent valuation. For example, several courts have rejected hedonic valuation methods – a revealed preference approach.⁴ In some cases, the rejection has been on grounds that the method is unreliable; in other cases, the rejection has been on the grounds that the methods are measuring “non-economic” losses, for which the specific law invoked does not provide a remedy.

A case in point is the native claim for lost subsistence harvests from the Exxon Valdez oil spill (a private cause of action independent from the trustee suit). Both plaintiff and defendant experts proposed using hedonic valuation, in which the value of subsistence harvests was revealed by the opportunity costs of foregone (paid) employment opportunities. Yet, the court rejected use of the method for valuing subsistence harvests on the grounds that it would capture ‘non-economic’ claims for injuries to the subsistence way of life; it restricted the analysis to the replacement cost of harvest on the grounds that it calculated the “economic” value of the losses (Duffield, 1997; *Exxon Valdez*, 1994, Order no. 90 at 2). [Note that the court is using the terms “economic” and “non-economic” losses to distinguish between financial and non-financial losses – both *are* economic in nature.]

NRDA RULE MAKING: THE CONTROVERSIES AND THEIR RESOLUTION (TO DATE)

The historical legal constructs limiting who has standing to bring suit, how damages are measured, and what types of studies may be admitted have been addressed by the statutes and their implementing regulations. Though the provisions for trustee standing do not appear controversial, aspects of the other two issues have been litigated over the last 10 years; in those cases, the D.C. Circuit Court has upheld a broad interpretation of the issues.

The 1977 provisions of the Clean Water Act established natural resource trustee authority to make claims for oil spills. The passage of CERCLA in 1980 subsequently established trustee authority to make claims for hazardous waste discharges. It also explicitly provided that the Executive Branch promulgate regulations to provide guidance to trustees in preparing claims under CERCLA (which would also apply to actions brought under the Clean Water Act.) The U.S. Department of the Interior, the agency to whom the authority was delegated, promulgated regulations in 1986 and 1987, and subsequently revised them in 1994 to respond to issues remanded to the agency by the court order for the suit challenging the regulations, *Ohio v U.S. Department of the Interior* (1989). In 1990, 17 months after the Exxon Valdez oil spill, Congress passed the Oil Pollution Act, which largely superceded the authorities previously specified in the Clean Water Act and other statutes. This time, Congress delegated the authority to write the implementing NRDA regulations to NOAA, which promulgated them on January 5, 1996.

The DC Circuit Court established important precedents regarding the measure of damages and the use of non-market valuation methods in the litigation over the original DOI rules (*Ohio*, 1989), and reaffirmed the precedents in the *GE* (1996) (for the NOAA rules) and *Kennecott* (1997) (the DOI rules) decisions. The DC Circuit Court opinions strongly affirm that: (1) the measure of damages is the cost of restoration of the injured resources plus compensation for lost direct use and passive use value; (2) trustees are not limited to methods specifically identified in the regulations, and do not need to provide detailed standards for the use of specific methods; and (3) contingent valuation may be reliable for measuring passive use value. The current approach in the OPA regulations, in particular, relies heavily on a case-by-case evaluation of the reliability and validity of specific studies applying natural and social scientific methods.

Original CERCLA regulations, and the Ohio opinion

Since the CERCLA regulations and the 1989 *Ohio* decision have been widely discussed, I review them only briefly here. (See Kopp and Smith, 1993 for more details.) *Ohio* affirmed a substantial portion of the original regulations promulgated by DOI, while overturning some of the more restrictive provisions pertaining to the measure of damages and the use of resource valuation methods. Specifically it rejected the provision that the measure of damages be the lesser of restoration costs or interim lost value, on the grounds that it was directly contrary to the clearly expressed intent of Congress to promote restoration. The court also rejected a hierarchy of resource valuation methods, in which contingent valuation was only to be used to measure passive use value if there were no direct use value: it found that contingent valuation is a “best available procedure” suitable for inclusion in the damage assessment regulations.

OPA regulations, and the post-Exxon Valdez controversy over CV

Much of the post-Exxon Valdez controversy about the use of non-market valuation for NRDA has played out in the context of NOAA promulgating regulations for the Oil Pollution Act of 1990. (Currently it continues to play out in the ongoing CERCLA reauthorization process.) To get an expert, non-adversarial perspective on the question of the reliability of the use of contingent valuation to measure total value (direct plus passive use value), NOAA commissioned in 1992 a Blue Ribbon panel of economics and survey research experts, chaired by two Nobel laureates, Kenneth Arrow and Robert Solow. The panel received hundreds of pages of comments and conducted a public hearing. In its report to NOAA (Arrow *et al*, 1993), the panel concluded that, if properly conducted under strict guidelines, contingent valuation “can convey useful and reliable information that can produce estimates reliable enough to be the starting point of a judicial process of damage assessment.” The Panel offered a variety of procedures to be employed to increase the reliability of the estimates.

