ASSESSING PERCEPTIONS ABOUT ECOSYSTEM HEALTH AND RESTORATION OPTIONS IN THREE EAST COAST ESTUARIES

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Abstract. Increasingly public and governmental agencies are concerned about revitalizing coastal environments. Understanding how the public uses these areas, and what they see as the most important improvements to these regions is critical to their assessment and management. Uses of three estuaries, and perceptions of possible management and restoration options, were examined for people who were interviewed in the New York/New Jersey Harbor, Manasquan Inlet, and Barnegat Bay, New Jersey. Nearly 90% of the people interviewed listed pollution as New Jersey's most important environmental problem. Most people (68%) used the habitat for outdoor sports, but rated communing with nature, walking, and the provision of open 'green' space as the most valued uses. Pollution prevention was the most often mentioned habitat improvement desired, and people rated removing pollution, cleaning up garbage, and creating more fish breeding habitat the highest. There were significant locational differences in how people used the estuaries, and in how they thought they should be improved. People from Barnegat Bay ranked most uses higher than did people from elsewhere, while the people from Manasquan Inlet rated the importance of most remediation and restoration actions higher. Many of the improvements fall within environmental management, including (rank order from high to low) creating more fish breeding habitat, improving native vegetation, improving habitat for birds, increasing plant diversity, improving habitat for butterflies, and enlarging adjacent marshes. The data provide clear support for the importance of these coastal habitats for communing with nature and having open 'green space' spaces, and for providing recreational opportunities. To enhance their value, people want to remove pollution and improve both the habitat quality and the educational and recreational facilities.

Keywords: assessment, attitudes, ecosystem health, estuaries, monitoring, restoration

1. Introduction

Management and restoration of estuarine environments is gaining in importance as more people live and/or concentrate recreational activities along coasts, adding pressures to limited coastal lands. Overall, the majority of people in the world live within 100 km of bays and estuaries, making the wise use of these habitats essential (Norse, 1993; NRC, 1996). The intrinsic value of native biodiversity is clear to some (Bengtsson *et al.*, 1997), but not to others that use coastal environments. Understanding how people use coastal environments, whether they value natural resources, and using tourism and recreation as drivers for sustainable development can provide one tool for monitoring and assessing biodiversity (Gale, 1991; Cairns



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and Pratt, 1995; Higgs, 1997). Recreationists can sway environmental policy, thus influencing ecosystem management and habitat protection (Haeuber, 1996).

The Americas have far more hectares of land protected per length of coastline than any other region of the world (Hammond, 1990; Roberts, 1996). North and South America also have a relatively low number of urban cities (population of over 500 000); the Americas have one large coastal city for every 4208 km of coastline, while the rest of the world has one for every 2845 km of coastline (computed from Hammond, 1990). Society may believe that it is important to maintain the undisturbed coastline we have. Maintaining and preserving coastal environments ultimately depends on the support of the public and their elected officials, which in turn requires stakeholder input concerning how people use the land and resources, and how they would like to see it managed or improved (Commission on Risk Assessment and Risk Management, 1996).

In this paper I examine the attitudes and perceptions of people inhabiting estuarine and coastal areas of New Jersey to determine their evaluation of environmental problems, land and resource uses, and importance of improvements to the habitat. I was particularly interested in whether people in a highly-populated and industrialized region (the Newark Bay complex of the New York/New Jersey Harbor) had different valuations than people in relatively undisturbed coastal bays and estuaries with little industrialization (Manasquan Inlet, Barnegat Bay). These areas also differ in other important aspects, such as ethnic composition, economic well-being, and population density.

O'Connor *et al.* (1994) examined the quality of life in southern coastal New Jersey and reported that citizens felt threatened by over-development and a lack of regional planning. Further, they indicated a willingness to pay for greater maintenance of open 'green' space and the provision of recreational opportunities. Their study was descriptive, without providing any quantitative evaluation of attitudes or perceptions, nor were comparisons made between alternatives. In the present report, subjects provided ratings for various alternatives, allowing managers to assess the relative importance of different uses and management options. Some of the options involved traditional restoration (restoring habitat for birds, fish and butterflies, removing exotic plants), while others were societal (more police) or recreational improvements (building boardwalks and fishing piers).

While environmental managers have mainly dealt with the botanical aspects of restoration, and less so with the animal components of ecosystems, even less attention has been paid to the human dimensions of ecosystem monitoring and management (Bradshaw and Chadwick, 1980; Handel *et al.*, 1994; Higgs, 1997; Montalvo *et al.*, 1997). Yet these aspects often determine both the degree and nature of management and restoration. Small changes in human dimensions can have large-scale effects on the structure and functioning of ecosystems (Cairns and Pratt, 1995), making it imperative that we understand how people view such changes. This papers illustrates a strong commitment on the part of the users of coastal environments to restore some aspects of the natural environment. Further,

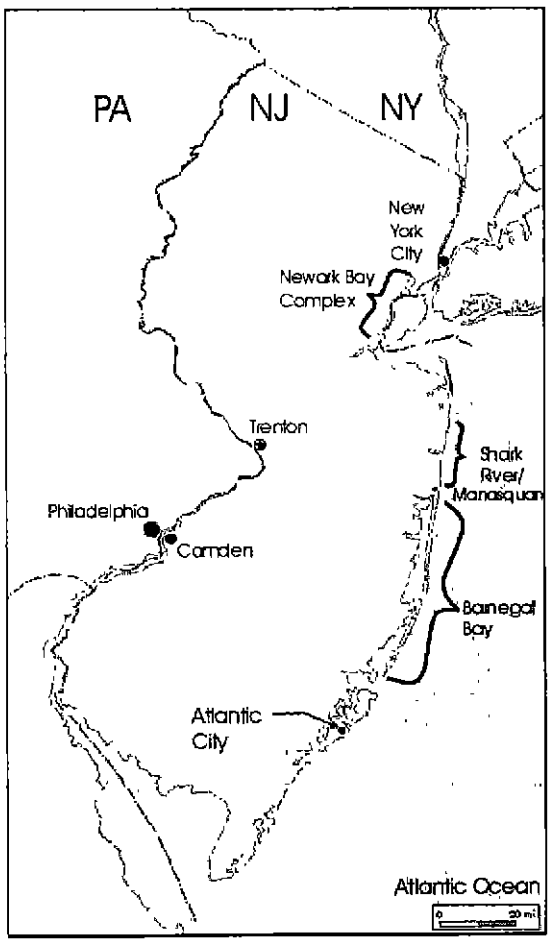


Figure 1. Map of New Jersey showing the areas surveyed.

