Abstract

If Justice Douglas has his way
O come not that dreadful day
We'll be sued by lakes and hills
Seeking a redress for (economic) ills

Our Brooks will babble in the Courts
Seeking damages for torts
How can I rest beneath a tree
If it may soon be suing me?

J Naff, ABA Journal 58 (1972) 820. The reference to Justice Douglas was provoked by his dissenting opinion in Sierra Club V. Morton, 405. US. 727 (1972).

Liability for natural resource damage is a prominent topic in New Zealand since the introduction of the Resource Management Act 1991. This paper seeks to clarify whether any natural resource economic equations could work with oil pollution restoration. An insight will be provided in to the possible strengths and weaknesses of the New Zealand system based on the previous and the current law.
New Zealand is completely surrounded by ocean which it seeks to protect in special pollution legislation. This legislation does not currently provide for any economic natural restoration equations. New Zealand marine pollution law is found in three separate statutes because the law is currently in a transitional position. The three pieces of law are:
Confusion and mismatch are rife among the different legal pieces of the jigsaw. The legislation is currently undergoing rationalisation and law reform is pending. However all the pieces of the jigsaw must be studied to establish the best method for restoring the health of the New Zealand’s surrounding seas after oil pollution damage. I propose to deal with each statute separately.

**Marine Pollution Act 1974**
The Marine Pollution Act governs civil and criminal liability for oil pollution within the specific jurisdiction of the New Zealand waters. The purpose of the Act as stated in the long title, is to «make better provision for preventing and dealing with oil pollution at sea.»
The Territorial Sea and Exclusive Economic Zone Act 1977 defines the territorial sea as a distance of 12 nautical miles from the New Zealand coastline. This clearly sets out the jurisdiction for the New Zealand Courts in prosecutions of oil polluters in the ocean.

**Criminal liability - strict or absolute liability ?**
Section 3 provides that if oil or pollutants are discharged or escape from: any ship, any place on land, any transfer or apparatus used, offshore installation or pipeline then the owner or the master commits an offence. It is unclear whether the Marine Pollution Act 1974 creates offences of absolute liability (where there is absolutely no excuse when you spill oil in the ocean) or strict liability (where taking due care exonerates the polluter). However at this stage there are no hard and fast rules but the entire picture is compounded by judicial decision.¹

In Charles George Hardy v. Union Maritime Services Limited (High Court Wellington M630/85 16 May 86) Jefferies J stated that offences under section 3 of the Marine Pollution Act are strict liability offences. The case of PJR Wavish (Northern Regional Council) v. Northland Port Corporation (NZ) Limited (Whangarei AP 47/94, March 24 1995) involved an oil spill of 1000 litres which seeped from the vessel’s open valves as a result of an item being thrown against them during the bunkering operation. Robertson J described this as an offence of strict liability and added: «The consequences of spillage are so horrendous that Parliament has created offences of strict liability and placed a maximum penalty upon them. It is clearly incumbent upon the Courts where there is a breach to respond in this way which reflects the potential

¹ The concept of strict liability is examined by the Court of Appeal in the case Civil Aviation Department v. Mackenzie [1983] NZLR 78. Richardson J. paraphrasing the decision of Dickson J. in the Canadian case R v. City of Sault Ste Marie [1978] 85 DLR(3d) 161.
magnitude of damage which can occur. I indicated to counsel I have recently attended an international conference in Guam where I listened to a discussion by the Judge responsible for the Exxon Valdez litigation in Alaska. It was a vivid reminder of what can happen in this area."

The problem is that other case law describes section 3 as creating absolute liability offences. This is difficult to reconcile with the special defences set out in section 6. The case of Tsibidis Andreas and Seatrans New Zealand Limited v. Ministry of Transport (Auckland High Court, AP 302.89, May 8 1990) concerned an appeal against their convictions on the grounds that the judge was wrong in holding that both the owner and the master could be charged under the Marine Pollution Act. Tompkins J made it clear that the offences created by section 3 are absolute liability offences. He states: «It is within the second category of offences referred to by Edwards J in R v. Ewart [1906] NZLR 709, namely, one in which the language of the enactment made plain that the act is prohibited absolutely. The existence of a guilty mind is relevant only to punishment.» This absolute liability trend was followed recently by Abbott J in Canterbury Regional Council v. Sealord Charters Limited (Christchurch District Court, August 7 1997 CRN 6009034330).

