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FINAL REPORT TO THE U.S. ENVIRONMENTAL PROTECTION AGENCY (CD-983376-01-0)

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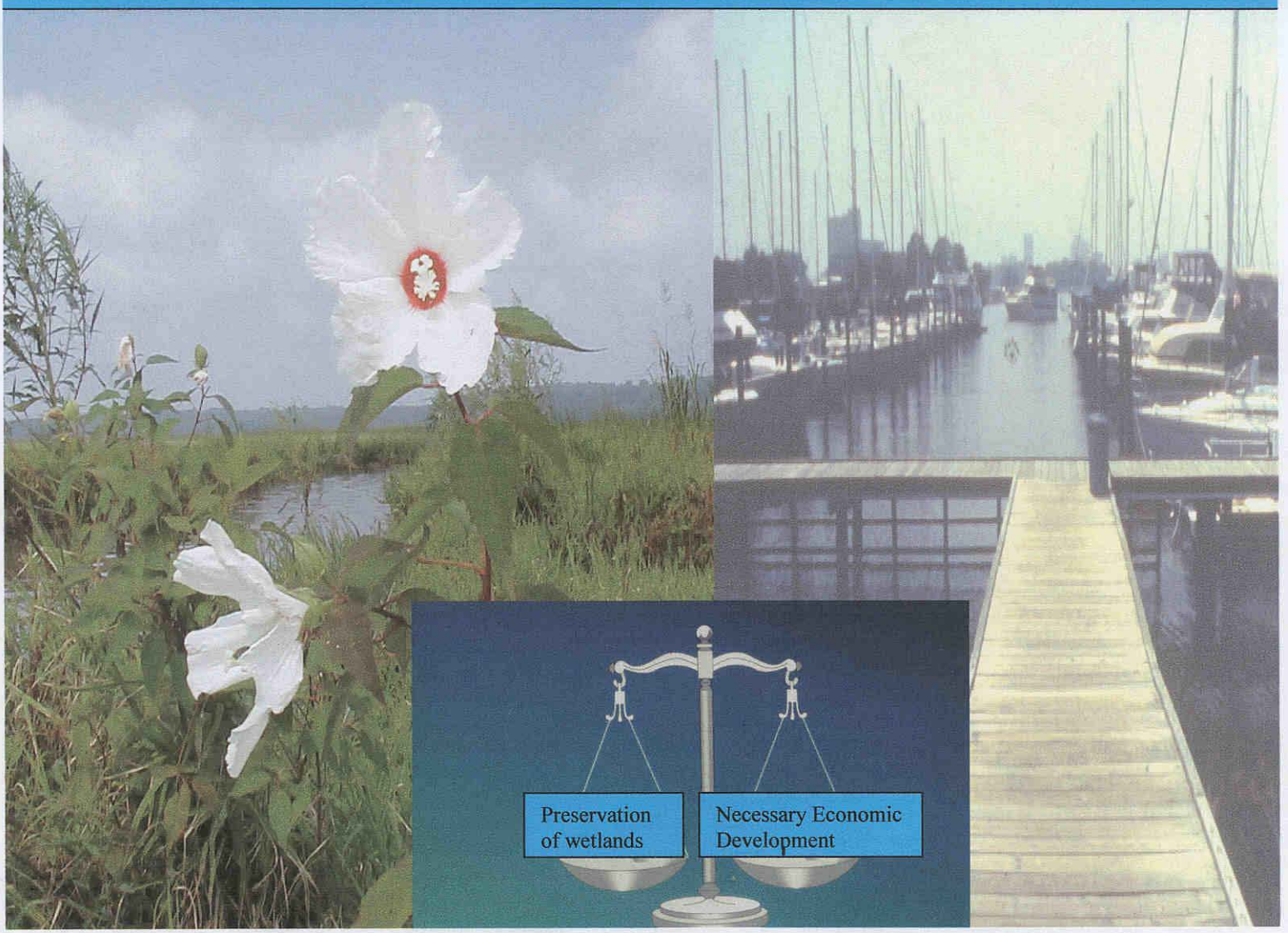

Assessing the Decision-making Process in Wetlands Resources Management in Virginia

Final Report to EPA

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Executive summary

The importance of incorporating social and economic considerations into the decisions relating to the regulation of development in wetlands areas in Virginia is well recognized. Yet, it remains uncertain how and to what extent these issues are considered. While theVirginia Institute of Marine Science (VIMS) is mandated to provide scientific and technical advice on ecological aspects of wetlands to the local wetlands board members, no such mechanism exists for social and economic considerations. We therefore conducted a study aimed at describing to what extent these issues are being considered, and suggesting a framework to facilitate a consistent and transparent process for incorporating these issues in decisions concerning wetlands.

In an attempt to identify the types of issues currently used by the local wetlands board members, we performed an analysis of the contents of wetland board minutes and their decisions on 106 randomly selected applications processed from1997 to 2001. We found that recurring issues discussed during the board meetings included those related to social and private benefits, e.g., jobs, taxpayer benefits, traffic control, and property protection. In addition, issues related to private and public costs, such as limited access, problems with trash and debris, and high costs for alternative methods, were also discussed. We noted that the concerns related to adjacent property owners were prominent among others, including values of wetlands and wildlife and aesthetic value of the ecosystems.

Next, we organized a workshop of wetlands board members, their staff persons and Virginia Marine Resources Commission (VMRC) personnel to obtain information about social and economic considerations they currently use in their decision-making process, as well as their opinion about other information useful in the process. The results from the workshop confirmed our findings from the content analysis that several social and economic issues are already being implicitly considered. Workshop participants generally agreed that more information is needed to understand social and economic values of wetlands and that a mechanism to assist local wetlands board members to incorporate them in the context of wetlands decisions is desirable.

A proposed framework to facilitate the incorporation of social and economic issues in local wetlands decisions includes three main steps, i.e., identifying social and economic issues, valuing and determining their importance, and integrating them with wetlands considerations. A participatory process with major stakeholders, particularly property owners, adjacent property owners, community members, and wetlands board members, is needed to test and implement this framework.

Introduction

The Commonwealth of Virginia has enacted laws to regulate development in wetlands and recognizes the unique functions and values associated with these ecosystems. However, the legislation also recognizes the need to balance conservation of the wetlands resource with the need for necessary economic development. The tidal wetlands legislation enacted in 1972 states, "In fulfilling its responsibilities under this ordinance, the board shall preserve and prevent the despoliation and destruction of wetlands within its jurisdiction while accommodating necessary

economic development in a manner consistent with wetlands preservation" (Virginia Code Ann.§ 28.2).

Similar language appears in the State's recently adopted nontidal wetlands legislation stating, "Whenever the Board considers the adoption, modification, amendment or cancellation of any standard, it shall give due consideration to, among other factors, the economic and social costs and benefits which can reasonably be expected to obtain as a consequence of the standards as adopted, modified, amended or cancelled" (Virginia Code Ann. § 62.1).

Objective, expert testimony on the extent of tidal wetlands impacts associated with proposed projects is provided to local wetlands boards and to the Virginia Marine Resources Commission (VMRC) by the Virginia Institute of Marine Science (which is the School of Marine Science for the College of William & Mary). The Virginia Institute of Marine Science (VIMS) provides independent scientific and technical advice on impacts associated with the marine environment. However, it is uncertain to what extent independent advice on economic and social impacts is available to resource managers and regulators. Social and economic considerations are generally proffered by the proponents of a project and resource managers have little or no independent validation of the claims of economic detriments or benefits. This results in a general lack of documentation on the quantity and type of social and economic information used in decision-making about wetlands management in Virginia. Further, the current management system of wetlands resources is through local wetlands boards, a process by which members of the boards make management decisions using the guidelines and standards provided by the Commonwealth. While environmental considerations are explicitly described in the guidelines, this is not the case with socioeconomic considerations.

For the last thirty years wetlands boards and the VMRC have been averaging approximately 800 shoreline management decisions per year based on the guidance summarized in the forgoing paragraph. The history illuminates a very well provisioned environmental side of the decision-making process but very little in the way of describing how the socioeconomic side of the equation is balanced. This study is thus the first step in trying to elucidate how these boards have balanced the environmental charge (for which they have significant guidance) with the socioeconomic charge, where there is nothing available beyond a requirement in the act to accommodate this factor. Further, the study aims to provide an assessment of the extent to which social and economic issues are currently incorporated in the decision-making process by the local wetlands boards, and to suggest a preliminary framework for incorporating social and economic considerations in the wetlands decision-making process. This framework is only the first step in suggesting key social and economic elements that should be considered. Further development and tests will need to be performed to evaluate the over all appropriateness and effectiveness of this framework.

Ths report is organized into four parts. First, we describe the structure of tidal wetlands management in Virginia. Next, we outline the two-step process taken in the study, i.e. the content analysis of the local wetlands board meeting minutes and a one-day workshop of wetland board members and county staff persons. Third, we discuss the results of the study and present the preliminary social and economic framework for wetlands management in Virginia. Finally, we

suggest future research to elucidate and support the consistent incorporation of social and economic considerations in the wetlands decision-making process.