I suggest that understanding the views and attitudes of the public toward environmental management and restoration is a form of environmental monitoring and assessment that has been largely ignored by environmental scientists.

2. Methods

2.1. Study areas

People were interviewed in three areas of New Jersey: the Newark Bay Complex of

the New York/New Jersey Harbor, Manasquan Inlet and Shark River, and Barnegat Inlet (Figure 1). The Newark Bay Complex includes the Passaic River, Hackensack River, Newark Bay, Arthur Kill and Kill van Kull. The Greater New York Estuary, including the Newark Bay Complex, is one of the most polluted in the United States (Ayres and Rod, 1986; O'Connor and Ehler, 1991; Squibb, 1992), and there are a number of angling advisories promulgated by both New York and New Jersey (NJDEP, 1994; NYSDOH, 1994). Both states have issued consumption advisories for blue crabs (*Callinectes sapidus*), bluefish (*Pomatomus saltatrix*), striped bass (*Morone saxatilis*) and American eel (*Anguilla rostrata*), and New Jersey has advisories for white perch (*Morone americana*) and white catfish (*Ameiurus [Ictalurus] catus*). The contaminants of concern for the Newark Bay Complex are PCBs and dioxins. Finley *et al.* (1997) examined the levels of PCBs in striped bass and other fish from the lower Passaic River (the study area) and reported levels that exceeded the NOAA benchmark level, leading to increased cancer risk estimates. The overall water quality of the New York-New Jersey estuary, however, has improved dramatically in the last 30 yr (NYCDEP, 2001).

In contrast, there are no state issued consumption advisories for the other two coastal sites, although recently the U.S. Food and Drug Administration issued a consumption advisory based on mercury that suggested that pregnant women, and women of childbearing age who may become pregnant, should avoid eating four species (or species groups) of saltwater fish: shark, swordfish (*Xiphias gladius*), king mackerel (*Scomberomorus cavella*), and tilefish (*Lopholatitus chamaeleonticeps*) (FDA, 2001). Thus, these three areas are also of interest because of the differences in overall contamination.

2.2. Protocol

Our protocol was to record basic information (site, date, day of week, time of day, tides, and weather), and then to approach people we encountered along the shore. Some people were fishing or crabbing, while others were walking, jogging, watching birds or butterflies, or otherwise enjoying the environment. All people encountered were approached. We identified ourselves from Rutgers University, and asked them if they would mind answering some questions. The overall interview usually required only about 20 min.

The survey design was developed by using the total design method (Dillman, 1978; Frey and Oishi, 1995). Fewer than 10 people refused to be interviewed, and these were usually people who were leaving or did not want to further interrupt their jogging. Although this study is based on a convenience sample, there is no reason to believe it was not representative of those using the respective areas because all people encountered were approached. That is, we did not select people, but interviewed everyone we encountered. People interviewed once were not interviewed on subsequent visits, although we often saw the same people. We alternated weekends and weekdays for the interviewing at each site, interviewed at

each site each week, and randomly determined the time of day [morning (07:00–12:00), afternoon (12:00–17:00), evening (17:00–21:00)] for our interviews. Interviewers were trained using the survey instrument, had been involved in several other similar research projects (Burger, 1999a, b), worked in pairs that could converse in both English and Spanish. In addition, pre-interviews were conducted on people in another coastal region to test reliability among interviewers ($r = 0.85$ for responses).

Participants were asked three open-ended questions: what they considered the most important environmental problems in New Jersey, how they used the estuary, and what improvements should be made. They were then asked to rate a list of environmental problems, possible uses of the estuary, and possible improvements on a scale of 1 (least important) to 5 (most important). Demographic information, asked last, included where they lived, gender, age, education, and income. Remarkably, none of the people interviewed at Manasquan Inlet would give their income, perhaps because the surrounding communities have higher incomes than those surrounding Newark Bay and Barnegat Bay.

For analysis, the data were divided by location, age classes (30 and under, 31–45, and over 46 yr), and educational level (high school or less, some college, at least an Associates degree). Although 240 people were interviewed, not all people gave their ethnicity, income, or schooling, thus on tables using these variables, the total sample size is slightly less. Attitudes and perceptions were compared using Wilcoxon X^2 tests to determine whether there were differences among variables as a function of location, gender, age, and education (SAS, 1995). There were almost no differences in attitudes as a function of ethnicity, income, age or schooling (those found are noted). One of the thrusts of this paper is to compare attitudes and perceptions among the three estuary areas.

3. Results

3.1. Demographics

Of the total sample interviewed, 7% identified themselves as Asian, 12% as Hispanic, 15% as Black, and the rest as White. However, there were significant differences in the three survey areas, with most non-Whites residing in Newark Bay (Table I). The ethnic composition of our survey matches closely that of the general population in the surrounding counties, with more non-White residents in the Newark Bay Complex than in the New Jersey shore areas (US Census Bureau, 2002).