It is respectfully submitted that Abbott J fails to distinguish properly between absolute and strict liability offences. At page 20 he states: «Furthermore, three of the section 6 special defences allow a defendant to escape liability for a discharge in particular circumstances if the defendant can prove that no deliberate or negligent act or lack of reasonable care was involved (section 6(2) and section 6(4)) and/ or that all reasonable or practicable steps were taken to prevent, stop, or reduce the discharge (section 6(2), section 6 (4), and section 6(5)), while the other two subsections contain provisos to similar effect but with the onus of proof reversed. In those circumstances, as Parliament has in effect stipulated that a defence of absence of fault will be available in certain limited factual situations, the presumption must be that the defence will not be available in other factual situations, including where an escape or discharge of oil occurs during or following bunkering, which is the most frequent encountered scenario.»

Possible penalties cover a fine not exceeding $100 000 and liability for the clean-up costs within New Zealand waters (section 10). But the legislation provides no way to establish or quantify how much environmental damage has occurred and how restoration should take place. The harbourmaster may take oil spill samples for analysis, but there is no requirement to do so. This information could be relevant to the penalty based on the type of oil spilled (section 17). In many of the court records the types of oil are not recorded at all. This factor is paramount as it is accepted that heavy fuel oils do more environmental damage.

The problems of inconsistent sentencing for oil pollution can be demonstrated by viewing the penalties imposed in the following cases. In Bay of Plenty Regional Council v. McKay Shipping Limited (unreported Tauranga District Court, May 24 1991) an estimated 200 litres of heavy fuel oil were discharged while bunkering in August, 1990 and the court imposed a $5000.00 fine.

In Wellington Regional Council v. Union Maritime Services Limited (Wellington District Court, April 14 1992 CRN 2085005947) approximately 100 litres of diesel oil were
discharged. In sentencing, Judge Pethig stated «The legislature obviously regards seriously any aspect, or at least any breach of any aspect of environmental conservation and that is expressed in the maximum penalty... » and fined the company $5000.00.

In Bay of Plenty Regional Council v. Seatrans New Zealand Limited (Tauranga District Court, April 1 1992 CRN 107011674) around 500 litres of oil were discharged into the harbour on 30 September 1991 and resulted in a fine of $15 000.00 and the responsibility for the clean up costs of an extra $18674.36. This case report from the Bay of Plenty Regional Council did not state the type of oil spilt.

In Taranaki Regional Council v. Union Maritime Services Limited (Taranaki District Court, February 25 1993 CRN 2043008157-9) three oil spills occurred. Incident one on April 7 1992 involved 1000 litres of gas oil resulting in a $6000.00 fine. Incident two on June 5 1992, a spill of 1000 litres of diesel oil, resulted in a $1000.00 fine. Incident three on June 15 1992 involved 1000 litres of diesel oil being discharged when an inappropriate pump was used to transfer oil and this spill incurred a $5000.00 fine.

In Canterbury Regional Council v. Cleasea Marine Services (Christchurch District Court, July 1 1994 CRN 4009006789) 30 litres of oil were discharged on March 28 1994 when the ship’s engineer and crew failed to observe the necessary precautions and ensure the vessel’s scuppers were closed. The late Mahon J imposed a fine of $3000.00, stating «... pollution of the sea, particularly in harbour waters [is] a matter of great concern, the effects of which would be far reaching».

In Canterbury Regional Council v. Southern Ocean Trawlers Limited (unreported, Christchurch District Court, April 21 1994) the spill was estimated to be between 40 and 100 litres of oil. When imposing the fine of $2500.00 Ryan J said «It is not an enormous discharge and it did not pose a serious risk to marine life although the potential was there. Pollution of the sea is a matter of social concern – grave concern, I think».

In Canterbury Regional Council v. Sea Resources Company Limited (unreported Christchurch District Court, August 15 1995) two oil discharges occurred on March 9 and 10 1995. Hattaway J in his summing up stated «although the size of the oil spill had not been ascertained such spills [are] a serious matter.» The first spill attracted a $6000.00 fine, and although the second one was not as large, it nevertheless attracted a $10 000.00 fine because the Judge said «...it should not have been allowed to happen again.» The key issue with all the case law is that it demonstrates no set system of how the courts should go about determining what is the damage to the ocean and how it can be measured effectively.