The structure of tidal wetlands management in Virginia

The Commonwealth of Virginia is the "poster child" for the decentralized approach to management of shoreline resources. Although the passage of the tidal wetlands act in 1972 named VMRC as the state agency with overall responsibility for wetlands protection, a local option clause has resulted in the formation of 35 local wetlands boards which have original jurisdiction over vegetated and nonvegetated intertidal wetlands within their respective political boundaries. Together they manage a permit system, which controls development within approximately 95% of Virginia's tidal wetlands. Where a local governing board creates a local wetlands board, the VMRC assumes an oversight role only. Where no local board is appointed, VMRC manages the wetlands for the locality. This system of local control of marine resources is relatively unique within the US and was set up primarily in reaction to the fact that private property in Virginia goes to the mean low water line and the Commonwealth has historically been a conservative, property rights state. The local option clause was added to the draft legislation in order to gain the support, or soften the opposition of these conservative interests.

Once a locality (county, city or town) has adopted the model wetlands act set out in the state law, a five or seven member board is appointed by the elected governing board from volunteers living within the locality. There are no specific qualifications or other prerequisites for serving on a local wetlands board. Members serve four-year terms that can be renewed by the governing board. A study of local board membership (Hershner, et al. 1985) found backgrounds to be highly varied in general with significant urban vs. rural composition. The study concluded however, that there was no indication that these differences had a significant effect on how the wetland resources were managed in the different localities.

Local wetlands boards take action upon the submission of a joint permit application by a shoreline property owner. A public hearing must be held within 60 days of receipt of a completed application and a decision must be rendered with in 30 days of the public hearing or the activity is automatically issued. The act provides standards and guidelines for the "use or development" of wetlands and the Virginia Institute of Marine Science provides an environmental assessment. The act states, "...In fulfilling its responsibilities under the ordinance, the board shall preserve and prevent the despoliation and destruction of wetlands within its jurisdiction while *accommodating necessary economic development in a manner consistent with wetlands preservation"* emphasis added. Wetlands boards are to issue the permit provided that the anticipated public and private benefit outweighs the public and private detriment, conforms to the standards and guidelines and does not violate the purposes and intent of the wetlands act.

Content analysis of wetlands board meeting minutes

In order to better understand the degree of incorporation of social and economic considerations in the decision-making process by the local wetlands boards, we first performed a content analysis of the wetlands board meeting minutes. Content analysis is a tool commonly used in social science research to identify, quantify and analyze the presence, meanings and

relationships of certain words or concepts within texts or string of texts (Weber, 1990). Following Carley (1990), the study used 'conceptual' analysis to examine the 'existence' of social and economic concepts represented by identified words and phrases reported in the minutes. The steps taken to perform content analysis of the wetlands board meeting minutes included:

(1) Selection of materials providing words and phrases for analysis

We used wetlands board meeting minutes to provide words and phrases for the content analysis, as they are commonly available from all localities. Only the localities with local wetlands boards were included in the population whereby minutes were randomly selected using three criteria, i.e. (1) to cover the period of wetlands applications considered by the board during 1997 to 2001; (2) to include projects impacting three groups of wetlands; and (3) to represent a range of project costs. The three wetlands groups were delineated in terms of the ecological value of the dominant wetland impacted by the project, such that group 1 represents high wetlands value, Group 1 from the Wetlands Guidelines (1993), group 2 represents medium wetlands value, Group 2 from the Wetlands Guidelines (1993), and group 3 refers to low value wetlands, Groups 3,4, and 5 from the Wetlands Guidelines (1993). Project costs range from (1) less than $15,000; (2) $15,000 to $49,000; (3) $50,000 to $100,000; and (4) greater than $100,000. The final cost category is for projects where the cost was not specified.

Using this sampling framework and depending on the availability of minutes in written form as provided by staff members of each locality, 93 cases were included in the analysis, as listed in Table 1, by wetlands group and by project cost. Additionally, 13 cases that went through an appeal process were included to broaden the range of issues discussed. These appealed cases were distinguished from others, as the data contained not only the local wetlands board minutes, but also minutes from VMRC. Seventeen localities were included in the analysis through the random selection process (see table 1). All selected minutes were electronically scanned as text files to use in the next step.

(2) Coding for content analysis

A set of social and economic concepts commonly considered in natural resource management was pre-defined for initial coding of the minutes. Other categories, particularly those pertaining to wetlands issues in Virginia were added to increase overall sensitivity of the process. This procedure proves to be very useful, as new important information enriched the final analysis. *Atlas.Ti*, commercial software for qualitative data analysis, was employed to record the codes, in terms of existence and frequency. *Atlas.Ti* can accommodate various ways of coding, e.g., in vivo (code as selected text), code by list (for the pre-defined words) and open coding (for adding of new codes). The general procedure for coding using *Atlas.Ti* includes reading the text, highlighting key words, selecting the coding method, and generating the frequency report.

(3) Cross-checking coded words

Content analysis, while useful as a tool to systematically analyze the presence of certain words or concepts as shown in this study, can be time consuming, even with the use of such

software as *Atlas.Ti*. The reliability of the results is also subjected to level of interpretation by different researchers. In our study, we performed reliability testing by having the original coder recheck all codes at a later time and by having a second researcher re-code randomly selected segments of text. Coding differences were reconciled and errors were minimized with this process.

Recurring issues obtained from content analysis of wetlands board meeting minutes

About 40 percent of the sampled applications were related to erosion control, with another 25 percent related to shoreline stabilization. Six main categories were created for analysis of the wetlands board meeting minutes, i.e., societal benefits, societal costs, private benefits, private costs, adjacent property owners' concerns, and concerns for ecological value of wetlands. These headings were chosen after the first round of analysis as they best represented the social and economic concepts, as well as ecological value of wetlands. The recording of issues under these headings was in the form of 'existence', not 'frequency' (Table 2). Frequency count is not the best measure for this study because of the varying length of the minutes from one locality to another, and also of those appealed cases. This implies that no inference can be made to suggest the difference in the number of issues discussed between projects impacting different wetlands groups and between projects with different costs.

Recurring issues discussed during the board meetings concerning these applications include those related to social and private benefits, e.g., jobs, taxpayer benefits, traffic control, and property protection. Some of the private and public costs discussed were limited access, problems with trash and debris, and high costs for alternative methods. The concerns related to adjacent property owners were separated from the others, as they often seem to be a prominent theme. Ecological concerns, particularly in terms of values of wetlands, wildlife and also aesthetic value were distinguished in the analysis to provide the context for comparison between ecological and socio-economic considerations in the decision-making process.

Workshop of wetlands board members and county staff

A one-day workshop was organized as the second step in understanding the importance of social and economic considerations in the current decision-makings by the local wetlands boards. The workshop aimed at obtaining directly from the wetlands board members social and economic issues currently considered in their decisions. This part of the study serves to add and verify the results of content analysis, acknowledging that the wetlands board meeting minutes capture, at best, partial information about the overall considerations in the decision-making process.

The workshop was held on Thursday November 21, 2002 at VIMS. All wetlands board members and staff persons of all 35 localities were invited, as well as staff persons from the Planning District Commissions (PDCs) and VMRC. A total of 48 people attended the workshop, representing a vast number of localities and roles (table 3; see Appendix 1 for the invitation letter and workshop agenda).

Participants were pre-assigned to four groups, two of which were composed of wetlands board members and two made up of staff persons. The workshop consisted of two major activities, facilitated by VIMS students with previous experience in facilitation. In the morning session, participants in each group were asked to identify social and economic issues that they use in their decisions, and were given a list of example of issues (excerpt from Table 2) as a starting point. Once all issues were listed and discussed, each group selected the five most important issues. Table 4 summarizes the top issues presented by each group, as well as the other issues which emerged during the group discussion.

In addition to issues related to environmental quality, impacts on natural resources, erosion protection of private property, and high costs of suggested alternatives, other important social and economic issues raised by the workshop participants were the trade-offs between short-term and long-term benefits and costs to society and property owners; and property owner's rights.

Participants continued to work in the same groups in the afternoon session where discussion centered around how the selected social and economic issues were incorporated in the decision making process. Participants were asked to answer three questions for each selected issue:

(1) What specific information pertaining to the issue was used to help make a decision? How and where was this information obtained?
(2) What additional information should boards have, that would help them to incorporate the issue in their decision?
(3) When they have the information, how do they weigh this issue in their decision-making against the wetlands impacts? More, equal, or less important? For this question, participants were further asked to provide example(s) for each of the following cases.
    - If the answer is "more": In what instance will this issue be equal or less important than wetlands impacts?
    - If the answer is "less": In what instance will this issue be equal or more important than wetlands impacts?
    - If the answer is "equal": In what instance will this issue be more important than wetlands impacts? And in what instance will it be less important?