There were income and age differences in the three areas. Average income was significantly lower in Newark Bay than in Barnegat Bay, and there were more middle-aged people in Barnegat Bay than the other two sites (Table I). While the population was evenly divided into the three age groups for Newark Bay and

TABLE I

Demographics for people interviewed in New Jersey about attitudes and perceptions of marine resources. Shown are the percent of people in each category for that wetland area

	Newark Bay	Manasquan Inlet	Barnegat Bay	X^2 (p)
Ethnicity				
White	38.5	91 1	97	
Black	28 2	1.8	1.5	
Hispanic	21.3	5.3	0.0	
Asian	12.0	1.8	1.5	84.5 (<0 0001)
Income				
Under 20K	59.0	[a]	5.3	
20–40K	23.0		15.8	
41-60K	8.0		31.5	
61K and over	10.0		47 4	19.5 (0.0002)
Age				
35 and under	31.0	31 5	20.0	
36–50	31 0	31.5	54 0	
Over 50	38.0	37.0	26.0	10.8 (0.03)
Education				
BS/BA+	32.5	39.0	41.0	
Some college	15.5	23.0	20 0	
HS graduate	52.0	38.0	39.0	4.81 (NS)

[a] Respondents did not answer.

Manasquan Inlet, there was an overabundance of middle-aged people in Barnegat Bay (Table I). There was no significant locational difference in education.

3.2. Environmental problems

When asked, 'What are the most important environmental problems in New Jersey?' most people listed pollution (Figure 2). While many people merely mentioned pollution (20%), others listed water pollution (27%), air pollution (14%), and dumping (12%). Only 9% of the people mentioned increasing human populations, while 5% mentioned societal problems such as lack of law enforcement and crime.

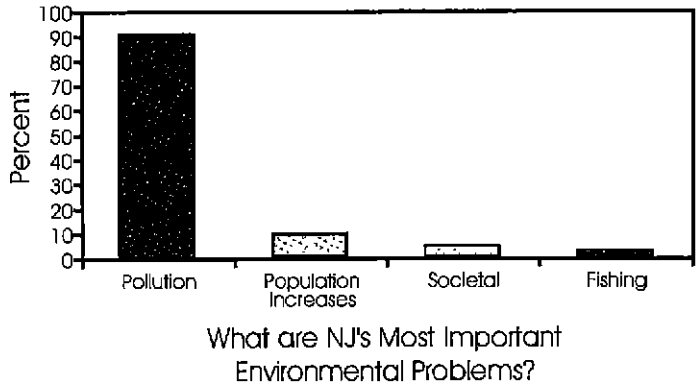


Figure 2. Responses of people in coastal New Jersey when asked to identify New Jersey's most important environmental problems. Shown are percent responding.

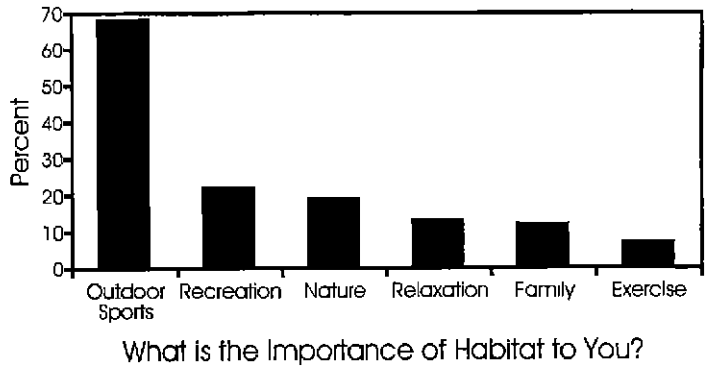


Figure 3. Responses of people interviewed in coastal New Jersey when asked the importance of the surrounding habitat to them. Shown are percent responding

3.3. USES OF THE ESTUARY

When asked, 'How are coastal or estuarine habitats important to you?', most people listed outdoor sports (Figure 3). On this question, people could list as many things as they wished; most listed only one or two. Nearly 20% of subjects listed recreation or nature, and others listed relaxation, family, and exercise.

When asked to rate the importance of wetland uses, communing with nature, walking, providing open 'green' space, and fishing were all ranked very high, and collecting plants and herbs was rated the lowest (Figure 4). Many recreational activities were given the same rating on the scale of 1–5, with birdwatching, jogging, and swimming rated lower than other activities (Figure 4). Open 'green' space refers to natural habitats, rather than to open space that is devoted to ball fields or other development (Kaiser *et al.*, 1995).

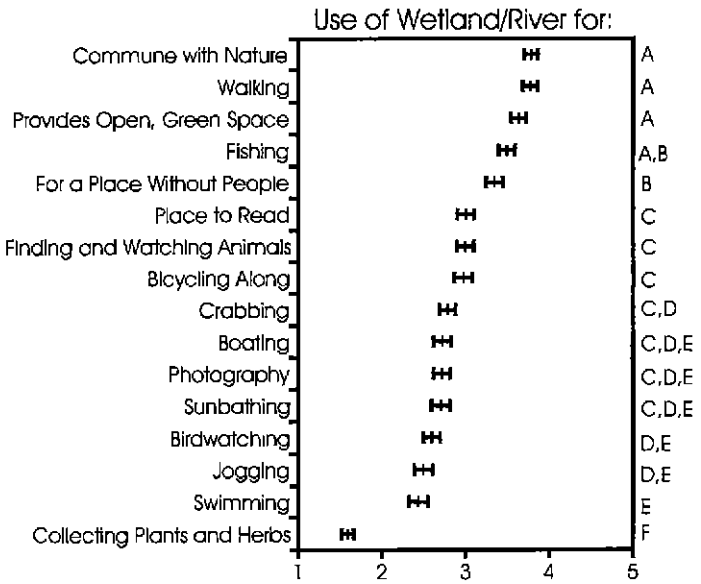


Figure 4. Responses of people when asked to rate on a scale of 1 (low value) to 5 (high value) how they use the surrounding estuarine and inlet habitats. Shown are mean + standard error. Items with different letters differ significantly from one another.