**Civil liability**
The Marine Pollution Act applies to civil claims in relation to oil. Liability for other pollutants is covered by the common law. The total responsibility for all oil pollution damage in NZ or in NZ waters goes to the «owner» of a vessel (section 31). The definition of an owner in this section appears to be wider than in section 2 of the same Act. The registered owner or the actual owner of an unregistered ship under section 32 will be liable where the ship is actually carrying a cargo of persistent oil in bulk and oil has been discharged or has escaped without the fault or knowledge of the owner. The liability limit is based on the International Civil Liability Convention on Oil Pollution Damage current limits.

Civil liability defences are contained in section 32. If the owner of the vessel can prove that the discharges or escape of the oil resulted from any act of war or natural phenomenon of an exceptional and inevitable character then the defence is made out. If
the owner proves that the spill was caused by any of the following factors then the
defence is satisfied: The act or omission of a third party with the intent to cause damage,
or was wholly caused by the negligence or any other wrongful act of any government, or
other authority and any person who is responsible for navigation equipment. Where there
is liability under section 32 of the Act, the owner cannot be liable for pollution damage
other than under that section (Williams 1997 p 361).

The Resource Management Act 1991
Criminal liability
Under this piece of environmental law reform in New Zealand, matters of national
importance must be recognised and provided for. This includes the preservation of the
natural character of the coastal environment (section 7(a)). Protection of the marine
environment within the 12 mile limit from oil discharges will be integrated into the
regional councils’ existing coastal management responsibilities under the discharge
sections were drafted widely for insertion into the existing legislation to cover for all the
situations currently provided for in the Marine Pollution Act (sections 15B and section
15C). The Marine Pollution Act will continue to be used until the new sections under
the Resource Management Act come into force. The forum is also significantly modified
with all matters to go before the Environmental Court. Until that happens, prosecutions
are under the Marine Pollution Act 1974.

Currently the Resource Management Act applies to all New Zealand vessels but foreign
vessels are excluded. This is because the Act is not consistent with the International
Convention for the Prevention of Pollution from Ships 73/78 (MARPOL). This will
require amendments to make the law effective to allow prosecutions of all vessels
carrying oil in New Zealand waters.

The liability for any oil spill rests still with the master and the owner of the vessel
(section 19). The maximum fine under the Act is up to $200 000.00 (plus $10 000.00 per
day for a continuing offence). Imprisonment and community service are also introduced
as penalty options. Penalties can also still include a requirement to undertake clean-up
operations or to stop activities. This is a higher fine limit than the Marine Pollution Act
and imprisonment was never part of that legislation. The fine limit based on international
standards under the Resource Management Act is still very low.

On the reverse side there are a number of defences which are available to an oil spiller
which were not available under the previous legislation. This will have a definite effect
on the ability of the courts to impose fines. Section 341 of the Resource Management
Act outlines a number of defences. One defence is available if the defendant can prove
that the oil spill was necessary to save or protect life or health, serious damage to
property, adverse effects on the environment; and the conduct was reasonable in the
circumstances; and the effects of the spill were adequately mitigated or remedied. This
follows the strict liability interpretation of section 6 of the Marine Pollution Act
following the Court of Appeal decision in McKnight v NZ Biogas Industries Limited
17/5/94 CA 526/93. The only difference to this comparison is contained in section
341(b) which sets out the defences of natural disaster, mechanical failure or sabotage
which are not specified in the Marine Pollution Act. For section 341(b) to apply the
defendant has to show the oil spill could not reasonably have been foreseen or provided
against and the effects of the spill were adequately mitigated or remedied.

This defence was successfully relied on by Shell Oil when one of the service stations they
constructed leaked over 30,000 litres of petrol due to a pipe failure. (Wellington Regional
Council v. Shell Oil and Cudby Motors (Wellington District Court, April 14 1992 CRN:
2032012951, 2032012948) Shell Oil was acquitted. The Court found that Shell had
been «environmentally conscientious and that management and directorate take a keen
interest in environmental matters, running courses and generally overseeing the activities
of its managerial staff. The company has in place well–tried engineering and operating
criteria for its service stations throughout the world, including New Zealand.»

