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

JOANNA BURGER
Division of Life Sciences, Environmental and Occupational Health Sciences Institute, Center for Urban Restoration Ecology, Rutgers University, Piscataway, New Jersey, U.S.A.

(Received 12 November 2001, accepted 17 May 2002)

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, clearing 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 recreation 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

Recreationalists can sway environmental policy, thus influencing ecosystem management and habitat protection (Haenber, 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'Conor 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 paper illustrates a strong commitment on the part of the users of coastal environments to restore some aspects of the natural environment. Further,
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 (Ayers 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 nebulosus carpi). 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 cavalla), and tilefish (Lopholatius 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. In-
viewers were trained using the survey instrument, had been involved in several
other similar research projects (Burger, 1999a, b), worked in pairs that could con-
verse 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 informa-
tion 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 X² 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 His-
panic, 15% as Black, and the rest as White. However, there were significant dif-
fences in the three survey areas, with most non-Whites residing in Newark Bay
(Table 1). The ethnic composition of our survey matches closely that of the gen-
eral 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 1). While
the population was evenly divided into the three age groups for Newark Bay and
TABLE 1
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.

<table>
<thead>
<tr>
<th></th>
<th>Newark Bay</th>
<th>Manasquan Inlet</th>
<th>Barnegat Bay</th>
<th>(X^2) (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>38.5</td>
<td>91.1</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>28.2</td>
<td>1.8</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>21.3</td>
<td>5.3</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>12.0</td>
<td>1.8</td>
<td>1.5</td>
<td>84.5 (&lt;0.0001)</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 20K</td>
<td>59.0</td>
<td></td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>20-40K</td>
<td>23.0</td>
<td></td>
<td>15.8</td>
<td></td>
</tr>
<tr>
<td>41-60K</td>
<td>8.0</td>
<td></td>
<td>31.5</td>
<td></td>
</tr>
<tr>
<td>61K and over</td>
<td>10.0</td>
<td></td>
<td>47.4</td>
<td>19.5 (0.0002)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35 and under</td>
<td>31.0</td>
<td>31.5</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>36-50</td>
<td>31.0</td>
<td>31.5</td>
<td>54.0</td>
<td></td>
</tr>
<tr>
<td>Over 50</td>
<td>38.0</td>
<td>37.0</td>
<td>26.0</td>
<td>10.8 (0.03)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BS/BA+</td>
<td>32.5</td>
<td>39.0</td>
<td>41.0</td>
<td></td>
</tr>
<tr>
<td>Some college</td>
<td>15.5</td>
<td>23.0</td>
<td>20.0</td>
<td></td>
</tr>
<tr>
<td>HS graduate</td>
<td>52.0</td>
<td>38.0</td>
<td>39.0</td>
<td>4.81 (NS)</td>
</tr>
</tbody>
</table>

* 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.
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).
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 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.

including preventing dumping and stopping development (Figure 5). Societal improvements included better policing, no littering and fewer jet skis, 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 New Jersey. Shown are means ± standard error only for those that were significant

<table>
<thead>
<tr>
<th>Sample</th>
<th>Newark Bay</th>
<th>Manasquan Inlet</th>
<th>Barnegat Bay</th>
<th>Wilcoxon X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of this wetland/river for:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commune with nature</td>
<td>3.63±0.12 (B)</td>
<td>3.68±0.19 (B)</td>
<td>4.16±0.14 (A)</td>
<td>8.50 (0.01)</td>
</tr>
<tr>
<td>For a place without people</td>
<td>3.52±0.12 (A)</td>
<td>2.79±0.21 (B)</td>
<td>3.52±0.19 (A)</td>
<td>9.28 (0.01)</td>
</tr>
<tr>
<td>Bicycling along</td>
<td>3.01±0.15 (A)</td>
<td>2.35±0.22 (B)</td>
<td>3.46±0.18 (A)</td>
<td>13.80 (0.001)</td>
</tr>
<tr>
<td>Fishing</td>
<td>2.87±0.14 (B)</td>
<td>3.98±0.17 (A)</td>
<td>4.20±0.13 (A)</td>
<td>38.40 (&lt;0.0001)</td>
</tr>
<tr>
<td>Finding and watching animals</td>
<td>2.72±0.14 (B)</td>
<td>2.93±0.20 (B)</td>
<td>3.57±0.17 (A)</td>
<td>13.80 (0.001)</td>
</tr>
<tr>
<td>Crabbing</td>
<td>2.58±0.14 (B)</td>
<td>2.54±0.23 (B)</td>
<td>3.38±0.19 (A)</td>
<td>12.60 (0.002)</td>
</tr>
<tr>
<td>Boating</td>
<td>2.23±0.13 (B)</td>
<td>3.28±0.23 (A)</td>
<td>3.17±0.21 (A)</td>
<td>20.20 (&lt;0.0001)</td>
</tr>
<tr>
<td>Sunbathing</td>
<td>2.07±0.12 (C)</td>
<td>2.98±0.23 (B)</td>
<td>3.63±0.20 (A)</td>
<td>38.20 (&lt;0.001)</td>
</tr>
<tr>
<td>Collecting plants and herbs</td>
<td>1.41±0.07 (B)</td>
<td>1.76±0.18 (A)</td>
<td>1.80±0.14 (A)</td>
<td>5.41 (0.07)</td>
</tr>
<tr>
<td>Swimming</td>
<td>1.30±0.07 (C)</td>
<td>2.96±0.22 (B)</td>
<td>3.98±0.18 (A)</td>
<td>105.00 (&lt;0.0001)</td>
</tr>
</tbody>
</table>