The summary of results of this part of the workshop is described in Table 5, for each prioritized issue. In general, participants reported the use of technical reports, scientific assessment and advice from VIMS and VMRC to assist them in their decisions. They also indicated the importance of site visits, site location, personal observation, as well as historical records of the sites and prior permits. Social and economic considerations currently used included actual property value and perceptual value, estimated project costs, past project costs per area, and conversation with applicants and contractors. Desirable information for social and economic considerations indicated by the participants were valuation of environmental and natural resources, such as value of clean water, recreational and commercial uses, public perception of environmental values, direct economic and indirect impacts of the projects, awareness of the public and their preferences about the issues, and clear definitions regarding legal rights and responsibility of property owners.

In most cases, participants stated that wetlands impacts were more important considerations than social and economic aspects. It was generally noted, however, that in cases where wetlands impacts were low and/or when benefits from economic development were high, social and economic issues may be equally or more important. Of particular interest was the observation that social and economic issues would also be important when the costs of suggested alternatives were too high and unaffordable by the applicants.

Preliminary framework for incorporating social and economic considerations in wetlands decision-making process

On the whole, the study shows that social and economic issues, along with ecological aspects, are considered in the decision-making for wetlands. Issues related to environmental quality and natural resource values, costs of suggested alternatives, short-term and long-term benefits and costs to community members and property owners, and property owners' rights and responsibilities are of particular importance. While information about ecological and environmental impacts is largely available, social and economic information is still lacking. A framework for incorporating social and economic considerations in the wetlands decision-making process may be therefore a useful guide that can help identify necessary information, suggest means to obtain them and how to integrate them with ecological and environmental factors.

The preliminary framework presented in this report is based primarily on the issues observed through content analysis and those identified at the workshop. It emphasizes the importance of valuation of natural resources through inputs and participation from stakeholders, mainly property owners and community members. Stakeholder input is particularly significant to an assessment of non-market values of natural resources, and, more importantly, results in greater transparency and consistency in the resource management decisions (Barbier, 1994; Chuenpagdee et al., 2002). The proposed framework would be utilized only after the project has passed the "**necessary** economic development" threshold.

Step 1: Identifying social and economic issues

Through an exercise similar to that conducted at the workshop, stakeholders are involved in a process to identify social and economic issues that they consider important when making decisions about wetlands. A list of issues provided in Tables 2 and 4 can serve as a starting point or a checklist, allowing also for other issues to be added. A discussion process between stakeholders to share their points of view is conducted prior to prioritizing issues. An exercise is performed to indicate the importance of each issue, using a rating of 1 to 5, where 1 is least important and 5 is most important.

Step 2: Valuations of prioritized social and economic issues

The next step involves classifying prioritized social and economic issues identified in Step 1 into two types: (1) those directly related to market; and (2) those not directly related to market. The former includes issues such as number of jobs, property value, and cost of suggested alternatives, which can be assessed using monetary estimates. The latter are issues related to

environmental quality, aesthetic value and intrinsic value of wetlands, such as value for research and education, which are more difficult to value in monetary terms, as they are not directly traded in the market. The methodology described in this step allows these two types of issues to be considered in terms of their relative importance in the same framework.

Although ecological and ecosystem functions and services of wetlands should not appear as 'social and economic issues', the workshop results suggest that these issues also need valuation. These ecological values of wetlands can be assessed using methods, such as the changes in productivity, and those suggested by Barbier (1994), Farber and Costanza (1987), and Ruitenbeek (1994).

Monetary valuation of social and economic issues

Several economic valuation methods are available to provide monetary estimates of social and economic issues related to wetlands (see description in Freeman III, 1993). For example, cost of suggested alternatives can be obtained through project evaluation using cost-benefit analysis. Property value can be estimated using hedonic pricing method or contingent valuation based on willingness to pay.

Non-monetary valuation of social and economic issues

Similar to monetary valuation, several methods can be used to assess non-monetary value related to wetlands, such as measures of social well-being and multi-attribute choice approach (Gregory, 1987). We present in this report a non-monetary valuation approach, called 'damage schedule', developed by Chuenpagdee et al. (2001) (see Appendix 1). While the damage schedule approach does not offer 'monetary' value for wetlands, it is advantageous in its explicit incorporation of stakeholders' inputs and thus is most inline with the wetlands decision-making process for Virginia. As previously stated, the approach integrates monetary and non-monetary estimates in the considerations.

The damage schedule is a simple choice method that provides 'interval' ranking of relative importance of social and economic issues, as defined by various interest groups, based on their knowledge and values. The approach is based on the method of paired comparisons commonly used in psychological research for studies such as taste testing (David, 1988). The method involves presenting two objects (in our case, social and economic issues) at a time to a group of respondents whose task is to identify, for each pair, which issue they consider more important. Responses from each individual can be aggregated to provide importance score and scale of relative importance (see example in Appendix 2). Respondents in our case are local wetlands board members. Each individual member conducts the paired comparison exercise before discussing in a group and finalizing the scale.

Social and economic issues related to wetlands that have monetary estimates can be included in the list of objects for comparison, to provide monetary anchoring points to the importance scale for extrapolation and interpolation of monetary values for other issues whose values are difficult to estimate. Even without any monetary estimates, the importance scale can

still be used to assist local wetlands board members in their decisions about wetlands (see Step 3).

Step 3: Integrating ecological, social and economic considerations in wetlands decisions

This step integrates ecological impacts of wetlands (determined by VIMS), ecosystem and social and economic values of wetlands, and scale of relative importance of social and economic issues through a discussion process, where trade-off scenarios are made for each possible option and decisions are made according to desirable outcomes. For example, decisions to protect high value wetlands may forego social and economic benefits. Similarly, when wetlands impacts resulting from certain development is too high, it may outweigh social and economic benefits. In general, decisions should also be made to balance ecological importance of wetlands with private and public benefits. The discussion can be first among wetlands board members, and then extended to include participation from other stakeholders such as property owners and community members.

Future research needs

The results from the content analysis and the workshop suggest that social and economic issues are important when making decisions about wetlands. Wetlands board members and related county staffs generally agree that more information is needed to understand social and economic values of wetlands and that a mechanism to assist local wetlands board members to incorporate them in the context of wetlands decisions is desirable. The proposed framework requires participation from major stakeholder groups, particularly property owners, adjacent property owners, community members, and wetlands board members, and technical skills to apply valuation methods. The former is feasible as the current format of the local wetlands board suggests that a successful decentralized management scheme, through direct public involvement and transfer of responsibility from the State to local boards, is already in place. The latter will require training of personnel, including county staff, VMRC and VIMS scientists, who can then provide advice on social and economic values of wetlands ecosystems.

A test of this framework is needed and can be done through a participatory research to ensure collaboration between researchers and wetlands board members. Moreover, training on monetary and non-monetary valuation techniques should be conducted and an education program to promote environmental awareness should be promoted. Other applications of the framework for natural resource decision-makers (i.e. non-tidal wetlands regulation) can be explored once the framework is well-developed.

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Table 1 Number of applications analyzed, by wetlands group and project cost. (A) denotes applications that went to an appeal process.

	Wetlands group			
Project cost	1	2	3	**TOTAL**
<$15,000	11	14	2	27
	3(A)	3(A)	1(A)	
$15,000 - $49,000	7	6	3	16
		2(A)		
$50,000 - $100,000	4	6	2	12
			1(A)	
>$100,000	4	16	3	23
Unspecified	5	9	1	15
	1(A)	1(A)	1(A)	
TOTAL	31	51	11	93
Total with appealed cases	35	57	14	106

Notes: Localities included in the analysis are Accomack, Chesapeake, Essex, Gloucester, Hampton, Lancaster, Newport News, Norfolk, Northampton, Northumberland, Poquoson, Portsmouth, Richmond City, Richmond, Suffolk, Westmoreland, and York.

Table 2 List of social and economic issues based on the content analysis of the local wetlands board meeting minutes. The existence of these issues is marked as 'X'.

	Type of wetlands impacts			Project cost				
List of Issues	High value wetlands	Medium value wetlands	Low value wetlands	<$15K	$15-50K	$50-100K	>$100K	Unpsecified
Societal benefits								
- Project provides jobs		X	X		X	X		
- Increase aesthetic value			X			X	X	
- Necessary economic development		X						X
- Equitable benefits		X						X
- Improve environmental quality		X	X		X	X		
- Reduce traffic			X		X			
- Returning benefits to taxpayers	X	X		X				
Societal costs								
- Limited access	X		X		X	X		
- Traffic		X			X		X	
- Trash / debris	X	X			X	X	X	
- Overall impacts to property value		X					X	
- General costs to society	X					X		
Private benefits								
- Personal gains from project	X	X		X	X			
- Protect property from erosion	X	X		X				X
Private costs								
- Cost of suggested alternatives too high	X	X		X	X			
Adjacent property owners' concerns								
- Adverse impacts on property value	X	X	X	X	X	X		X
- Increase road traffic		X			X			
- Adverse impacts on natural resources		X			X			
- Growth beyond capacity		X			X			
- Reduced aesthetic value			X					X
- Effects on livelihood	X					X		
Concerns for ecological value								
- Impacts on wildlife (e.g. egrets)	X	X		X				X
- Impacts on wetlands value	X		X	X	X			
- Impacts on aesthetic value	X	X		X			X	

Table 3. Number of workshop participants, by locality or agency and by role.