Offences under this Act are therefore strict liability based on the wording in section 341.

The sentencing principles for New Zealand have been adopted from the Ontario case R v.
Bata Industries Limited [1992] OR (3d) 329, which involved drums of waste leaking into
water. The Judge clearly set out the factors he considered courts should have regard to
when sentencing the defendant for environmental offences. The severity of any sentence
should be based on the following factors:

- the nature of the environment effected
- the extent of the damage that has resulted

(There is no way in the New Zealand legislation to determine how you measure these two
items for consistency to result in the court’s application of the law.) The second part of
this paper will discuss the appropriate economic model or equations to address this issue.

- if the offence was deliberate
- the attitude of the defendant

In sentencing corporations convicted of environmental offences, the judge considered the
Court should have regard to:

- the size, wealth, nature of the operation and power of the corporation
- the extent of the defendant’s attempts to comply
- remorse for the offence
- profits realised by the offence
- if a criminal record exists or evidence of good character.

The judge saw the purpose of sentencing was «to protect the public, to deter and
rehabilitate the offenders, to promote compliance with the law, and to express public
disapproval of the act»(p2.) «This sentence must be that even in this bleakest of financial
times, the environment must not be a sacrificial lamb on the altar of corporate
survival»(p6.) These principles were adopted in the case of Machinery Movers v.
Auckland Regional Council (1993) 2 NZRMA 661 and will no doubt be applied to oil
pollution cases in an attempt to protect the ocean around New Zealand.

MARITIME TRANSPORT ACT

This legislation requires the reporting of the arrival in New Zealand of ships which carry
bulk oil, so that effective oil pollution response planning can take place. Any discharge
of oil outside the twelve mile limit around New Zealand is within the ambit of the
Maritime Transport Act and the Marine Protection Rules. Possible confusion arises in
relation to whom to sue as the law contains at least two divergent definitions of «owner».
This could lead to difficulties in judicial interpretation. The issue is yet to be tested in the
New Zealand courts.
Civil liability
For the recovery of oil clean up costs civil liability is only appropriate where clean up costs are not being sought via a criminal prosecution under the Resource Management Act.

Criminal liability
This will only apply outside the coastal marine area. There are identical provisions in the Maritime Transport Act that replace the discharge of oil and defence provisions of the Marine Pollution Act 1974. The position under the Maritime Transport Act with defences is summed up in obiter by Abbott J. in Canterbury Regional Council v. Sealord Charters Limited (Christchurch District Court, August 7 1997 CRN 6009034330) at p24 25:

«... the relevant provisions of the Maritime Transport Act in fact make it clear that Parliament intends criminal liability in respect of discharges of oil in New Zealand water should continue to be determined on an absolute liability basis, subject only to certain specified defences.» At page 26 the Judge continues to misinterpret the defences: ‘The fact the phrase «without reasonable excuse» is not used in section 237 and the fact the act contains a separate section which prescribes the defences which are available to a defendant who faces a charge under section 237 in my view clearly indicates the intention of Parliament is that only those defences which would otherwise be available are therefore to be excluded in respect of oil discharge offences. Put shortly, the statutory framework is compelling.»

This is another example of the existing confusion with the interpretation of the legislation. With all due respect, the judge has confused the notions, in speaking of «absolute liability» but actually discussing strict liability, with its due diligence defences. Clearly, no specific economic restoration equation will ever work while there is such confusion in judicial decisions. But in any event, a new system is required to prevent the roller coaster of fines that occurred under the previous legislation. It appears that the historical problems of the legislation are inherent in the new system being put in place. The key question that must be answered is how do we use an «economic model» to measure the damage to the ocean by oil pollution to reflect a consistent system of penalties in the law?

When commodities are not traded in the competitive markets such as the oceans, there is no market revealed measure of value. The market price fails to efficiently allocate resources to the "highest" bidder (that is marginal benefit equals marginal cost). As long as some goods are not tradeable in the market place, efficiency in the allocation of resources is unobtainable even under the most extreme assumptions regarding the separability of utility functions (Hoehn and Randall, 1982). This results in resource allocation decisions made within the realm of government independent of the market indicators of economic values.