3.4. IMPROVEMENTS

When asked, 'What improvements do you think should be made to this habitat?' pollution prevention was the most common answer, followed by remediation, in-

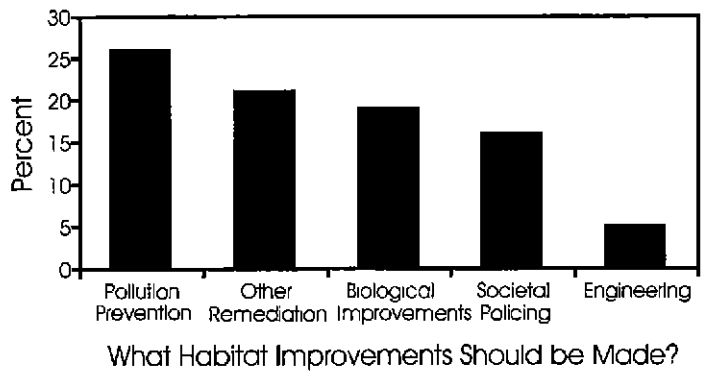


Figure 5. Responses of people when asked what improvements they would like to see in the surrounding environments (Newark Bay Complex, Manasquan Inlet, and Barnegat Bay, New Jersey)

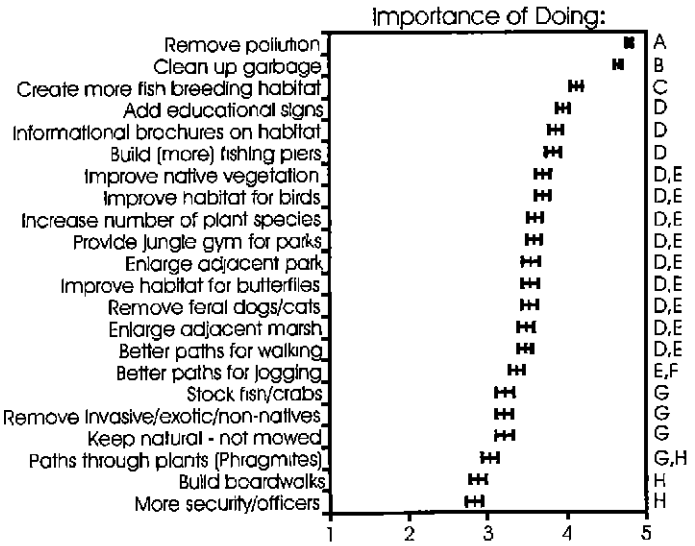


Figure 6. Responses of people when asked to rate on a scale of 1 (low value) to 5 (high value) various remediation and restoration options for the surrounding estuarine and inlet habitats. Shown are mean + standard error. Items with different letters differ significantly from one another.

cluding preventing dumping and stopping development (Figure 5). Societal improvements included better policing, no littering and fewer jetskis, and enforcement of fishing and boating laws.

When asked to rate the importance of a list of specific remediation and restoration activities that we provided, reducing or stopping pollution and cleaning up garbage where ranked the highest, and adding more security officers was lowest (Figure 6). Of the choices people were given, habitat improvements (creating or improving habitat for fish, birds, butterflies) were rated equally with recreational improvements (educational signs and brochures, building fishing piers and providing jungle gyms).

3.5. Differences among estuaries

One objective of the paper was to determine if there were differences in the perceptions of people residing in the three estuaries, and the factors that influenced these perceptions. There were significant differences in how the three areas were used, and in their valuation of various remediation and restoration options (Table II). People interviewed in Barnegat Bay always rated each use higher than people interviewed from the other two sites. In contrast, the people from Newark Bay rated the importance of doing nearly every remediation and restoration activity lower than the people interviewed from Manasquan Inlet and Barnegat Bay (Table II).

TABLE II

Rating of habitat use and improvement questions for three coastal areas of Ney Jersey. Shown are means ± standard error only for those that were significant

	Newark Bay	Manasquan Inlet	Barnegat Bay	Wilcoxon X^2
Sample	118	57	65	
Use of this wetland/river for.				
Commune with nature	3.63±0.12 (B)	3.68±0.19 (B)	4.16±0.14 (A)	8.50 (0.01)
For a place without people	3.52±0.12 (A)	2 79±0 21 (B)	3 52±0.19 (A)	9 28 (0.01)
Bicycling along	3.01±0.15 (A)	2.35±0.22 (B)	3.46±0.18 (A)	13.80 (0.001)
Fishing	2.87±0.14 (B)	3.98±0.17 (A)	4.20±0.13 (A)	38 40 (<0.0001)
Finding and watching animals	2 72±0 14 (B)	2.93±0.20 (B)	3.57±0.17 (A)	13.80 (0.001)
Crabbing	2.58±0.14 (B)	2.54±0 23 (B)	3.38±0.19 (A)	12 60 (0 002)
Boating	2 23±0 13 (B)	3.28±0.23 (A)	3.17±0.21 (A)	20.20 (<0.0001)
Sunbathing	2.07±0.12 (C)	2.98±0.23 (B)	3.63±0.20 (A)	38 20 (<0 0001)
Collecting plants and herbs	1.41±0.07 (B)	1 76±0 18 (A)	1.80±0.14 (A)	5.41 (0.07)
Swimming	1.30±0.07 (C)	2.96±0.22 (B)	3 98±0.18 (A)	105.00 (<0.0001)
Importance of doing the following:				
Create more fish breeding habitat	3.83±0.12 (B)	4 40±0 14 (A)	4 38±0 12 (A)	13.30 (0.001)
Build (more) fishing piers	3.70±0.14 (B)	4.29±0.15 (A)	3.68±0.19 (B)	5.64 (0.06)
Remove feral dogs/cats	3.52±0.14 (AB)	3 91±0 19 (A)	3.20±0.21 (B)	7 18 (0 003)
Build boardwalks	3 43±0.13 (A)	2.46±0.19 (B)	2.23±0.20 (B)	28.70 (<0.0001)
Improve native vegetation	3.39±0.14 (B)	4.02±0.16 (A)	4 00±0.13 (A)	10 00 (0.007)
Improve habitat for birds	3.39±0.14 (B)	4 00±0 16 (A)	4.00±0.15 (A)	8 77 (0 01)
Better paths for walking	3 33±0.13 (B)	4.00±0.15 (A)	3.31±0.17 (B)	10.60 (0.005)
Better paths for jogging	3.17±0.14 (B)	3.82±0.18 (A)	3.34±0.18 (AB)	7.50 (0.02)
Stock fish/crabs	2.82±0.15 (B)	3.69±0.20 (A)	3.52±0.19 (A)	13.20 (0 001)
Keep natural – not mowed	2.43±0.15 (B)	4.04±0.17 (A)	3.88±0.16 (A)	47.20 (<0.0001)