Locality or Agency	Board members	Staff*
Chesapeake	3	1
Essex		
Fairfax	1	
Gloucester	2	2
Hampton	2	1
Isle of Wight	1	
James City	2	1
King & Queen		
King William	1	
Lancaster	1	1
Mathews	2	1
Middlesex	2	1
Newport News	1	1
Norfolk		1
Poquoson	2	1
Portsmouth	4	
Prince William		1
Richmond		1
Virginia Beach	1	1
Westmoreland	2	
Williamsburg		1
Virginia Marine Resources Commission		3
Planning District Commission		3
Total	27	21

* Some Planning District Commission staff service multiple counties.

Table 4 Issues identified by workshop participants as important in their decision-making process about wetlands projects

A. Issues identified as top priority

Environmental quality/natural resource value
Erosion protection of private property
Cost of suggested alternatives
Short and long-term benefits & costs to community members and to property owner.
CBPA/Maintaining buffer
Property owner's rights
Mitigation costs/success
Performance Bonds
Repair vs. Reconstruction

B. Issues identified as second priority

Societal cost/benefits
- Effects on neighboring property owners
- Issues related to water access
- Issues related to boat traffic
- Property assessment / raising taxes
- Number of jobs and employment
- Benefits to community members
- Flood protection
- Seafood industry value
- Cost of mitigation/compensation/restoration

Private costs/benefits
- Improve property value
- Private property rights
- Economic impact on homeowner
- Recreational use of private property-groins
- Commercial development
- Economic cost of project/application preparation cost

Ecological value
- Short & long term benefits/costs of natural vegetation
- Aesthetic value of the area

Trade-offs
- Private vs.community piers
- Aesthetics vs.cost

Legal and procedural issues
- Enforcement of laws varies by locality
- Lack of objectivity by local/state officials, boards
- Collection of fines not enforced
- Compliance of local gov't /exemption
- Jurisdiction awareness
- Illegal filling (increasing property)

Technological issues
- Shoreline cleanup
- Land use
- Siltation/dredging
- Dredge spoil disposal
- Technological improvements

C. Other issues discussed

Cost of relocating exisitng structure
Working around existing site conditions (landscaping)
Public access
Adjacent structures
Long term impacts to adjacent property owners
Maintaining viewshed
Community improvement as a result of development
Contractor recommendations (cost vs. value vs. impact)
Increase development infrastructure costs
Wetlands have resulted from erosion
Farms (surface runoff issues)
Political pressures
Adjacent development
Applicants ability to pay

Table 5 Currently used information, desirable information and importance of prioritized issues (list A in table 4)

Issue: Environmental quality/natural resource value		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Environmental information, such as flood control, water quality, wildlife, fishery resources, and micro-organisms from VIMS case reports, VMRC staff, wetlands guidelines and other reports, and resource management literature	- Socio-economic valuation of environmental issues, e.g., values of spartina marsh in terms of dollars/sq. ft.; value of clean water, recrational uses, property value and commercial uses	- Weltands is always first! But in general, if environmental quality is low wetland impacts are not as important when weighed against other issues. In many cases, these issues are of equal importance.
- Neighborhood perceptual value and property value	- Public perception of environmental quality and natural resource value	- Need information to consider socio-economic factors related to environmental quality. Such evaluation would tend to quantify and perhaps displace a judgement that is presently qualitative/subjective.
- Site visit or photos	- Acceptable level of erosion	
	- Tide range and water flow measure	
	- Scientific evidence of adverse and detrimental erosion	
	- More specific guidelines, particular from VIMS	
	- Relationship between maintaining wetlands and water quality	
	- GIS maps of water use tied to water quailty	
	- Baseline data for all bay/wetland habitats	

Issue: Erosion protection of private property		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Technical advice from VIMS/VMRC; SEAS; VIMS shoreline reports and shoreline assessments	- History of erosion at the site.	In general, equally important. It is more important when the wetland impact is minor and the erosion is significant, and less important when the wetland impact is great and the erosion is not presenting an immediate/significant problem.
- Topographic map, aerial photographs, location of project	- Case studies of similar problems/solutions.	The level of importance depends on: (1) positive/negative impacts to commercial activites (maintain or improve); (2) number of people to benefit; (3) water quality/protection
- Soil survey	- Comprehensive proposal/site plan	
- Personal observation	- Area of land disturbance	
	- Control measures (E&S)	
	- Specific potential impacts (with or without permit)	
	- Proposed stabilization	
	- Costs	
	- Economic impact	
- Erosion rate, impacts of erosion upstream and downstream	- Information about indirect impacts.	
- Parcel value - Location of project		

Table 5 (Continued)

Issue: Cost of suggested alternatives		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Historical estimates & reported estimated cost - Joint permit applications and building permits - Information from reliable contractors	- Objective estimates from industry and/or VIMS - Updated and current estimates - Longevity of method - Cumulative replacement costs - Permit/structure/method history of property	Equally important. More imortant if (a) more costly alternative resulted in less impacts; and (b) if applicant cannot afford more costly alternative.

Issue: Benefits and Costs (short-term vs. long-term) to both community members (livlihood of community members), and to adjacent property owners (property value).		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Determination of relevance, provided by staff, VIMS, VMRC and people at meeting. - Erosion rates - Zoning information and lot size - Conversations with/info provided by applicant	- Awareness of the community and their opinion about relevance of the issues - Prediction of fate/lifespan of wetland resource and method - Shoreline change maps	- More important when economic development benefit outweighs minimal impact. Less important when major wetland impacts and minor community benefit. Equally important when more benefit to community at large and less-benefit to few. Also, depends on whether future land use is known.

Issue: CBPA/Maintaining buffer		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- RPA Location - Permissable uses - Drawings and staff - Planning, zoning and land use - Topo maps and subdivision plots - Site plans and GIS - Field observations - Research by USDA and VA Tech, and soil surveys - Check other localities, Army Corps, VMRC, VIMS, CBLAD	- Practical alternatives (e.g. siting, drainage of land, alternative activities). - More educational materials and studies regarding the value of the buffer - Monitoring the water quality	Equally important when buffer and wetland impacts are similar. Less when activites encroach into wetlands, and when non-vegetated buffer adjacent to a highly functioning wetlands. More when buffer activity so intensive that it impacts wetlands, or, when wetlands permit adversely impacts buffer; and when highly functioning and vegetated wetlands occur as buffer.

Table 5 (Continued)

Issue: Property owner's rights		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Assessments - Information provided by property owners	- Specific information and clear definition regarding legal rights and responsibilities of property owners - Length of time applicant owns property - Intentions for land use	Wetland impact considered first and is primary factor: (a) if impact is major, property rights weigh less; (b) if impact is equal/minimal, property rights more highly considered.

Issue: Mitigation costs/success		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Past projects-cost/area - Publications showing cost scale (DCR E&S Handbook) - Project estimates	- Site specific data base from VIMS, Corp. of Engineers, VMRC, etc.	Equal-less importance if mitigation exceeds area lost.

Issue: Performance Bonds		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Past performance - Replacement of vegetation, when mitigation involved - Magnitude of project (by 1000 sq.ft.)	- Climatic and environmental variables - Past performance and work history - Impact on neighboring properties	- Equally important when impacts are either positive or negative, if work is done properly and in accordance with approved project. - Notes that impacts on environment (both negative and positive) depends on size of activity

Issue: Repair vs. Reconstruction		
Currently used information and sources	Desirable information	Importance of issue compared with wetlands impacts
- Whether or not structure is pre-existing (to what extent, erosion to existing structure, when damage occured) - Prior permits	- Uniform standards regarding repair vs. reconstruction. - Site visit.	- Less important. Difficulty of rebuilding a structure and its impact to wetland

Appendix 1. Letter of Invitation and workshop agenda.

Invitation to a Workshop

"Dollars and Sense in Local Wetlands Decision Making: The Role of Socio-economics"

The Virginia Institute of Marine Science's Center for Coastal Resources Management and Department of Coastal and Ocean Policy are sponsoring a workshop to be held on November 21, 2002 entitled "Dollars and Sense in Local Wetlands Decision Making: The Role of Socio-economics."

Virginia's tidal wetlands legislation states "In fulfilling its responsibilities under this ordinance, the board shall preserve and prevent the despoliation and destruction of wetlands within its jurisdiction while accommodating necessary economic development in a manner consistent with wetlands preservation' (28.2-1302).