The Measurement Issues of Non use Values
Economists have defined economic values in a variety of ways. Mitchell and Carson
(1989) argue that goods may possess use (consumptive) and/or nonuse (nonconsumptive) values. Use values include all current direct and indirect consumptions in which people can make physical use of a good. When goods are not traded in markets, there is no market revealed measure of value. Price fails to equate marginal benefits to marginal costs of the goods consumed. Thus the questions concerning the definition of nonuse values, their measurement, and their including in environmental policy-making have been widely contested in journals, conferences, and policy decision making (see, for example, Smith, 1992; Larson, 1992; Nickerson, 1993).

The presence of nonuse values implies that people do not have to visit (consume directly) a public amenity to benefit from its maintenance, improvement or existence. This includes vicarious consumption and stewardship. The literature on nonuse values emphasises the uniqueness of the resource in question and the irreversibility of the loss or injury (Freeman III, 1993). For example, there might be important nonuse values in preserving the Grand Canyon in its natural state and in preventing the global or local extinction of species and the destruction of unique ecological communities.

Measuring Economic Values

In an organised competitive market, it is often easy to observe the choice people make in terms of the good and services available. Equilibrium prevails between willingness to pay and willingness to accept between the buyers and sellers respectively and pareto efficiency is achieved. Both buyers and sellers improve their welfare by taking advantage of the opportunities for exchange, with a sale being agreed upon as long as the price offered is at least as great as the value of the goods sold (Bicknell and Gan, 1997). In a competitive market the total willingness to pay (TWTP) for a particular good is estimated as the area under the demand curve. The net benefit to consumers (consumers' surplus) is represented by the area under the demand curve, but above the price line. In short, the amount paid must be subtracted from the total willingness to pay to arrive at a net benefit. The measurement of economic benefits for consumptive types of goods traditionally involves the mathematical estimation of a demand curve using market transaction data between buyers and sellers.

However, the problems in estimating the TWTP arises when goods and services are traded outside the competitive market system especially public goods. For example, environmental amenities are not traded in ordinary markets, their values must be inferred indirectly from consumer purchase of related commodities, or directly from experimental methods. Therefore, Adam Smith invisible hand hypothesis can not serve to efficiently allocate resources to their best use in the marketplace.

Researchers therefore have to look for alternative ways for measuring the economic values of goods for which there are no relevant markets, such as environmental resources. Such economic values might be revealed through observable choices. A rich body of theory and extensive literature exists with this approach, commonly known as nonmarket valuation. Nonmarket valuation methods attempt to bring some of the nonmarket items out of the realm of nonquantifiable and unmeasurable items, and into the policy
framework on a comparable basis with market items.

Nonmarket Valuation Techniques

Nonmarket valuation techniques were first proposed some forty-five years ago and the applications have since been multiplied (Smith, 1993). Interest has been on a rise in estimating economic values for environmental resources as part of public investment, management and regulatory decisions. This includes the court seeking valuation information for assessing natural resource damages, environmental costing by public utility commissions and trade policymakers in evaluating the legitimacy of environmental policies in trade barriers (Smith, 1993).

These nonmarket valuation methods are broadly grouped into two categories, direct and indirect valuation (Pearce and Turner, 1990; Mitchell and Carson, 1989; Randall, 1987). Direct, or observed methods measure directly revealed preferences for changes in environmental improvements or gains and are implemented by using surrogate or experimental markets. The surrogate approach uses a market which has factors of production that are exchanged in the marketplace and also have environmental attributes. For example, a clean lake or water quality may be an important attribute of a house on a lake. The experimental approach creates a market in which consumers can give hypothetical valuations of environmental improvements (Pearce and Turner, 1990). For example, a consumer can express the value of a decreased level of bacteria in a recreational water body versus the original, very high, level. Indirect methods calculate a "dose-response" relationship between an externality and its effect. An example of a dose-response relationship is the effect of pollution (dose) on health (response). Since indirect methods estimate the relationship between a dose and its non-monetary effect instead of a willingness to pay (WTP) value, the direct methods tend to be preferred. There are two generally acceptable techniques for determining WTP statement for valuation of water and related land resources which are not traded in markets; the travel cost method (TCM) and contingent valuation method (CVM).