These differences were generally not due solely to ethnicity or age (the factors that varied among the bays, see Table I). For example, there were few significant ethnic differences in uses (only fishing, crabbing, boating, sunbathing) and improvements (improving habitat for fish and birds, keeping natural, and building

TABLE III

Rating of habitat use and improvement questions for three coastal areas of New Jersey. Shown are means ± standard error only for those that differ significantly by age

	Under 35	35 to 50	Over 50	Wilcoxon X^2
Sample	68	89	83	
Use of this wetland/river for:				
Bicycling along	3.28±0.19 (A)	3.16±0.16 (A)	2.53±0 19 (B)	9.33 (0.009)
Provides open green space	3.21±0.18 (B)	3.67±0.15 (A)	3.98±0.14 (A)	10.60 (0.005)
Crabbing	2 81±0.19 (AB)	3.15±0.16 (A)	2 40±0 18 (B)	9.42 (0.009)
Enlarge adjacent park	3.26±0.18 (B)	3 79±0.16 (A)	3.54±0.16 (AB)	6.19 (0.05)
Importance of doing the following:				
Enlarge adjacent park	3.26±0.18 (B)	3 79±0.16 (A)	3.54±0.16 (AB)	6.19 (0 05)
More security/officers	3.20±0.18 (A)	2.85±0.16 (AB)	2 49±0.18 (A)	7.59 (0.02)
Enlarge adjacent marsh	3.11±0.19 (B)	3.59±0 16 (AB)	3.69±0.17 (A)	6.41 (0.04)
Keep natural – not mowed	2.88±0.20 (B)	3.56±0.17 (A)	3.10±0.19 (AB)	7 33 (0.03)

boardwalks). Asians generally rated the uses lower than did all others ($P < 0.001$), while there was no overall ethnic pattern in ratings for improvements.

The significant differences as a function of age and education are shown in Tables III and IV. In general, where there were significant differences, middle-aged people rated most uses of wetlands higher than did others (Table III), but the patterns for improvements were less clear. Even where there were significant differences for education, the patterns were less clear. There were few differences in remediation and restoration options as a function of education, and the differences were not great (Table IV). There were no differences as a function of income for uses of the estuaries, and only two significant differences for improvements. As income increased, the rating for improving native vegetation increased significantly ($X^2 = 10.2$, $P < 0.02$), and the rating for keeping it natural and unmoved increased ($X^2 = 10.7$, $P < 0.01$).

TABLE IV

Rating of habitat use and improvement questions for three coastal areas of New Jersey. Shown are means ± standard error only for those that were significant by education level

	HS graduate	Some college	BA/S or more	Wilcoxon X^2
Sample	104	43	84	
Use of this wetland/river for:				
Fishing	3.78±0.13 (A)	3.30±0.25 (A)	3.30±0.17 (A)	5 03 (0 08)
Walking	3.62±0.14 (B)	3 64±0 20 (B)	4.13±0.12 (A)	7.11 (0 03)
Provides open green space	3.57±0.14 (AB)	3.32±0.24 (B)	3.98±0.14 (A)	7.10 (0.03)
Crabbing	3.11±0.15 (A)	2 21±0.25 (B)	2.76±0.18 (A)	9.97 (0.007)
Photography	2.66±0.16 (AB)	2.40±0.22 (A)	3.00±0.17 (B)	5.10 (0.08)
Importance of doing the following				
Clean up garbage	4.61±0.09 (B)	4 93±0.05 (A)	4 54±0.10 (B)	8.06 (0.02)
Increase number of plant species	3 44±0.15 (B)	4.12±0.19 (A)	3.58±0.16 (B)	7.52 (0.02)
Build boardwalks	3.26±0.15 (A)	2.49±0.24 (B)	2.65±0.17 (B)	10.60 (0.005)

4. Discussion

4.1. Environmental problems

Environmental and social scientists have devoted a great deal of attention to public attitudes toward environmental problems and issues (Dunlap and Van Liere, 1978). Much of the debate has centered around what types of people are most concerned with environmental quality. Factors that partly explain differences in concern relate to age, ethnicity, social class, education, residence, political views (Van Liere and Dunlap, 1980), and culture (Huerta and Macario, 1999). Generally the percent of variation in level of concern explained by factors is low, suggesting that social scientists have not been successful at explaining the differences. Further, Kanagy *et al.* (1994) found that from 1980 to 1990 concern about the environment reflected both age (younger people were more concerned) and year (all age groups were more concerned in later years). In this study, these factors affected ratings, but the interlocational differences were not great, and there were no differences in many aspects.