Similar language appears in Virginia's nontidal wetlands legislation "whenever the Board considers the adoption, modification, amendment or cancellation of any standard, it shall give due consideration to, among other factors, the economic and social costs and benefits which can reasonably be expected to obtain as a consequence of the standards as adopted, modified, amended or cancelled" (62.1-44.15.3a).

The workshop will explore the use of social and economic considerations in decisions concerning Virginia's tidal wetland resource. We are inviting all local wetlands board members and staff persons, along with VMRC engineers and planning district commission staff. We hope you will be able to attend. Your experience with wetlands regulation will provide crucial input and allow for continued research and understanding of the use of socio-economics in wetlands decision-making.

The workshop will be held at the NERRS Conference Center on the VIMS campus. A continental breakfast and registration will begin at 0900. Lunch will also be included. See attached for the workshop agenda and directions to the VIMS/NERRS Conference Center. Please RSVP (804) 684-7380 or dawnf@vims.edu by November 15th.

Thomas A. Barnard, Jr.
Center for Coastal Resources Management

Ratana Chuenpagdee
Department of Coastal & Ocean Policy

Workshop Agenda for "Dollars and Sense in Local Wetlands Decision-Making"

Thursday November 21, 2002
Virginia Institute of Marine Science

0900 – 0930	Continental breakfast and registration (Lobby, Waterman's Hall)
0930 – 0950	Welcome – Tom Barnard (Auditorium) Project background – Kirk Havens Charge to participants - Ratana Chuenpagdee
0950 – 1000	Small break (participants walk to break-out session rooms)
1000 – 1130	Breakout Session 1: "Identify and prioritize social and economic issues"

Group Green:	Director's Conference Room
Group Red:	Pollock House
Group Orange:	DCOP Facility
Group Blue:	Sowers House

1130 – 1140	Small break (participants walk back to the Auditorium)
1140 – 1210	Report out from each group (Auditorium)
1210 – 1300	Lunch (Lobby, Waterman's Hall)
1300 – 1400	Breakout Session 2: "Incorporating social and economic issues in the decisions making process" (Participants go the same room, as in Breakout Session 1)
1400 – 1410	Small break (participants walk back to the Auditorium)
1410 – 1500	Report out and concluding session (Auditorium)
1500	Adjourn

Appendix 2. Description of the damage schedule and an example of its application.

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Environmental Damage Schedules: Community Judgments of Importance and Assessments of Losses

Ratana Chuenpagdee, Jack L. Knetsch, and Thomas C. Brown

ABSTRACT. *Available methods of valuing environmental changes are often limited in their applicability to current issues such as damage assessment and implementing regulatory controls, or may otherwise not provide reliable readings of community preferences. An alternative is to base decisions on predetermined fixed schedules of sanctions, restrictions, damage awards, and other allocative guides and incentives, which are based on community judgments of the relative importance of different environmental resources and particular changes in their availability and quality. Such schedules can offer advantages of cost savings and consistency over current methods, as demonstrated in the case of Thailand coastal resources.* (Jel Q20)

I. INTRODUCTION

While not the whole of the matter, many environmental policy and management issues center on the economic value of changes in environmental resources and amenities and much attention has consequently been focused on monetary assessments of their degradation or changes in their provision. These issues increasingly include assessing environmental damages, weighing of resource degradation with commercial gains, valuing the preservation of environmental assets and maintenance of resource productivity, and generally setting regulatory restraints in accord with community preferences and objectives—issues that largely involve environmental losses and mitigation of losses. However, current methods of estimating monetary values often remain limited and there is little widespread agreement that they provide dependable and consistent valuations (Binger, Copple, and Hoffman 1995; Kahneman, Ritov, and Schkade 1999), particularly in the case of environmental losses, or reductions in losses, for which the compensation measure of value rather than the willingness to pay measure is appropriate (Knetsch 1990, 1997).

An alternative to allocating resources and setting damage awards on the basis of estimates of monetary values, is to base damage assessments and allocative guides on predetermined fixed schedules that reflect community judgments of the relative importance of different environmental assets and particular changes in environmental resources. Such schedules would detail an array of sanctions, restrictions, and monetary damage awards, which would vary depending on the importance of different losses resulting from the impacts of activities or developments on the natural environment. The use of such damage schedules could be far more universally and less expensively employed than current methods, and could provide more consistent deterrence incentives, restitution for harms, resource allocation guidance, and greater fairness of similar treatment of similar losses (Rutherford, Knetsch, and Brown 1998; Kahneman, Ritov, and Schkade 1999).

The efficacy of a damage schedule scheme is to a large extent dependent on the assessment of community preferences with respect to changes in environmental and resource values. The following reports a test of this. The sections, first outline the advantages and limitations of use of damage schedules, especially as compared to current practices; second, examine the use of paired comparison methods as a means of assessing community preferences on which damage schedules

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might be based; and third, report the results of a case study in which scales of the importance of coastal resource losses in Thailand were elicited by this method.

II. COMMUNITY PREFERENCE-BASED DAMAGE SCHEDULES

Damage schedules do not provide, nor are they intended to provide, monetary measures of value. Yet, even based on more limited assessments of community preferences, schedules may provide transparency, ease of implementation, and most, though not all, of the benefits of monetary valuations, without many of the disadvantages such as the often quite arbitrary and variable assessments resulting from use of current non-market valuation methods. Further, the disadvantages of a seeming lack of more precise valuation may be of little importance in actual practice.

While individuals appear to be unable to assign consistent monetary measures to environmental losses, in large part because of the seemingly inherent insensitivity of people's responses to the quantity dimensions of particular losses at issue and to the context dependence of values (Kahneman, Ritov, and Schkade 1999), respondents are able to provide less demanding assessments of relative values with high levels of consistency (Kahneman, Schkade, and Sunstein 1998). Damage schedules require only the latter; they can be based on assessments of community preferences derived from more easily obtained choices of the relative values of various losses without requiring people to assess such impacts in monetary terms. Such empirical support for damage assessments and weighing of environmental trade-offs is likely to be more consistent with community preferences and objectives than most present strategies, including those based on monetary estimates of people's willingness to pay for losses, negotiations between interested parties, and the often arbitrary resolutions imposed by tribunals.

Damage schedules can provide greater predictability by specifying remedies in advance, rather than after, an event or a change such as an oil spill or degradation of wildlife habitat has taken place. This advanced knowledge can provide more effective and efficient deterrence incentives because people responsible for potential losses would be more aware of the consequences of their actions, thus allowing them to undertake appropriate levels of precaution.

Similarly, enforcement of sanctions would likely be easier because once liability is established in any particular case, the consequence is foretold from the predetermined schedule, rather than being the uncertain result of self-serving data collection, attempts to discredit methods, and contentious adjudication. For many of these same reasons, the costs of using damage schedules should be much lower than those encountered with present practices. Once a schedule is implemented, improvements can be made as new information is brought forward, but there is then no need for new assessments and challenges for each incident or activity as it occurs. Also, initial schedules can be based on sanctions for a relatively few harms, and then expanded as more harms are encountered by interpolating and extrapolating from those assigned previously. In this way, similar to other scheduled damages such as those used to define compensation for workers' injuries, increasingly comprehensive schedules could be developed that would assign remedies to each harm that is appropriate to its importance relative to other losses.

Predetermined schedules of sanctions should also better serve horizontal equity goals as greater similarity of treatment of similar losses will likely result (Sunstein, Kahneman, and Schkade 1998). Present after-the-fact valuations often lead to erratic assessments of similar losses, the product of unreliable methods, differences in protocol, and often in the case of contingent valuations, the arbitrary decisions of how many people's loss over what geographic area are to be "counted" in any particular assessment. They also vary as a result of the inherent difficulty people have in assigning monetary sums to particular resources or changes in their quality or availability. This difficulty was recently demonstrated when a large sample of individuals was found to strongly agree on the relative severity of a series of personal and other injuries, but reached very erratic judgments of the punitive damage

awards that should be imposed for each—"the consensus breaks down, however, when jurors are asked to express punitive intent in dollars." (Kahneman, Schkade, and Sunstein 1998, 50).

As damage schedules do not yield accurate valuations of environmental losses, the goal of completely optimal allocations and perfectly efficient deterrence cannot be fully met by their use. Although attractive in principle, this level of certain guidance is not usually a realistic alternative as current methods are incapable of providing such estimates. Each approach has limitations of its own that preclude any such expectation, but beyond the shortcomings of each technique, each is at best used to provide willingness-to-pay measures of loss, rather than the more appropriate compensation demanded (or willingness-to-accept) measure (Rutherford, Knetsch, and Brown 1998). Further, monetary estimates are not normally determinate of specific sanctions and resulting incentives even when they are available.[1] Thus the presumed disadvantage of using the more modest guidance of damage schedules rather than monetary valuation may be more illusory than real. And, as Epstein (1995, 39) suggests in discussing the alleged disadvantage of an analogous alternative legal reform, "The relevant comparison between simple and complex rules should be conducted not in the language of aspiration, but in the language of realizable achievement."

