Journal of Coastal Research	5	3	563-572	Charlottesville, Virginia	Summer 1989

A Preliminary Review of Water Quality Parameters and Recreational User Perceptions of Nearshore Water Quality

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ABSTRACT

WEST, N., 1989. A preliminary review of water quality parameters and recreational user perceptions of nearshore water quality. *Journal of Coastal Research*, 5(3), 563-572. Charlottesville (Virginia). ISSN 0749-0208.

The underlying principle which has guided all of this country's environmental monitoring efforts has been based on the scientist's view of the physical and bio-chemical health of the natural environment. It is the tenant of this paper that substantial discrepancies exist between the quality of the nearshore defined scientifically and the quality of the water as viewed (perceived) by the many users of that environment. Furthermore, it is hypothesized that these perceptions influence the way the resource is being used and managed to a much greater extent than the specific scientific parameters defining the quality of the water.

Although perceptions (and thus users' decisions) are influenced by a host of factors, including 'expert opinion' as reported by public interest groups, news media, policy makers, past experience and education of the user etc., this paper is concerned primarily with the effect in which the physical environment has on the user's perception of that environment.

Discrepancies between scientifically defined water quality and the manner in which the quality of the water is perceived by the users present both opportunities and obligations for the coastal and nearshore manager and policy maker. Shore and nearshore areas, which from a scientific point of view are classified as marginal, may be useful for some recreational activities. It is suggested that additional non-scientific water quality parameters be included in future water quality surveillance efforts which are meaningful to both existing and new users of that environment.

ADDITIONAL INDEX WORDS: *perception, water quality, water quality classification, environmental monitoring, environmental management*

INTRODUCTION

The underlying presumption guiding resource management is that the greater the congruity between the objectives of the users and those formulated by management, the fewer the conflicts and the greater overall utility of the resource[1]; in other words, the greater the degree of consonnance between managers and users the greater the proportion of people satisfied. This results in more intensive use of the resource in the form of more participants, and continues until such time when the physical and/or psychological carrying capacity has been reached. This argument is based on the notion that different culture groups perceive and thus react to the environment differently and is an outgrowth of Hall's seminal work on environmental perception and non-language communication (Hall, 1959 and 1966).

Discrepancies between management and user objectives are likely to lead to inefficient use or conflict of water resources. For instance, a regulation restricting a given activity such as shorebased striped bass fishing may lead to one of two results: first, if the regulation is issued arbitrarily without supporting research, conveyed in a manner which is not believed by the user, or administered unfairly, there is every likelihood the regulation will not be adhered to. This may require increased and costly enforcement efforts which may limit management efforts in other important areas. In the event that the regulation is capricious, issued without adequate supporting research, a valuable resource—in this case the striped bass that will

88020 received 30 March 1988; accepted in revisions 20 January 1989.

[1] The term utility in economics refers to the flow of benefits which accrue as a result of a given investment. In this paper the term utility refers to the total package of benefits which the user expects to receive from the resource, (most of which are psychic benefits). The resource in this context refers to the water and adjacent beach. It should be quite clear that in most instances where one deals with recreational benefits, the actual investments made by the user do not cover the investments which are required to provide the recreational opportunities which are being sought.

not be caught—represents a loss to the fishing community (commercial or recreational) as well as the local economy.

The second possible effect occurs in the hypothetical case where the regulation is based on solid water quality evidence suggesting that deteriorating water quality has led to diminishing stocks. In such cases the probability is increased that the regulation will be adhered to, assuming for the moment that the possible allocations between user groups (commercial and recreational fisheries) can be agreed upon. Furthermore, if the evidence is believed (perceived) to be correct by the fishing groups and the manager, both the biological and social impacts caused by the implementation of the regulation will have been minimized. Consequently, for a resource to be well managed, attempts must be made by the resource manager to incorporate the views of the user. If that is not possible because of overriding concerns affecting the health, economics or environmental integrity of an area, the manager should communicate to the impacted users why their goals can not be fully met; failing that, the resources will be used less efficiently.