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) |
| Stack 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.

<table>
<thead>
<tr>
<th></th>
<th>Under 35</th>
<th>35 to 50</th>
<th>Over 50</th>
<th>Wilcoxon Z^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample</td>
<td>68</td>
<td>89</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td><strong>Use of this wetland/river for:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bicycling along</td>
<td>3.28±0.19 (A)</td>
<td>3.16±0.16 (A)</td>
<td>2.53±0.19 (B)</td>
<td>9.33 (0.009)</td>
</tr>
<tr>
<td>Provides open green space</td>
<td>3.21±0.18 (B)</td>
<td>3.63±0.15 (A)</td>
<td>3.98±0.14 (A)</td>
<td>10.60 (0.005)</td>
</tr>
<tr>
<td>Crabbing</td>
<td>2.41±0.19 (AB)</td>
<td>3.15±0.16 (A)</td>
<td>2.40±0.18 (B)</td>
<td>9.42 (0.009)</td>
</tr>
<tr>
<td>Enlarge adjacent park</td>
<td>3.26±0.18 (B)</td>
<td>3.79±0.16 (A)</td>
<td>3.54±0.16 (AB)</td>
<td>6.19 (0.05)</td>
</tr>
<tr>
<td><strong>Importance of doing the following:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enlarge adjacent park</td>
<td>3.26±0.18 (B)</td>
<td>3.79±0.16 (A)</td>
<td>3.54±0.16 (AB)</td>
<td>6.19 (0.05)</td>
</tr>
<tr>
<td>More security/officers</td>
<td>3.20±0.18 (A)</td>
<td>2.85±0.16 (AB)</td>
<td>2.49±0.18 (A)</td>
<td>7.59 (0.02)</td>
</tr>
<tr>
<td>Enlarge adjacent marsh</td>
<td>3.11±0.19 (B)</td>
<td>3.59±0.16 (AB)</td>
<td>3.69±0.17 (A)</td>
<td>6.41 (0.04)</td>
</tr>
<tr>
<td>Keep natural - not mowed</td>
<td>2.88±0.20 (B)</td>
<td>3.56±0.17 (A)</td>
<td>3.10±0.19 (AB)</td>
<td>7.33 (0.03)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Use of the wetland/river for:</th>
<th>HS graduate (A)</th>
<th>Some college (A)</th>
<th>BA/S or more (A)</th>
<th>Wilcoxon $X^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fishing</td>
<td>3.78±0.13</td>
<td>3.30±0.25</td>
<td>3.30±0.17</td>
<td>5.03 (0.08)</td>
</tr>
<tr>
<td>Walking</td>
<td>3.62±0.14</td>
<td>3.64±0.20</td>
<td>4.13±0.12</td>
<td>7.11 (0.03)</td>
</tr>
<tr>
<td>Provides open green space</td>
<td>3.57±0.14 (AB)</td>
<td>3.32±0.24 (B)</td>
<td>3.98±0.14 (A)</td>
<td>7.10 (0.03)</td>
</tr>
<tr>
<td>Crabbing</td>
<td>3.11±0.15 (A)</td>
<td>2.21±0.25 (B)</td>
<td>2.76±0.18 (A)</td>
<td>9.97 (0.007)</td>
</tr>
<tr>
<td>Photography</td>
<td>2.66±0.16 (AB)</td>
<td>2.40±0.22 (A)</td>
<td>3.00±0.17 (B)</td>
<td>5.10 (0.08)</td>
</tr>
</tbody>
</table>

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 Berons, 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.

Acknowledgements

I thank J. Leonard, D. Pinto, and S. Shukla for interviewing and data analysis, R. Ramos for graphics, and M. Gochfeld, M. Greenberg and C. Powers for helpful comments on the research and manuscript. This research was partially funded by the Consortium for Risk Evaluation with Stakeholder Participation (CRESPP) through the Department of Energy (Al/1 DE-FC01-95EW55084, DE-FG 26-00NT 40938), NIESH (ESO 5022), and the Environmental and Occupational Health Sciences Institute.

References

ASSESSING PERCEPTIONS ABOUT ECOSYSTEM HEALTH AND RESTORATION OPTIONS


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


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.