Loss assessments and compensation payments serve other important social purposes in addition to directing resources to more efficient uses. And these are by and large even less demanding of accuracy. One such purpose, for example, is to provide some form of social or corrective justice for a loss. For this, it is more important that people see that environmental resources are not taken to be without value and to be disregarded accordingly, but instead have real worth that is recognized by some form of protection and sanctions that attend their degradation—and the more automatic the attendance, the better. Or, parallel to cases of pain and suffering to individuals, it is often important to provide a means of redress. And as suggested by Radin (1993, 60): "Requiring payment is a way both to bring the wrongdoer to recognize that she has done wrong and to make redress to the victim. Redress is not restitution or rectification. Redress instead means showing the victim that her rights are taken seriously." More important, goals of corrective justice and redress, and ones of providing solace to victims, can largely be met by sanctions and damage awards that need only to be widely seen to be roughly correlated to the severity of the transgression; they do not require an accurate assessment of the monetary value of each loss. Damage schedules may well better serve these purposes by providing more predictable, prompt, and consistent assessments than other approaches.

A further perceived disadvantage of the use of guides such as damage schedules is that these are seen to be based on evidence of relationships that are more generic and more relevant to general classes of cases and less applicable to each individual case. Among the reasons for this bias against use of such more general models are an inflated belief in the accuracy of case-by-case decisions, fears of errors being made in the implementation of more general rules, and the difficulty people have in accepting some level of error associated with the application of a general remedy to a specific case (Payne and Bettman 1992). However, numerous studies have shown that judgments are usually better when "formulas" are used rather than reliance on individual determinants of each case (Dawes, Faust, and Meehl 1989; Payne and Bettman 1992). While there is yet little evidence for the case of environmental loss damage schedules, there appears to be little reason to expect more rather than less case by case inconsistency here as well.

Schedules or their equivalent, have of course been used and accepted in other areas in which specific assessments of the value of losses is difficult or expensive. A somewhat analogous case is the widespread use of scheduled awards for injuries used in most workers' compensation schemes. While usually initially designed to compensate for pe-

[1] For example, Exxon apparently agreed to pay less than one billion dollars ($1.15 billion payable over eleven years) for the natural resource damages caused by the Exxon Valdez oil spill, even though a contingent-valuation study indicated lost existence values *alone* were $3 billion (Portney 1994).

cuniary losses, such as lost wages and medical expenses, most have been implicitly or explicitly extended to cover non-pecuniary losses such as pain and suffering as well. And although the specified sums are not taken to reflect the value of such losses to individuals, they do reflect relative values and are therefore widely accepted and achieve many of the efficiency enhancement and other goals of sanctions. Another similar case of an effective and efficient means of getting many of the benefits of accurate valuations when such assessments are impossible or costly to obtain is the use of liquidated damage clauses in contracts. In such cases, the parties voluntarily agree in advance to a preestablished payment in the event of a breach. Damage schedules, or replacement tables, have also been used for environmental losses, but essentially all instances of such use have been limited to minor harms—usually small oil spills—and the sanctions have typically been based on notions of replacement costs or on fairly arbitrary legislative directives rather than on some empirical assessment of community preferences regarding the importance of different losses (Rutherford, Knetsch, and Brown 1998).

III. DERIVING SCALES OF IMPORTANCE

To a considerable degree the efficacy and advantage of widespread use of damage schedules is likely to depend on the extent to which the damage sanctions or incentives incorporated in them clearly reflect changes in social well-being associated with the change in environmental quality. The usefulness of the approach will be greater if consistent judgments of environmental importance can be elicited that provide more accurate signals of community preferences.

Indicators of community preferences might be formulated in several ways. One relatively simple means which at this point seems most promising, and provides a high degree of transparency, is to elicit scales of relative importance of environmental changes by means of paired comparison surveys (Peterson and Brown 1998). Paired comparison is a well-established psychometric method for ordering preferences among objects of interest (Fechner 1860; Kendall and Smith 1940; David 1988). The method involves presenting binary choices for a set of objects—gains, losses, activities, or whatever is being scaled—to each respondent. For example, if three objects, x, y, and z, are being compared, there are three possible paired comparisons: (x vs. y), (x vs. z), and (y vs. z). If the number of objects is not too large, each respondent can be presented with all possible pairs of the objects.[2]

While varying methods may be used to summarize the respondents' choices among the pairs, the most straightforward is to express them as a function of the frequency with which an object is preferred to (or considered more important than) other objects in the choice set. One way to report this frequency, used in the study reported here, is in terms of the proportion of times that an object is chosen relative to the maximum number of times it is possible to be chosen by all individuals in the sample (Dunn-Rankin 1983). If there were, for example, ten people judging three objects, then any one object could be chosen as being most important a possible 20 times (twice for each individual). As all objects are paired an equal number of times, each object has the same probability of being selected. The proportion indicates the collective judgment of the relative importance of the different elements being compared. Multiplying this proportion by 100 eliminates the decimals, yielding a scale from 0 to 100.[3]

The paired comparison procedure provides an indication of the relative importance of the items being compared, to the groups represented by the individuals taking part in the survey.[4] The results of an exploratory

[2] For each individual, the total number of possible pairs of n objects is: $n(n - 1)/2$. It is possible for each judge to be given only a portion of the possible pairs.

[3] Strictly speaking, this scaling procedure yields an ordinal scale of preference, but if the number of respondents is sufficiently large the scale can approximate an interval scale. More sophisticated scaling procedures, such as those proposed by Thurstone (1927) (see also Torgerson 1958), yield a theoretically correct interval scale measure. The two approaches usually produce scales that correlate nearly perfectly with each other (Dunn-Rankin 1983).

[4] Each respondent, unlike contingent-valuation and other valuation methods, provides numerous judgments

study of the effects of oil spills on four different environments illustrate the procedure. Each of 57 respondents—graduates of a resource management program—was asked to select the more important loss from each of the six possible pairs of the four habitat impairments caused by a spill. On the basis of their choices, a 0 to 100 scale was developed indicating the relative importance of the four losses. The scale values were 91 if the spill occurred in a productive marsh area, 57 if in a deep bay, 48 on an ocean beach, and 4 if on an outer continental shelf (Rutherford, Knetsch, and Brown 1998).

A concern with the elicitation of preferences among objects sufficiently different as to prompt differing attitudes or emotions, is that individuals may feel that the objects are incommensurate. This is frequently cited as a problem for people asked to accept monetary sums in exchange for suffering an environmental loss (or even to pay money to avoid such a loss)—some people consider such environmental losses incommensurable with money. However, judgments of the relative importance of even widely different kinds of losses may avoid this incommensurability concern. As Sunstein (1994, 798) concludes:

> We might also believe that goods are comparable without believing that they are commensurable—that is, we might think that choices can be made among incommensurable goods, and that such choices are subject to reasoned evaluation, without believing that the relevant goods can be aligned along a single metric. . . . Both people and societies do make choices among incommensurable goods, and they do so on the basis of reasons.

Consistent with this view, people do seem to make choices over wide ranges of possible changes, not only in their daily lives, but in paired comparison surveys. In one test of this, different groups of respondents were faced with: (1) pairs of disparate environmental losses; (2) pairs of personal injuries; or (3) pairs that included *both* environmental losses and personal injuries. The evidence suggested that respondents in the third group had only slightly more difficulty in choosing between pairs than the other two groups (Gorter 1997).

Individuals are not expected to be perfectly consistent in their choices. Inconsistent choices, which result in circular triads, may occur because of mistakes, systematic intransitive choice, or random choice in cases too close to call. Systematic intransitive choice is more likely when alternatives are multidimensional so that the prominence of different attributes or dimensions may vary depending on the objects being compared (Tversky 1969; Kahneman, Ritov, and Schkade 1999). Close calls occur when two objects are considered of equal or nearly equal importance, such that one may be chosen over the other in some comparisons, and the other chosen at other times. Peterson and Brown (1998) concluded that the great majority of the circular triads in their data were due to close calls.

IV. AN APPLICATION AND TEST

The usefulness of paired comparisons to assess the relative importance of environmental changes is at least in part a function of the ability of individuals representing relevant reference groups to make sufficiently consistent choices to provide a useful scaling on which schedules can be based. A test of such an ability to make meaningful choices among a variety of realistic resource losses was conducted for both formal experts and actual users of natural resources in Phangnga Bay, a coastal area of southern Thailand.

Like other Thai coastal regions, Phangnga Bay is rich in resources but faces problems associated with the rapid increase in population and economic activities that bring about conflicts among resource users. Dominant coastal ecosystems are mangroves, coral reefs, and seagrass beds (Chansang and Poovachiranon 1994). Many rivers flow into the bay and supply it with nutrients and minerals, making the bay an important spawning ground, nursery area, and habitat for many economically important species including marine shrimps, lobsters, crabs, clams, Indian mackerel, and pomfret. Several species of molluscs and crustaceans inhabit the remaining old growth stands of mangroves. Fishing has been an important activity in the area, but catches have declined with over-

thus adding to the internal consistency of the resulting scale.

fishing and resource degradation. Coastal aquaculture involving black tiger prawns, cockles, oysters, and cage culture of snapper and groupers has become an important activity in the past decade. Developments of residential housing, tourism related facilities and businesses, and a variety of industries along the coast, have become major sources of economic activity and change, and have become increasingly competitive uses of coastal resources.