The first NOAA proposed regulation included a series of detailed requirements for CV *only* – for no other method from the social or natural sciences were specific requirements identified in the proposed regulations. NOAA received more than 5,000 pages of comments on the proposal, with about half of the pages pertaining to contingent valuation. Several of the comments received, mainly from industry viewpoints, agreed with the concept of including the proposed guidelines, or even stricter

ones, within the regulatory language. However, the majority of comments from states, environmental organizations, and the U.S. Environmental Protection Agency, argued that including such guidelines would be too restrictive and inflexible.

In the context of the wide-ranging public debate that continued after the first proposal, NOAA re-framed the interim lost value component from a monetary compensation measure (*how much money does the public require to make them whole?*) to a resource compensation measure (*how much compensatory restoration does the public require to make them whole?*) This change was motivated in part by the statutory restriction that trustees may spend their recoveries *only* on enhancing or creating (“restoring, rehabilitating, replacing or acquiring the equivalent of”) natural resources. The alternative measure of damages for the interim loss of resources becomes the cost of “compensatory restoration” actions providing resource-based compensation of a sufficient quality and quantity to make the public whole for the interim losses. (Jones and Pease, 1997.) The trustee claim then takes the form of a Restoration Plan to restore resources to baseline and to compensate for the interim loss of resources, and the measure of damages is the cost of implementing the Plan.

Further, the final NOAA regulations provide a predictable procedural framework containing numerous required analyses and determinations, with identified factors to consider, as well as an open administrative record and public comment periods. Additional limits on trustee discretion are provided by the encouragement for trustees to involve responsible parties in *cooperative* studies as a basis for the restoration plan that serves as the basis for damages.

The reframing of the damage claim brings some advantages. By recovering the costs of compensatory restoration actions (costs of resource compensation) rather than the value of the interim losses (monetary compensation), the revised format avoids circumstances in which not enough money is collected to implement sufficient compensatory restoration to make the public whole. Further, for a variety of reasons, it deflects some of the public controversy about economic methods. For one, damages to be collected from the responsible parties are the costs of restoration, not the monetized value of interim losses. Further, in some cases it may not be necessary to conduct valuation studies to determine the appropriate scale of compensatory restoration: an in-kind compensation approach may be feasible when trustees determine that the value of resource services lost and resource services gained are comparable. (Definition of

the units of services becomes critical.) The judgements necessary to determine equivalency per unit of services are analogous to those required to conduct benefits transfers, or to implement environmental trading programs for wetland banking and sulfur dioxide emissions trading. And finally, in cases where valuation studies are conducted, the requirements for precision may be less demanding: selecting the appropriate scale of compensatory restoration actions generally requires precision only up to the ratio of lost value from injuries to gains in value from resource projects, rather than precision in the absolute dollar amounts of lost value (as required for calculating monetary compensation.)

The Appendix to the preamble of the NOAA regulations identifies a list of methods for calculating damages in different circumstances, including the simplified methods (not requiring site-specific economic studies), that are applicable when compensation is occurring in the form of in-kind restoration. The list is non-exclusive – trustees may use other methods as long as they meet the requirements in section 990.27, which specifies that: (1) the procedure must be capable of providing assessment information of use in determining the type and scale of restoration appropriate for a particular injury; (2) the additional cost of a more complex procedure must be reasonably related to the expected increase in the quantity and/or quality of relevant information provided by the more complex procedure; and (3) the procedure must be reliable and valid for the particular incident.

1997, 1996 DC Circuit opinions on the challenges to the 1996 OPA, and 1994 CERCLA regulations

The NOAA approach, which has found some support in the responsible party community, was recently upheld by the DC Circuit Court (in the challenge filed nonetheless by industry). Again, the challenges to the use of economics included in the suit pertained to recoveries for passive use value and to the use of CV. The court upheld the agency regulations on all counts pertaining to economic issues.

Specifically, the court reaffirmed that Congress clearly intended to authorize trustees to recover passive use values. Regarding the challenge to claims for passive use value for temporary losses, the court ruled that that issue will only be ripe for review if and when a trustee assesses the damages for temporary losses in a particular case; however, it noted that the administrative record “lends support to NOAA’s contention that temporary losses can cause loss of passive use values...”

In terms of the use of contingent valuation, the Court rejected the plaintiff’s arguments that NOAA should have

barred the use of CV, on the grounds that there was nothing in the record, including the Panel report, that upholds industry’s attack that CV can never be used reliably. The Court held that *Ohio*, as well as the Panel report, are authority for the proposition that CV can produce useful and reliable results. The Court also rejected the plaintiffs’ fall-back challenge – that if CV were not to be excluded entirely, NOAA should include in the regulations the Panel’s recommendations of procedures for use of CV. The Court determined that prescribing standards for using all possible procedures in all possible situations was infeasible and that the general standards for acceptable procedures in section 990.27 can adequately ensure that the trustees do not abuse their discretion.