1. Travel Cost Model

The travel cost method (TCM) is the standard model employed in the recreation demand literature and has been employed to evaluate wetland recreation functions. This method assumes that the decision on the number of trips to a recreation site in a given period is determined at the beginning of the period. The travel cost method uses the costs of travel and the value of travel time as a proxy for WTP. The method further assumes that recreationists react to increases in travel expenditures as they do to increases in admission fees. Distance or travel time then acts as a barrier for different users.

The basic TCM can be modelled as the maximisation of utility of consuming trips and other goods subject to available income. A demand function for visits to a particular site can be derived and takes the form
\[ X = f(P, Y, z^*) \]  

where \( X \) is the total number of visits by the recreationist to a specific site, \( P \) is a vector of prices including travel costs to the site, \( Y \) is income, and \( z^* \) is the value of travel time. The value of travel time is some function of the wage rate (Bockstael, Strand, and Hanemann, 1987). The demand function for a single-site model is estimated on the number of visits and travel cost to the site.

TCM estimates WTP indirectly. TCM is theoretically as well as empirically attractive because it is based on actual behaviour of recreationists as they adjust to real economic variables. According to the TCM, as distance to a recreation site increases, the number of visits to the particular site will decrease while cost will increase. Distance travelled, the travel costs and the recreation site are positively correlated in the TCM. A site demand curve and sufficient variation in travel cost expenditures is obtained by differentiating between users having origins at different distances from the designated site. The farther away the users of the recreation site live, the less is their expected demand for the site. Users who live close by would be expected to demand more of the site because its implicit price, as measured by travel costs, is lower than for users living farther away from the site. In terms of consumer's surplus, the user farther away from the site with the highest travel cost is assumed to have the lower consumer's surplus. Likewise, those who live closer and have lower travel costs will have larger consumer's surplus.

Hufschmidt el at. (1983) suggested that we should be aware of two problems in applying the TCM:

i. since the results are a function of the current distribution of income and if current distribution is not equitable, then the results should be used with great care especially for those areas with a very skewed distribution of income; and

ii. the benefit calculated must be considered as a minimum estimate of total benefits derived from a recreational facility under the assumptions used in the analysis. Other values associated with the site-specific recreation experience may not be captured in the analysis.

However, several weaknesses govern the applicability of the TCM in measuring the values and attributes associated with wetlands, including recreational uses. A variety of issues have been raised including data truncation problems and heteroskedasticity.

TCM is applicable to specific sites and often is impossible to use for evaluating specific components or characteristics of a site. The method is limited because trips with multi-destinations cannot be measured, it does not measure consumer surplus directly, and it cannot evaluate specific components of a wetland recreation experience, such as fishing (Vincent, Moser, and Hansen, 1986). The model works best when the recreationist visits only one site during his trip (Sorg and Loomis, 1985).
TCM cannot be applied to unique recreation sites without reservation, for example, the Grand Canyon or to sites which are located in urban areas. Problems also arise because the observed willingness to travel distribution is truncated, which causes the weak complementary assumption to be violated. Weak complementarity is a maintained feature of a person’s preferences (Green, 1978). It is based on the assumption that a commodity will only be valued if some other privately marketed good is consumed. The assumption implies that if travel costs to a site are small, then marginal valuations for use of the sites are small as well. However the fact that travel costs to the site are minimal for the majority of recreationists does not imply that marginal valuations for the use of the site are small as well. Total WTP for use of the site, above and beyond actual costs, may be substantially large. Therefore, TCM may underestimate this total WTP because of the violation of the weak complementarily assumption (Titre, Jr. et al. 1988).

2. Contingent Valuation Methods

The CVM method provides a method of directly measuring both willingness to pay (WTP) and willingness to accept values which uses a direct method, such as a survey, to elicit individuals' preferences for public goods by asking what they would be willing to pay for improvements in them (Mitchell and Carson, 1989). Responding to the lack of a market for public goods, CVM creates a hypothetical market and asks what individuals would be willing to pay for a good if the market actually existed. These markets define the good or amenity of interest, the desired level of provision, the institutional structure under which the good or amenity is provided, the methods of payment, and the decision-rule in implementing the proposed program (Randall et al., 1983). This can be obtained through the use of a personal interview or telephone or mail survey. The rationale of the valuation question is to generate information about the respondent's compensating variation for the increase or decrease level of provision.