Paired comparisons can be used to derive two types of scales of importance on which to base damage schedules. The first is to select a series of specific resource losses, such as a specified fish or mangrove loss, and have participants select the loss in each pair that they feel is the most important. The second is to select a series of activities, such as an oil spill or hotel construction, that gives rise to resource losses and ask respondents to select the activity they feel will give rise to the more serious resource losses in the instances described. The first has the advantage that the scale of importance applies directly to the resource loss at issue, and damages or other sanctions could be based on this loss in accord with a pre-existing schedule. This option, however, requires field investigation of the extent of the resource loss (or losses) occurring because of an event or activity. The alternative schedule for events or activities would base damage awards or other sanctions on the particulars of the event, such as the size and location of an oil spill, regardless of the actual losses caused by the spill.

The results of the paired comparison study of specific resource losses in Phangnga Bay are reported here.[5] The eight specific resource losses used in the paired comparison survey were developed from personal visits to the area, interviews of resource users and other residents, discussions with resource managers and government officials in the area, and the results of an extensive pre-test of the survey. The losses include two levels of damage to four important resources in the area and are as follows:

1. partial damage to sandy beaches;
2. severe damage to sandy beaches;
3. severe damage to mangrove forests;
4. clear-cutting of mangrove forests;
5. partial damage to sea grass beds;
6. severe damage to sea grass beds;
7. partial damage to coral reefs; and
8. severe damage to coral reefs.

In each case, detailed information was provided on the nature and productivity of the resource, extent of the human-caused damage at issue, expected changes in the level of productivity due to such losses, and the length of the likely recovery time for the resource loss to be eliminated in those cases for which this was possible. For example, in the case of partial damage to coral reefs, the importance to marine organisms and recreation and natural beauty were outlined before informing respondents that this loss would reduce the resource productivity by half, and that it would take from 6 to 10 years to recover to previous levels.

Two main samples of respondents were used, one of experts and one of resource users or "layexperts." The former included researchers, academics, administrators, and other government officials with experience and knowledge of the area and the resources at issue. The list of formal experts was based on a registry of the National Research Council of Thailand, and suggestions of known experts on the resources of the area. The layexperts included people living in the area and dependent for the most part on the resources. Quota sampling of individuals willing to participate was used to obtain reasonably comparable separate sub-samples of (1) fishers; (2) shrimp farmers; (3) people in tourism-related businesses; and (4) others living in the area whose dependence on coastal resources was less specific. Convenience samples of respondents from these four occupation groups in the immediate Phangnga Bay area were selected.

Each participant was given a set of paired losses with each pair presented on a separate half sheet of paper and presented side-by-side. The half sheets with each of the individ-

[5] The results of a parallel study using a series of events, such as expansion of shrimp farming, housing development, and oil spills, are summarized in Chuenpagdee, Knetsch, and Brown (in process).

TABLE 1
SCALE VALUES OF RESOURCE LOSSES IN PHANGNGA BAY

Resource Loss	Total	Formal Experts	Lay Experts	Fishers	Shrimp Farmers	Tourism	Others
Clear-cutting of mangrove forests	83	85	83	84	81	80	84
Severe damage to coral reefs	78	83	76	73	76	79	76
Severe damage to mangrove forests	66	62	67	72	67	64	65
Partial damage to coral reefs	54	59	53	51	53	56	51
Severe damage to seagrass beds	44	51	42	42	41	45	41
Severe damage to sandy beaches	40	31	43	41	44	41	47
Partial damage to seagrass beds	20	24	19	18	20	23	16
Partial damage to sandy beaches	15	6	17	19	18	12	19
N	221	51	170	45	40	39	46
Kendall u	0.4683	0.5525	0.4523	0.4667	0.4267	0.4644	0.4401
Observed chi-square	2,912.50	801.49	2,168.40	602.93	494.00	522.15	582.52

ual pairs were arranged in random order, and the losses in each pair were randomly ordered to avoid any bias due to sequencing and location of the losses on the sheets. A reference table listing each resource, the magnitude of loss, and recovery time was provided along with a map of the area. For each paired comparison, participants were asked to choose, "the more important loss, not only to yourselves, but also to the environment, to the economic and social values of the community, and to the future of the area." Instead of the 28 possible pairs of the eight losses, the questionnaires excluded the three obvious pairs in which a more severe loss was compared to a less severe loss of the same resource—with the assumed answers included in the results.[6] Participants in the five samples—the experts, and four groups of layexperts—were asked all of the 25 paired comparison questions.

The results of the paired comparisons from the 221 respondents who completed the survey are summarized in Table 1, in which the scale values for all of the eight losses are listed for each sub-sample and for the totals. The most striking finding is the close correspondence of the scale values across the different sub-samples. Not only did resource users generally give similar scale values as did the experts, but the scale values among the sub-groups of users did not vary widely despite the differing self-interests of the different occupational groups. All sub-samples, for example, considered clear-cutting of mangrove forests to be the most important loss, followed by severe damage to coral reefs. There was, furthermore, relatively close agreement among sub-groups of respondents on the differing importance of each of the other losses. This is indicated by the high Kendall u values, which measure the degree of agreement in the preferences among individuals. The null hypothesis, that there is no agreement among the respondents, was rejected in all sub-samples, which generally means that in this case of resource losses in Phangnga Bay, there was significant agreement among respondents, both in the total sample and in all sub-groups.

The close correspondence of the scale values for the eight individual losses among the various subsamples is further evident in the high correlation coefficients (Table 2). These results illustrate a further property of the paired comparisons as their being analogous to providing respondents with a category or bounded scale, which has been found to yield far more consistent judgments—reflecting the apparent wide sharing of norms—than

[6] The comparison between severe damage to mangrove forests and clear-cutting of mangrove forests was left in the questionnaire since it was not certain how respondents would rate the relative importance of these losses.

TABLE 2
PEARSON CORRELATIONS OF SCALE VALUES OF RESOURCE LOSSES IN PHANGNGA BAY

			Lay Experts			
	Formal Experts	All Lay Experts	Fishers	Shrimp Farmers	Tourism	Others
Formal	1.0000	0.9586	0.9409	0.9541	0.9850	0.9349
Fishers	—	—	1.0000	0.9933	0.9738	0.9985
Shrimp farmers	—	—	—	1.0000	0.9886	0.9954
Tourism	—	—	—	—	1.0000	0.9764
Others	—	—	—	—	—	1.0000

elicited responses based on unbounded magnitude scales (Sunstein, Kahneman, and Schkade 1998).

Although the results indicate a significant level of agreement among respondents in the scale values of resource losses and the significant correlation of values of the relative importance among different groups of respondents, Kruskal-Wallis one way analysis of variance on *ranks* was performed to further test if different groups of respondents were from the same population. The results showed that formal experts differed from three groups of resource users only in their rankings of the importance of partial damage to sandy beaches and with two groups of users for severe damage to beaches. The four groups of layexperts generally agreed in the rankings of all resource losses—an indication that they did not act strategically in favoring resources of particular interest to them.

Two further tests were performed on the scale values of the aggregate responses from all groups. The critical range test helps determine if the two choice scenarios come from the same population of stimuli, and the scalability index is used to quantify the ability of different groups of people to distinguish among these scenarios (Dunn-Rankin 1983). If the difference in the aggregated preference scores of any two choice scenarios is greater than the critical range at the accepted level of probability, the two scenarios can be taken to be significantly different. A positive result provided by this test, together with the high scalability index, leads to the conclusion that the scenarios are sufficiently different that respondents should be able to distinguish among them. On the other hand, when the difference between the two choice scenarios is not significant, this suggests they share some common features and thus could be grouped together as having similar overall importance, though it does not imply that they are otherwise equal. The results showed a very high scalability index of 0.858 for Phangnga Bay, and that out of 28 pairs of comparisons, only four pairs fell within the critical range. Although we concluded that most pairs of the resource losses presented to respondents in the study were substantially different from each other and that respondents were able to distinguish between them, it might still be helpful to suggest groupings of these losses to ease the process of mapping different policy responses onto the importance scale. Figure 1 shows three levels of importance on the importance scale, indicating that resource losses within each level were not significantly different from each other and might be treated with similar policy responses.

In sum, each of the groups of layexperts was able to provide consistent scale values for a range of coastal resource changes, and further, their judgments of the relative importance did not differ greatly from those of a group of experts. This high level of agreement lends increased credence to schedules based on these distinctions. Also, this level of agreement made it possible to use the responses from all respondents, expert and layexpert together, as a basis for a single importance scale. As the scale values were already normalized, they could be directly arrayed on a 0 to 100 importance scale, as in Figure 1, representing the different losses and the respondents judgments of their importance.