In a related prior opinion for the challenge to the 1994 CERCLA regulations promulgated by DOI (*Kennebec*, 1996), the Court examined whether allowing trustees to use unlisted cost-estimating and economic methodologies gave trustees too much discretion, in violation of CERCLA’s requirement that the NRDA regulations establish “protocols” for conducting assessments. The court concluded that the provision satisfied CERCLA by providing a standard process, including substantive criteria that trustees must satisfy before using unlisted methodologies and procedural requirements, to constrain use of inappropriate methodologies.

CASE-SPECIFIC LITIGATION: 1997 SUCCESSES

As discussed above, the OPA regulations establish criteria for demonstrating that methods are appropriate for a particular case. In contrast to cases filed challenging executive agency regulations, most individual civil actions settle before trial (since the costs of litigation generally are very high, and may exceed the perceived benefits). As a consequence, it is difficult to establish precedents.

However, with the evolution of statutory and regulatory damage measures that include utility-theoretic concepts of consumer surplus losses, we are beginning to see that as NRDA cases are litigated, the courts are admitting non-market valuation methods in these cases, paralleling the acceptance over the last few decades of market valuation methods to value financial losses. Below we report on the three NRDA cases litigated by NOAA in 1996 and 1997, in which the courts admitted resource valuation studies and found RPs liable for damages.

In December 1997 a jury awarded \$12.8 million in damages (and \$5.3 million in penalties) for injuries from a 400,000 gallon oil spill that closed a 14-mile stretch of southern California beaches around Huntington Beach in

1990 (*State of California v. American Trading Transportation Co.*, 1997). The spill closed portions of the beaches and surrounding waterways for up to 5 weeks, impeding local access to beach recreation (including surfing), boating, and wildlife/bird viewing for residents of Orange County and southern Los Angeles County.⁵

To estimate the interim lost value of oiled beach resources, the trustees chose to use benefits transfer in conjunction with a site-specific trip prediction model,⁶ in the expectation that the case would be settled against all defendants and to reduce assessment costs. (Because the spill occurred so long ago, the analysis pre-dated the NOAA regulations and employed a monetary compensation measure of damages.) For beach recreation the existence of daily aggregate beach attendance data made it possible to perform an analysis of both what recreational attendance was after the spill and what it most likely would have been if the spill had not occurred. The recreation-day values employed in the damage calculations for general beach recreation, surfing, and boating were based on taking a conservative point estimate from the range generated by a variety of beach, boating and surfing recreation studies. (Hanemann, 1997)

In July 1997, the U.S. District Court, So. District of Florida (Key West Division) awarded \$589,311 in damages for the destruction of 1.6 acres of seagrass during 1992 treasure hunting activities in the Florida Keys National Marine Sanctuary (*U.S. v. Melvin A. Fisher*, 1997). Because the site of the injury is swept by high-energy waves that keep bare sand areas in motion, natural re-colonization and recovery is expected to take between 50-100 years and pilot projects to restore seagrass in the zone of destruction were unsuccessful. Consequently NOAA, the trustee for national marine sanctuaries, proposed an off-site restoration project and employed the method of habitat equivalency analysis to determine the size of the restoration project necessary to compensate for the acre-years of lost services (Julius, 1997). Habitat equivalency analysis is a simplified approach suitable when the compensatory restoration is in-kind and the trustees make the judgment that the lost resources and services are equivalent on a per unit basis to the resources and services to be gained from the restoration projects. Under these assumptions, the determination of the appropriate scale of the restoration project simplifies to selecting the scale of a restoration action for which the present discounted quantity of replacement services equals the present discounted quantity of services lost due to the injury. [For more details, see NOAA, 1997].

In addition, in December 1995 the same court awarded \$1,873,741 in damages for the destruction of coral reef habitat in the Florida Keys National Marine Sanctuary, when the defendants did not respond to the trustee claim (*U.S. v. M/V Miss Beholden*, 1995). In this prior case, NOAA also employed habitat equivalency analysis to scale a compensatory restoration project that would restore injured framework and structure and transfer corals to expedite recovery and for compensatory projects, create coral reef habitat using reef modules and transplantation. The court concurred with NOAA that "HEA is the most technically appropriate and cost-effective method to quantify the natural resource damage" (*U.S. v. M/V Miss Beholden*, 1995, p. 10) and awarded damages in the amount calculated by the experts.