CVM has gained widespread acceptance as an alternative method for estimating public and nonmarket commodities (Brookshire et al. 1982; Sellar et al., 1985). Individual preferences which are unobservable over the level of provision of a nonmarket good, CVM is the only method available to value changes in the level of provision. Carson et al.’s (1994) bibliography provides a list of over 1,600 CVM studies and related publications. As discussed by Freeman (1993), the CVM is the only available method for measuring nonuse values. Boyle et al. (1996) use a CV instrument to determine local response centers to clean up the effects of oil spills in U.S. The estimated values are expected to be largely composed on nonuse values, similar to Kealy and Turner's (1993) acid rain report and McFadden's (1994) wilderness study. CV is thus capable of measuring both use value and nonuse values such as an existence value - simply knowing that a resource exists independent of any current or possible future use values (Krutilla, 1967).

In a typical WTP contingent valuation study, an individual is asked to imagine he or she is faced with a decision regarding the level of provision of public or nonmarket good. The individual has the opportunity to increase the level of provision of the good, but must be willing to give certain amount of money to do so (Ready, et al., 1996). Assume an individual has a well-defined indirect utility function before an improvement in...
environmental quality \( (E_1) \) give as follows:

\[
WTP_1 = W(Y, P, E_1, X) \quad (2)
\]

where \( Y \) is income, \( P \) is price index, \( E_1 \) is the initial environmental quality, and \( X \) is a vector of all other variables of concern. An improvement in environmental quality from \( E_1 \) to \( E_2 \), the individual's utility value would be:

\[
WTP_2 = W(Y, P, E_2, X) \quad (3)
\]

The individual's WTP for environmental quality improvement can be defined by the following equation:

\[
WTP_1 = W(Y, P, E_1, X) = W(Y - WTP, P, E_1, X) \quad (4)
\]

\[
WTP = WTP(Y, P, E_1, E_2, X) \quad (5)
\]

Equation 5 shows the WTP as the individual's monetary value of change in the individual's welfare resulting from the improvement in environmental quality from \( E_1 \) to \( E_2 \), which is determined by characteristics of the environmental quality change and the individual's socioeconomic and demographic characteristics. Thus, the expenditures necessary to maintain a specified utility level decrease with an increase in environmental quality (\( E_1 \) to \( E_2 \)) so that \( WTP \geq 0 \). Whitehead and Blomquist (1991) suggested the inclusion of information factor about the natural resource change is a necessary condition for positive WTP. Therefore, the individual would gather information and then form values for the environmental improvement which can be expressed as follows:

\[
WTP = WTP(Y, P, E_1, E_2, X_\text{I} > 0) \quad (6)
\]

where \( I \) is the information about the improvement in environmental quality. When the individual has information about the improvement in environmental quality (\( I > 0 \)) a positive WTP statement can be formulated (\( WTP \geq 0 \)). However, if the individual has no information about the improvement in environmental quality (\( I < 0 \)), WTP is equal to zero. Positive WTP valuations result from observable behaviour that leads to acquired information (Whitehead et al., 1995).
The validity and reliability of WTP depend on the amount and type of information available to the individual. The better information, both acquired through personal experience (familiarity) and available in the survey instrument, the more valid and reliable are the WTP valuations made by the individual (Whitehead et al., 1995; Cummings et al., 1986).

Reliability and Predictive Validity of Contingent Values

While contingent valuation (CV) instruments have been widely used, critics have expressed concerns about the reliability and validity of valuation derived through CVM (Cummings et al., 1986; Mitchell and Carson, 1989). Consequently, much recent work has concentrated on comparisons between CV studies themselves and between CVM and other methods of estimating economic values. Virtually all competent contingent valuation studies have generated a nucleus of value information which performs well on the various tests (Randall et al., 1981; Randall et al., 1983).