Environmental Management, Perception and Decision-making

While resource economics research is entirely based on the normative model, research related to the manager's and the user's *perceptions* of how the resource *should* be used normatively is quite limited. SEWELL (1971), analyzing differences in perception between engineers and health officials, was able to show significant differences in how water reservoirs should be managed, particularly with regard to recreational activities. His interpretation of these differences relates in part to the professional philosophy which guides the behavior of these officials. For example, the health official in charge of providing the public with a safe and adequate source of potable water is guided by a set of principles which have evolved in response to the research findings conducted by members of the professions concerned with the health of the general public. Although discrepancies may exist among professionals within a given discipline, most execute their responsibilities in accordance with nationally developed standards which are periodically updated as the scientific community uncovers new findings.

The water manager/engineer has the responsibility of maintaining the physical system and maximizing the overall social benefit of the community resource. This professional is governed by principles which have evolved through a process similar to that of the public health official, although the specific management *objectives* may be different. Consequently, the engineer/manager may perceive of multi-use opportunities which from a professional management point of view appear compatible with the primary goal of providing the public with a safe supply of potable water.

This problem is not limited to professionals from different disciplines with common or perhaps overlapping management responsibilities for a given resource. BAUMAN (1969) identified regional differences of opinion (perceptions) among eastern and western reservoir managers with respect to what recreational activities should be permitted on reservoirs and in what intensities. Briefly, he found water managers in the Northeast to be considerably more restrictive in permitting activities on public water reservoirs compared to colleagues in the Southwest. He ascribed these differences to the scarcity of the water and concluded that in areas where water is relatively more abundant, managers can afford to be more restrictive in permitting uses which they *perceive* to be incompatible with the primary purpose of the reservoir. Bauman's interpretation of these findings concerns the relative regional availability of potable water. Int he Northeast, precipitation is greater and surface water much less scarce enabling managers to set greater restrictions on the use of the reservoirs since alternate recreational opportunities are readily available. In the Southwest, water is much more scarce; consequently, there is a greater willingness to permit other forms of uses on the reservoirs.

The above examples illustrate differences between and among resource managers. Other studies have illustrated significant perceptional differences between managers and users of the resources. For example, the National Forest Service has for some time supported a significant amount of research dealing with perceptional differences between and among professional forest managers and recreational users of the national forests (U.S. FOREST SERVICE, 1973; DANIEL, 1976 and 1977). These studies were initiated in an attempt to manage the nation's forest resources in accordance with the multi-use principle first proposed by Pinchot (NASH, 1968). Other studies have dealt with the perceived threat of floods along rivers and coastal areas between occupants and floodplain managers (BURTON and KATES, 1964; PENDSE and WYCKOFF, 1974).

The studies described above are primarily related to terrestrial and freshwater resources and the activities which depend on these environments. Similar questions can be raised concerning the perceived quality of the nearshore and how it is likely to affect the use of that resource.

The presumption guiding many of the environmental monitoring efforts is the more pristine the environment the greater the number of potential uses and the higher the aggregate level of satisfaction derived from the resource. For the manager this poses another dilemma, how to allocate the stream of benefits for uses generated by a given resource. Should the resource be managed on the basis of a total benefit maximization criterion or should it be managed in such a way as to maximize the utility of a few specialized water users willing to spend (travel) considerably longer to travel, even though the total aggregate benefit created may be significantly less? For instance should a given waterbody be protected for the benefit for a few waterskiiers who may value the calm conditions of the water, or should the resource be made available to a greater number of users such as recreational fishermen? Most fishing activities use considerably less water per user compared to the waterskiier, thus the value accruing to the individual angler may be somewhat lower assuming the availability of other equally suitable and available waterbodies. However the aggregate value generated by fishing may far exceed the fewer waterskiiers who can be accommodated within the area used by those fishing.

The problem raised here has implications for the management of nearshore water quality as well. The water quality classification scheme mandated by the Clean Water Act, 1972, requires each state to classify coastal waters on the basis of existing and projected uses of the water. This raises two questions of potential interest in this discussion. First, the classification is based entirely on scientifically defined criteria, a point which will be returned to below. Secondly, the classification generally ranges from near pristine water, which because of its high quality can accommodate many different types of uses, to an industrial class which commonly limits use to non-contact activities. To what extent does this classification accommodate efficient use of the water? Since the resource is limited, we need to recognize that different users have different environmental requirements. There is a need to identify how different users perceive the coastal environment. This will enable a better match between existing water conditions and optimal user requirements. How does the current water quality classification provide the manager with opportunities to increase the utility by permitting, perhaps even advocating, uses in environments which are perceived more favorable to specific user groups compared to the use designation created by the scientific classification?