POSTSCRIPT

The recent case history litigating the NRDA regulations strongly affirms the statutory basis for a measure of damages that incorporates the full social costs of environmental accidents and for the use of reliable and valid natural resource valuation methods to calculate them. The critical litigation forum now becomes the trial courts in which the individual claims are filed, if resolution cannot be achieved otherwise. As individual NRDA claims have begun to be litigated, the courts are admitting non-market valuation methods in these cases, paralleling the acceptance over the last few decades of market valuation methods to value financial losses.

The three recent NRDA cases described above are fairly typical of the trustee caseload, both in the small-to-medium size of the injuries and the use of simplified methods of analysis. (Nonetheless, it seems that the Exxon Valdez oil spill still forms the basis for many parties' concept of NRDA.) In these three cases, the court found the simplified methods to be reliable and valid for the specific contexts. In contrast, a small percentage of trustee cases have potentially very large damages; trustees generally expect those cases to be sufficiently controversial (and to be very aggressively defended by the responsible parties) that they conduct site-specific valuation studies. None of the very large cases has been litigated to date—it will be most interesting to see how the courts will address the issues of admissibility and reliability in these cases. See Helton, *et al.*, (1997) for an overview of oil spill cases that have been resolved to date.

Having failed to achieve judicial prohibition on the use of contingent valuation (and the expected attendant reduction in potential claim costs), industry is continuing to lobby the U.S. Congress to revise the statutes to

prohibit claims for passive use value and to prohibit the use of contingent valuation. Such revisions would represent a turning back to a limited damage measure for injuries to natural resources, and a consequent reduction in environmental protection. It would also mark a retreat from the principles that vigorous cross examination, presentation of contrary evidence and careful instruction of the jury on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence - not exclusion.

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Daubert v. Merrell Dow Pharmaceuticals, 113 S.Ct. 2786. (1993)

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G.E. v. U.S. Department of Commerce, NOAA, No. 96-1096 (D.C. Circuit, November 18, 1997).

Indiana Colts, Inc. v. Metropolitan Baltimore Football Club L.P., No. 94-2578, (7th Cir., 1994).

Kennecott Utah Copper Corp. v. U.S. Department of Interior, 88 F.3d 1197 (D.C. Circuit, 1996).

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U.S. v. M/V Miss Beholden, 93-10024-CIV, (D.S.D. FL, Dec. 1, 1995).

Ohio v. U.S. Department of Interior, 880 F.2d 432, 443 (D.C. Circuit, 1989).

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Zippo Manufacturing Company v. Rogers Imports, Inc., 216 F.Supp. 670 (S.D.N.Y., 1963).

Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601-9675.

Federal Water Pollution Control Act (*or* Clean Water Act), 33 U.S.C. §§1251-1376.

Oil Pollution Act, 33 U.S.C. §§2701-2761.

National Marine Sanctuaries Act, 16 U.S.C. §§1431-1445.

Park System Resource Protection Act, 16 U.S.C. §19jj.

ENDNOTES

1. For example, since all Great Lakes fisheries have fish consumption advisories, these methods can be used to value clean-up of contaminants sufficient to allow removal of the advisories, whereas revealed preference methods cannot.
2. In other words, the measure of social costs would not include surplus changes in markets where losses were simply attributable to price changes, since for every price increase there are gainers (sellers) and losers (buyers)– and the effects essentially may cancel out. (Johansson, 1993)
3. The hedonic price model relates the price of a marketed commodity to its various attributes. In the natural resource damage assessment context, it may be used to determine the change in value of some nonmarket services from public trust natural resources (for example, environmental amenities such as water or air quality) where they function as attributes of private market goods, such as property. For example, the value of beach front property may be directly related to the quality and accessibility of the adjacent coastline.
4. Other defendants had previously settled their natural resource damage liabilities in the case, which were applied to restoration of the bird and fish injuries: BP America, \$3.9 million; Trans-Alaska Pipeline Liability Fund, \$3.0 million; and Golden West Refining Co., \$4.2 million.
5. Benefits (or valuation) transfer involves the application of existing value estimates or valuation functions developed in one context to address a comparable natural resource valuation question in a different context. The site-specific data for the affected area were numbers of daily beach visits; there were no data that could be used to calculate travel costs and thereby use a travel cost model to estimate site-specific benefits.

Carol Adaire Jones received her Ph.D. in Economics from Harvard University. She taught at the University of Michigan from 1984-1990, after which she became Chief of the Resource Valuation Branch of the Damage Assessment Center of NOAA. In that position, she was responsible for oversight of the economic analysis in NOAA NRDA cases and of the development of the economics component of the OPA regulations. In January 1998 she joined the faculty at INCAE, Costa Rica, the Central American School of Business Administration, and is involved in various research projects with the Center for Competitiveness and Sustainable Development. Her area of expertise is natural resource valuation.