CV bids do not resemble random numbers. Many empirical studies demonstrate that individual or household bids are closely related to income, availability of substitute and complement goods, availability of information and socio and demographic characteristics (Randall et al., 1983). The results obtained are also consistent and systematic with various types of actual behaviour. Individuals are WTP positive amounts in contingent markets for amenities that they value or prefer. For example, Thayer (1981) demonstrates the WTP to preserve recreation site amenities was consistent, whether estimated by CV or a site substitution method. Brookshire et al. (1982) show the WTP for improved air quality in metropolitan areas was consistent regardless of a CV or hedonic price measurement. Rae (1982) shows the WTP for recreation and related benefits of in-stream water quality improvements were consistent, whether assessed by CV, the TCM or a contingent ranking method. WTP for goose hunting permits in Wisconsin was found to be consistent, whether measured by a contingent purchased method, TCM, or cash transactions in an experimental willingness-to-sell market (Bishop and Heberlein, 1979).

Carson et al. (1997) use a CV instrument to measure the WTP for a program to protect Prince William Sound, Alaska, from future oil spills, like the Exxon Valdez spill. Their findings indicate that choices made two years after the spill are not significantly different from those made four years after the spill. Carson and Mitchell (1993) also report similar results using a CV instrument to value changes in surface water quality, showing no significant differences in estimates of WTP between two surveys conducted three years apart.

Brookshire et al. (1976) found their estimates of aesthetic value for Lake Powell were quite similar to the results obtained by Randall et al. (1974) for the Four Corners region. Rowe et al. (1980) found their estimates for the Four Corners region to be comparable to these other studies. Brookshire et al. (1982) used the hedonic measures to estimate the values for air quality in Los Angles and found close agreement in values obtained by CV.
approaches. Smith et al. (1986) showed that contingent values in combination with indirect methods can generate meaningful answers.

Kealy et al. (1990) examines this issue by comparing the reliability and predictive validity of self-reports of WTP for two commodities, a brand name chocolate bar and a deacidification program for lakes in the Adirondacks region in New York State. Their results showed the subjects were as reliable in their statements of behavioural intentions with public goods as with the private good and both commodities had high reliability independent of the measure of reliability used. In addition, their findings about relative predictive validity was comparable across the two commodities. This is because CVM employs behavioural intentions rather than general attributes, elicit specific intentions about specific behaviours and links people's WTP statements to a realistic and genuine payment obligations.

Whitehead et al. (1995) find that the availability of information to the respondents before the survey information is presented can be a key determinant of validity and reliability. Validity and reliability increases with familiarity. This implies that contingent markets presented to respondents who are unfamiliar with the resource will generate less accurate or bias statement of WTP. Thus greater effort should be made to inform respondents about the characteristics of the choice issue, such as the quality of the resource and related environmental goods (Bergstorm et al., 1990; Whitehead et al., 1991).

Critics of CVM also cite strategic bias as one of its fundamental weakness; however, little empirical evidence is found on its existence. Bohm (1972) found that strategic bias was not a problem in his examination of WTP for television services. Brookshire et al. (1982) examined the aesthetic damages associated with the building of the Kaiparowits power plant on Lake Powell in the Glen Canyon National Recreation area and found no evidence of strategic bias in the two estimation techniques used.

Conclusions

The WTP measurement can be criticised as a relatively narrow, economic measure of value that often does not do justice to the broad costs and benefits that may be associated with a public good. Based on the theory of attitudes and behaviour of individuals, the psychological value of any good, whether traded in the marketplace or not, is influenced by factors that differ greatly from the factors associated with their WTP. WTP is selected as the correct compliment to the New Zealand legal system to allow natural resource enforcement to be effective.

Mitchell and Carson (1989) do acknowledge that "people tend not to have previously well-defined values for many of the goods valued in CV studies" (p. 249). However, they argue that improvements in the method can overcome potential biases resulting for this lack of well-defined markets for nonuse values. For example, further experimentation with different question formats, question framing methods, and payment vehicles can improve CVM accuracy (Kealy et al., 1990). With respect to the respondent characteristics, individuals who have greater experience or familiarity with the
commodity in question demonstrate greater correspondence between their verbal reports and their actual behaviours (Borgida and Campbell, 1982). Concerning the method, better question formats and framing, perhaps allowing respondents to learn the market rules better, can improve construct validity with regard to the commodity.
References


Economics Association Meeting, Logan, Utah.