From an environmental assessment and management perspective, however, it may be most important to know how environmental problems are ranked. Much of

the discussion about coastal areas has dealt with fisheries, contamination, and consumption patterns (McCay and Acheson, 1987; McCay, 1995; Burger, 2000, 2001). Although these topics deal with marine and coastal habitats, public attitudes and perceptions about these environments are seldom examined by managers. While social scientists have focused on urban neighborhood quality, and the importance of leadership (both elected and grassroots) in improving neighborhood quality (Greenberg, 2000a), there is little concerning attitudes about environmental problems and their solutions. This paper addresses this issue for coastal New Jersey.

4.2. USES OF THE ESTUARY

For the United States as a whole, walking is the most popular recreational activity, followed by sightseeing, picnicking, swimming, fishing, bicycling, and birdwatching (Cordell *et al.*, 1999). The fastest growing activities are birdwatching, hiking, backpacking, downhill skiing, and primitive camping. In 1982, 21.2 million Americans (12%) were birdwatchers, while in 1995 the number had grown to 54.1 million (27% of Americans, Cordell *et al.*, 1999). Most of these activities are accomplished near home. Watching butterflies is a pastime gaining in importance, but not normally examined in national surveys. Most public use studies of particular rivers, lakes, or estuaries concentrate on angling (fishing, crabbing) because of the potential for human exposure to contaminants via fish or shellfish consumption (see Ebert, 1996; Burger *et al.*, 1999a, b; Burger, 2000). Although Toth and Brown (1997) examined fishing within a larger social context, they did not examine fishing compared to other recreational activities.

Managers interested in recreation and coastal development have not examined the underlying reasons for engaging in recreation. Recently, Greenberg (2000b) suggested that remedies for increased cultural pace often relate to having places to meditate, jog, or watch birds or butterflies. Such pristine places are often especially hard to find in urban environments. In this study, both recreational uses (e.g. walking, jogging, fishing, etc) and aesthetic values (e.g. commune with nature, appreciate open green spaces) were both investigated. To some extent, the data in the present study provides support for Greenberg's thesis that being in or near nature is a remedy for the accelerating pace of our culture.

On the open-ended question, people generally listed outdoor sports as their most frequent use. However, when asked to rate a list of possible uses, two of the highest rated uses were 'to commune with nature' and 'to provide open green space', which are aesthetic values rather than recreational values. Godbey *et al.* (1992) similarly found that people positively linked parks and open space to good health and feeling better. Of the outdoor sports or recreational activities, fishing was rated significantly higher than all others, and jogging and swimming were rated the lowest. These data suggest that people engage in recreational activities when they use estuarine and coastal habitats, but they value them most for their ability to provide open 'green' space to commune with nature and themselves.

4.3. Environmental assessment and management

Public officials spend a great deal of time on management within their jurisdictions, yet rarely are the users of specific habitats directly involved with rating the improvements or selecting between alternatives. Further, when such stakeholder input is solicited, it is usually in public meetings, where only those particularly interested in the resource attend. One of the objectives of this study was to determine what improvements the users of the three areas felt were important, and their relative rating of a list of possible improvements provided for them.

Remarkably, adding more security officers did not rank high, as it often does in poor quality neighborhoods (Greenberg, 1999). Greenberg (1999), working in New Jersey, found that poor neighborhood quality was associated with crime and physical decay. While the Manasquan and Barnegat Bay areas are clearly not poor quality neighborhoods, some of the areas of the Newark Bay Complex might be considered poor quality in terms of heavy industrialization and urbanization (Pflugh *et al.*, 1999). Yet the people interviewed who use the coastal zone, even in the Newark Bay Complex, did not feel that increased security officers was an important improvement, while they did rate creation of additional habitat for birds, fish, crabs and butterflies highly. This bodes well for the restoration potential of these regions.

A restoration goal that would be ranked high by managers, removing invasive and exotic plants, was rated relatively low by the people interviewed. Rather, the public rated creating habitat for fish, birds and butterflies much higher. This suggests that: (1) managers have not sufficiently alerted the public to the importance of removing invasive and exotic vegetation to habitat quality, or (2) the public does not agree that removing invasive plants is important. I believe it is the former because people rated improving native vegetation high, and to improve native vegetation it is sometimes necessary to remove invasive species that are out-competing the native vegetation. This provides one important avenue for public education.

Adding educational signs and providing informational brochures on the habitat were also rated relatively high, suggesting that the public is interested in learning more about these coastal habitats. This provides one useful avenue of education about the importance of native vegetation and functioning ecosystems.

4.4. Differences among estuaries

There were significant locational differences in how people used the estuaries, and in how they thought they should be managed and improved (refer back to Table II). People from Barnegat Bay ranked most uses higher than people from the other regions, and people from Manasquan Inlet rated the importance of most remediation and restoration actions higher than other people. There were locational differences in 10 of the 16 uses, and 10 of the 22 remediation and restoration activities. While a few of these differences correlated with ethnicity (9 of the 20 differences), education (3/20) and age (3/20), these factors do not account for most of the differences.

I attribute many of the differences in ratings among people living in the different estuaries to the ways the bays are used by local residents. Boating, swimming and sunbathing were not rated highly by people from Newark Bay. This is not surprising since there are no beaches for sunbathing and no easy access for swimming. Further, the water is more polluted in the Newark Bay complex (O'Connor and Ehler, 1991; Squibb, 1992; Burger *et al.*, 1999b), making swimming less appealing.

The relatively lower rating for most remediation and restoration actions by the people in Newark Bay may relate to differences in income. The argument could be made, however, that the expenditure of money to improve the more urban environment in the Newark Bay complex is even more important than in the other areas because of the relative lack of undeveloped, natural habitats in an otherwise urbanized environment.