An illustrative damage schedule was con-

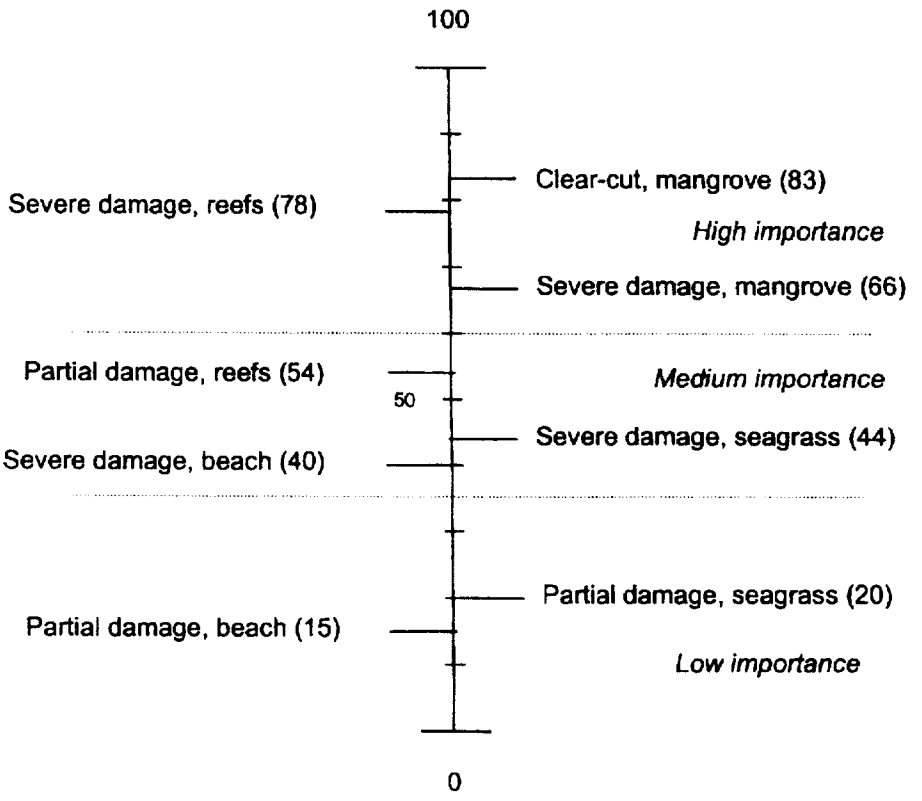

FIGURE 1
SCALE OF IMPORTANCE OF RESOURCE LOSSES IN PHANGNGA BAY

structed based on this importance scale. In general, this process involves assigning different policy responses to these losses according to their level of importance. Figure 2 is an example of a loss damage schedule for Phangnga Bay. If damage payments are to be charged for the damage to these resources, the highest payments would be made for clear-cutting of mangroves, a relatively high damage assessment would be applied to partial damage to coral reefs, a lower payment would be levied for severe damage to seagrass beds, and so forth.

In general, the scale values do not provide an automatic set of sanctions, but they do provide a guide to formulate sanctions, including damage payments, and to design other policies regarding competing uses of these resources which are consistent with an empirical reading of the relative importance of various losses by members of the community. For example, absolute prohibitions or more onerous sanctions might be adopted to severely restrict losses judged to be of the highest importance, such as the clear-cutting of mangrove forests and severe damage to coral reefs. Somewhat less serious losses, such as partial damage to seagrass beds and to sandy beaches, might be subjected to somewhat less stringent restrictions or high damage payments to discourage their loss, but to allow compromise and accommodation in cases of extremely valuable alternative uses. Losses considered by the community as being increasingly less serious might be made subject to notable but successively more lenient restrictions and smaller damage assessments. And in the cases of losses judged to be trivial, an absence or near absence of sanctions could reflect this valuation.

The variable sanctions and damage payments in the design of the damage schedule should make these restrictions more consistent with community judgments of the importance of various losses. This should encour-

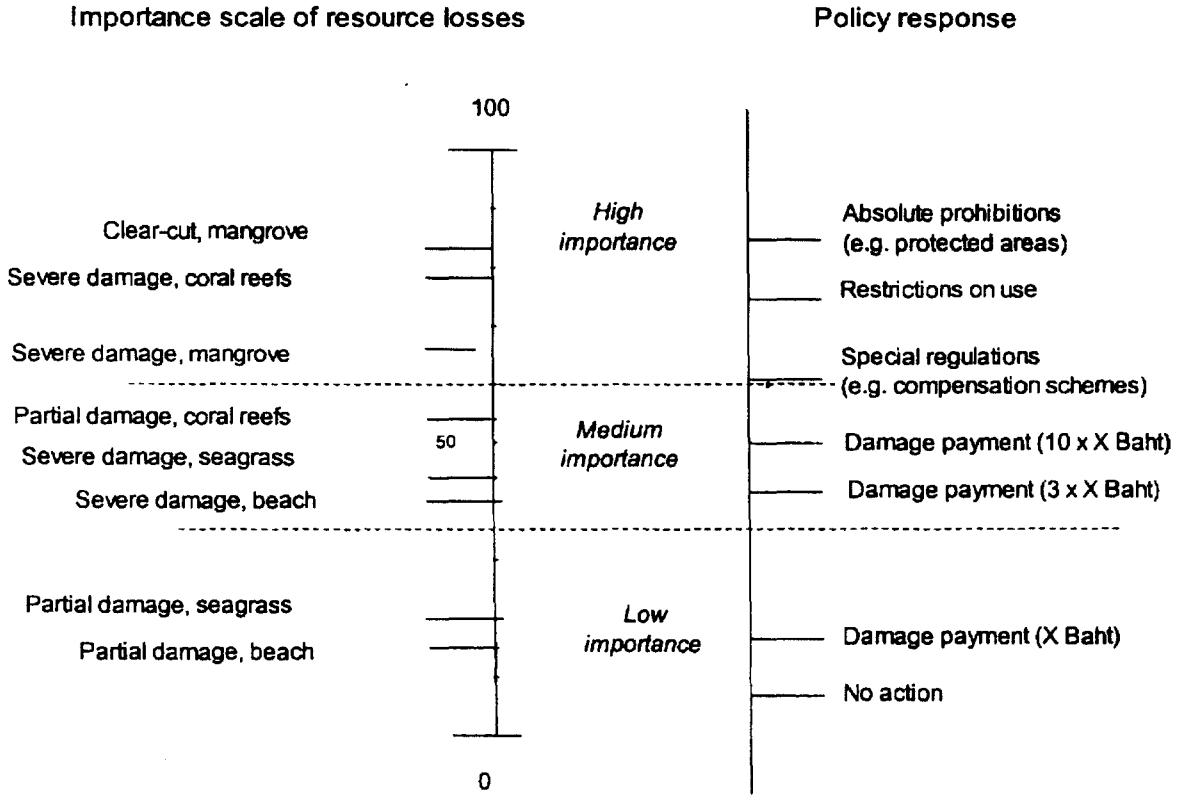

FIGURE 2
ILLUSTRATIVE DAMAGE SCHEDULE FOR PHANGNGA BAY

age more efficient allocations in light of other community goals. As sanctions are set in advance, competing uses of resources would be directed to locations and modes of operation that would take greater account of the full costs of these uses, and restitution would be provided that would be more in keeping with the losses sustained. Further, the sanctions in damage schedules could reflect the disparity in people's valuations of gains and losses and could be adjusted to account for evidence on sums necessary to achieve deterrence and other desired social objectives (Sunstein, Kahneman, and Schkade 1998).

V. CONCLUSION

The mapping of scales of relative importance from, for example, a paired comparison survey, is, like workers' compensation award schedules, with which they have much in common, not an automatic translation nor without the need for somewhat arbitrary assignments. However, in practice, this might well be much less so than the current resolutions. It appears not only possible but likely, based on the results of the Phangnga Bay study, that useful damage schedules can be constructed based on empirically based importance scales so that the damages and sanctions specified by the schedule impose more severe sanctions on what are widely judged to be more serious harms, and lesser sanctions on less important losses.

The schedule represents only approximations of cardinal measures of the social worth of environmental resources, but it does allow policy responses, incentives, and compensation remedies to be tied to internally consistent community judgments of the relative costs or importance of different changes. Further, in much the same way as workers' compensation schedules are developed, more extensive schedules can be developed over time by establishing the relative importance

of subsequent changes as they are encountered by interpolation and extrapolation from scale values of those previously assessed.

The use of damage schedules based on people's judgments of relative importance of environmental changes is unlikely to lead to optimal deterrence and maximum efficiency in the allocation of environmental resources. But the alternative is realistically not one that provides this. And for many purposes, including providing socially useful incentives and dependably consistent compensation, this is not a necessity, as long as sanctions and incentives are in accord with the relative importance of changes.

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