While a branch of welfare economics has attempted to quantify intangible values such as scenery and environmental quality (EDWARDS, 1984; SINDEN and WORRELL, 1979), many of these solutions have been suspect if only because the variables affecting environmental perception are not constant. Perceptions, including those addressing environmental quality, change in response to new experiences, information and education. Research in progress by the author suggests statistically significant differences in environmental perception among several user groups including coastal residents, tourists, bathers, shellfishermen and boaters tested in both Narragansett, Rhode Island, and San Francisco Bays (WEST, in prep.), a point which is suggested by Nordstrom and Lotstein (in press) concerned with use of coastal dunes. These problems are illustrative of the complexity confronting the resource manager responsible for managing an environmental resource as well as permitting its reasonable use.

The argument which is presented here is based on the observation that different user groups[2] with proprietary interest in the

[2] In the context of this paper user groups and interest groups are different. The term user groups is understood to be a group of people who use the environmental resource in roughly the same manner. Examples of user groups include shorebased fishermen, bathers,

resource are likely to view it with respect to the expected *utility* of the resource. Expected utility as used here denotes the benefits which the various users expect from visiting or otherwise using the environmental resources. Thus, a person operating a pleasure craft would expect a waterbody reasonably free of floatables and clear water, but would be less concerned with the amount of vegetation and bottom cover as long as these environmental factors do not impede the expected utility or benefit from the use of the environment. Conversely, a bather appears to place much greater emphasis on clear water free of floatables and a bottom with no stones, mud and vegetation, while other user groups will place different demands on the same environmental resource.

Consequently, the manager views (perceives) the resource on the basis of what management (normatively) knows to be the "proper" course of action. Such perceptions appear to be strongly influenced and reinforced by the professional training, experience, goal setting, and planning horizon of the individual manager who derives his authority from the research conducted by the profession and the underlying philosophy which each discipline evolves over time.

User Perception and Environmental Decision Making

The resource user's utility is influenced by many different sets of criteria. First, depending upon the user, the expected utility may be interpreted from an economic, environmental, residential or recreational perspective. Although the individual's prior experience with a particular environment may constitute an important component of his or her expected utility, these are nonetheless influenced by a different set of factors compared to those of the manager discussed above a point which was discussed extensively by MITSUDA and GEISLER (1988). While some workers have noted perceptual differences between managers and users of lakes (BERINS, 1972; MILBRAITH, 1975; and KAMIENIECKI, 1979) as mentioned by Mitsuda and Geisler (*op. cit.*), studies dealing with perceptual differences between and among users of the marine environment are almost nonexistent.

The difference between the manager's and user's perception of the environment is that the former is reacting to and incorporating such measurements in the planning and management of the resource and its related activities; users often base their decisions on other common non-scientific information. It appears that each group evaluates the total environment based on the perceived expectations of that environment. Consequently, if the purpose is to catch fish, the expected utility will be evaluated on the basis of the ability to reach the shore, availability of piers or other structures from which to fish, and catch success measured by species, size and number of fish caught. The quality of the water only plays a role insofar as it may affect the user's ability to catch fish, assuming that that is the primary objective. If the expectation is to swim and relax on the beach, the environmental requirements will be different. A sandy beach free from glass and stones, clear water without floating garbage and a gently sloping bottom are viewed as the optimum environmental conditions for this group (WEST, 1987). While this discussion deals with the total characteristics of the environment with respect to the utility goals of managers and users, it is clear that utilities or expected benefits can be further broken down into those concerned with the *quantity* of the resources, for example, the number of beaches, boating ramps, marinas, fish caught, fishing piers, ramps and other access points *etc.*, and the *quality* of the environment. Since much of the environmental/recreational management literature has been concerned with the number and distribution of facilities (McALLISTER, 1975), and the demand for specific sites and facilities (MATHEUSIK and MILLS, 1983; BURTON, 1971; COPPOCK and DUFFIELD, 1975; and McALLISTER and KLETT, 1976), this topic will not be further addressed although the arguments presented can be applied to demand (MURPHY, 1975) for coastal facilities as well.