4.5. Assessment and management implications

Increasingly policymakers that control public funds rely on economic valuations to determine management actions, especially with open space and parks (Garvin and Berens, 1999). Yet, the policies adopted by public officials often follow community views and perceptions in the United States. Three decades ago most community action was by small middle-class groups; now there is a wider range of community organizations (Miller *et al.*, 1990; Greenberg, 2001). Approaches now include identity, grassroots, advocacy, self-help, mutual aid, and many mixtures (Miller *et al.*, 1990). Public actions, however, are augmented by shifts in public opinion, or by a clarification of public opinion. Clearly, public opinion polls have a major influence on policy formation (Asher, 2001). Management in estuaries, such as the New York/New Jersey Harbor, may require land acquisition and large-scale environmental clean up (Matsil, 2001), but local constituencies may also be interested in less extensive restoration projects. Such smaller actions are seldom examined in public opinion polls or studies.

While the people interviewed in this study clearly use the habitat for outdoor sports and recreation, they also value these habitats as open 'green' spaces, and places to commune with nature. Thus, in designing management and restoration projects, the open spaces should provide adequate places for 'communing' with nature without other distractions and annoyances.

The data provided in this report clearly show that there is agreement among people living along three estuarine areas of New Jersey in the relative rating of many environmental problems, uses of coastal environments, and the importance of specific improvements to coastal environments. Many of the improvements fall within management and restoration, including (rank order from high to low) creating more fish breeding habitat, improving native vegetation, improving habitat for birds, increasing plant diversity, improving habitat for butterflies, and enlarging adjacent marshes. Indeed they fall clearly within the category of enhancing conservation values in protected landscapes (Hobbs and Norton, 1996). The data also

indicate some differences among the three estuaries in how people use the habitats, and how they wish to see them restored. Such regional differences even within a state need to be considered by local and regional public officials when designing restoration projects. Restoration may be particularly important where habitat loss and fragmentation is severe, such as the highly industrialized and urbanized New York/New Jersey Harbor Estuary, because of the potential to provide people in densely populated areas with some semblance of natural ecosystems.

While one might argue that people respond to such a survey within a context of recent media events, their views nonetheless provide a context for general public opinion. Moreover, the highest ranking habitat improvements are not necessarily those reported most often in the media. Higgs (1997) has argued that good restoration (and management) requires an expanded view that includes historical, social, cultural, political and aesthetic aspects, and this paper provides a beginning for evaluating some of these issues. The data provided in this paper will be useful to public officials, managers, biologists, conservationists, educators, and restoration ecologists for the management, restoration, preservation, long-term stewardship, and long-term monitoring and assessment of coastal lands.

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References

Asher, H.: 2001, *Polling and the Public: What Every Citizen Should Know*, CQ Press, Washington D.C.

Ayres, R. V and Rod, S. R.: 1986, 'Patterns of pollution in the Hudson-Raritan Basin', *Environ.* **28**, 14–43.

Bengtsson J , Jones, H. and Setala, H.: 1997, 'The value of biodiversity', *Trends Evol. Ecol.* **12**, 334–336.

Bradshaw, A D. and Chadwick, M. J.: 1980, *The Restoration of Land*, Univ. of California Press, Berkeley.

Burger, J.: 2000, 'Consumption advisories and compliance: the case of the fishing public and the deamplification of risk', *J. Environ. Plan. Manag.* **43**, 471–488.

Burger, J.: 2001, 'Multiuse Coastal Commons: Personal Watercraft, Conflicts, and Resolutions', in J. Burger, E. Ostrom, R. B. Norgaard, D. Policansky, and B. Goldstein (eds), *Protecting the Commons: A Framework for Resource Management in the Americas*, Island Press, Washington D C , pp 195–217.

Burger, J., Stephens Jr., W., Boring, C. S., Kuklinski, M., Gibbons, J. W. and Gochfeld, M.: 1999a, 'Ethnicity and risk: Fishing and consumption in people fishing along the Savannah River', *Risk Anal.* **19**, 421–421

Burger, J , Kirk Pflugh, K., Lurig, L., Von Hagen, L. A. and Von Hagen, S.: 1999b, 'Fishing in urban New Jersey: Ethnicity affects information sources, perception, and compliance', *Risk Anal.* **19**, 217–229.

Cairns Jr., J. and Pratt, J. R.: 1995, 'Ecological restoration through behavioral change', *Restor. Ecol.* **3**, 51–53.

Commission on Risk Assessment and Risk Management: 1996, *Report of the Commission on Risk Assessment and Risk Management*, U.S Congress, Washington, D.C.

Cordell, H. K., Herbert, N. G. and Pandolfi, F.: 1999, 'The growing popularity of birding in the United States', *Birding* **31**, 168–176.

Dillman, D. A. 1978, *Mail and Telephone Surveys: The Total Design Method*, John Wiley & Sons, N Y.

Dunlap, R. E. and Van Liere, K. D.: 1978, 'Environmental Concern: A Bibliography of Empirical Studies and Brief Appraisal of the Literature', *Public Administr. Series Biblio*, No. 44, Monticello, Illinois.

Ebert, E. S.: 1996, 'Fish consumption and human health: Developing partnerships between risk assessors and resource managers', *Am. Fish. Soc. Symp.* **16**, 261–270.

Finley, B. L., Trowbridge, K. R., Burton, S., Proctor, D. M., Panko, J. M. and Paustenbach, D J . 1997, 'Preliminary assessment of PCB risks to human and ecological health in the Lower Passaic River', *J. Toxicol Environ. Health* **52**, 95–118.

Food and Drug Administration (FDA): 2001 , 'FDA consumer advisory', http//www fda.gov/bbs/topics/ANSWERS/2000/advisory.html.

Frey, J. H and Oishi, S. M.: 1995, *How to Conduct Interviews by Telephone and in Person*, Vol. 4 of The Survey Kit. Sage Publ., Thousand Oaks, CA.

Gale, R. J. P.: 1991, 'Environment and development. Attitudinal impediments to policy integration', *Environ. Conserv.* **18**, 228–236.

Garvin, A. and Berens, G . 1997, *Urban Parks and Open Spaces*, Urban Land Institute, Washington D.C.

Godbey, G , Graefe, A and James, S.: 1992, *The Benefits of Local Recreation and Park Services: A Nation-wide Study of the Perceptions of the American Public*, National Recreation and Parks Association, Washington D.C.

Greenberg, M.: 1999, 'Improving neighborhood quality: A hierarchy of needs', *Housing Policy Debate* **10**, 601–624.

Greenberg, M.: 2000a, 'Grassroots leadership, personality, and urban neighborhood environments: A cast study in New Jersey', *Human Ecol. Rev.* **7**, 21–29.

Greenberg, M.: 2000b, 'Neighborhoods. Slow places in a fast world? ', *Soc.* **33**, 28–32.

Greenberg, M.: 2001, 'Elements and test of a theory of neighborhood civic participation', *Human Ecol. Rev.* **8**, 40–51.

Haeuber, R.. 1996, 'Setting the environmental policy agenda: The case of ecosystem management', *Nat. Res. J.* **36**, 1–27.

Hammond, A L. (ed.): 1990, *World Resources (1990–1991)*, Oxford University Press, Oxford, U.K.

Handel, S N., Robinson, G. R. and Beattie, A. J.: 1994, 'Biodiversity resources for restoration ecology', *Restor. Ecol.* **2**, 230–241.

Higgs, E. S.: 1997, 'What is good ecological restoration?', *Conserv. Biol.* **11**, 338–348.

Hobbs, R. J. and Norton, D. A.. 1996, 'Towards a conceptual framework for restoration ecology', *Restor. Ecol.* **7**, 93–110.

Huerta, E. E. and Macario, E.. 1999, 'Communicating health risk to ethnic groups: Reaching Hispanics as a case study', *J. Nat. Canc. Inst., Monogr.* **25**, 23–36.

Kaiser, E J , Godschalk, D. and Chapin Jr, F. S.: 1995, *Urban Land Use Planning*, 4th ed , Univ. Illinois Press, Urbana, IL.

Kanagy, C. L., Humphrey, C. R. and Firebaugh, G.: 1994, 'Surging environmentalism: Changing public opinion or changing publics?', *Soc. Sci. Quart.* **75**, 804–819.

McCay, B. J.: 1995, 'The ocean commons and community', *Dalhousie Rev.* **74**, 1–29.

McCay, B. J. and Acheson, J M (eds): 1987, *The Question of the Commons: the Culture and Ecology of Communal Resources*, Univ. Arizona Press, Tuczon.

Miller, S , Rein, M. and Levitt, P.: 1990, 'Community action in the United States', *Comm Dev. J* **25**, 356–368.

New Jersey Department of Environmental Protection, Division of Science and Research (NJDEP): 1994, *A Guide to Health Advisories for Eating Fish and Crabs in New Jersey*, New Jersey Department of Environmental Protection, Division of Science and Research, Trenton, NJ.

Matsil, M. A.: 2001, 'Protecting and restoring urban watersheds: conserving biodiversity in the New York/New Jersey Harbor Estuary', *Coastlines* **11**(1), 4–5.

Montalvo, A. M., Williams, S L., Rice, R. J., Buchmann, S. L., Cory, C., Handel, S. N., Nabhan, G. P., Primack, R. and Robichaux, R H.: 1997, 'Restoration biology: A population biology perspective', *Restor Ecol* **5**, 277–290.

National Research Council: 1996, *Understanding Risk: Informing Decisions in a Democratic Society*, National Academy Press, Washington, DC.

New York City Department of Environmental Protection Health (NYCDEP): 2001, *New York Harbor Water Quality: Regional Summary*, NYCDEP, New York, NY.

New York State Department of Health (NYSDOH) 1994, *1994–1995 Health Advisories. Chemicals in Sportfish or Game*, New York State Department of Health, Bureau of Toxic Substance Assessment, NY

Norse, E. A (ed): 1993, *Global Marine Biological Diversity Strategy: Building Conservation into Decision Making*, Center for Marine Conservation, Washington, D.C.

O'Connor, R. E., Bord, R. J. and Pflugh, K. K.: 1994, 'The two faces of coastal environmentalism: Environmental protection and development on Cape May', *Coast. Manage.* **22**, 183–194.

O'Connor, T. P. and Ehler, C. N.: 1991, 'Results from the NOAA national status and trends program on distribution and effects of chemical contamination in the coastal and estuarine United States', *Environ. Monit. Assess.* **17**, 33–49.

Pflugh, K. K., Lurig, L., vonHagen, L. A , vonHagen, S., and Burger, J.: 1999, 'Urban angler's perceptions of risk from contaminated fish', *Sci. Total Envir.* **228**, 203–218.

Roberts, L. (ed.): 1996, *World Resources (1996–1997)*, Oxford University Press, Oxford, UK.

Statistical Analysis System (SAS): 1995, *SAS Users' Guide*, Statistical Institute, Inc. Cary, NC.

Squibb, K. S.: 1992, 'Overview of toxics in the harbor estuary', *Tidal Exchange* **3**, 1–2.

Toth Jr., J. F. and Brown, R. B.: 1997, 'Racial and gender meanings of why people participate in recreational fishing', *Leis. Sci.* **19**, 129–146.

Van Liere, K. D. and Dunlap, R. E.: 1980, 'The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence', *Publ. Opinion Quart.* **44**, 181–197.