Concentrating on the qualitative aspects of the environment, some fundamental differences exist between environmental managers and

boaters, shellfishermen, residents adjacent to the shore, *etc.* In this paper interest groups include spokespersons for public advocacy groups usually environmental groups who are loosely supported—often financially—by contributions by a concerned public. While public interest groups supposedly speak for the public, they are often too broadly based to articulate the needs and interests of specific user groups.

users in how environmental quality is perceived. The former are primarily interested in understanding the cause-and-effect relationship between the initial environmental change and any environmental modification because these relationships may provide the solution to the abatement of future polluting events. The end-user, on the other hand primarily is concerned with the effects which any degradation may have on his or her expected use of the water.

WATER QUALITY PARAMETERS

Estuarine and Nearshore Water Quality Surveillance

The quality of the environment is typically defined on the basis of a series of biophysical and chemical parameters. The relative health of that environment is related directly to any deviation from some specified norm. For example, a biologically healthy nearshore marine environment is characterized as having dissolved oxygen (DO) in the mid-latitudes at 4 to 5 ppm and a pH range from 7.4 to 8.3 (MOREL and SHIFF, 1983). The DO level is an average and represents the optimum range for game fish (as opposed to industrial fish) which require more oxygen to sustain their metabolic rate. Similarly, pH is affected by temperature and biological activity within the water column. The ecosystem is influenced by a host of geological, oceanographic and climatological factors many of which are interrelated and interdependent.

National concern for the quality of the nearshore is a relatively recent development compared to the surveillance of fresh water resources which began back in the mid-19th century (MUELLER and ANDERSON, 1983). The wider surveillance efforts were initiated nationally in the coastal environment during the mid-1960's[3] and amended several times since (PUBLIC LAW 92-500 and PUBLIC LAW 95-217). At about the same time, a more holistic effort was undertaken to address marine technology and science concerns in the oceans and coastal environment. This effort resulted in the so-called Stratton Commission Report (STRATTON, 1969) which provided much of the impetus for the Coastal Zone Management Act (CZMA) in 1972 (PUBLIC LAW 94-370).

The passage of the CZMA represents an important departure from previous environmental legislation. The act dealt with an environmental problem both comprehensively and regionally in contrast to previous environmental programs which addressed environmental problems sectorally (SORENSEN, *et al.*, 1984). Nonetheless, this legislation has had relatively little impact on the way in which the quality of the physical environment, including the coastal and nearshore water, has been monitored. Most of the approaches that have been taken even now have sought to solve environmental problems through 'technical fixes,' (ROBADUE, pers. com.). The issues of dredging and the prohibition of discharge of human waste from recreational vessles are cases in point. Dredging should be viewed holistically in the context of all the users of the marine environment. Similarly, the implementation of Section 312 of the Federal Water Pollution Control Act, mandating the installation of federally approved marine toilets (Marine Sanitation Devices) was promulagated without adequate research concerning the potential impact on the marine environment (WEST, *et al.*, 1982).

Although the professional concern related to the health problems associated with sewage contaminated water (MUELLER and ANDERSON, *op. cit.*), subsequent concern has been expressed by the Environmental Protection Agency (EPA) and the Public Health Service (PHS) relating to potential health threats for swimmers and bathers, especially along some of the more polluted urban beaches (CABELLI, MORRIS and DUFOUR, 1983). The parameter used to determine whether a given beach environment is safe for water contact has almost exclusively been based on one of several coliform bacteria (MUELLER and ANDERSON, *op. cit.*) and not on how that environment is being perceived by the user. Although information related to environmental hazards has been difficult to convey to the affected public, efforts must be made to improve this transfer by incor-

[3]The passage of the Clean Water Restoration Act, PL 89-753 resulted in the first National Report dealing exclusively with the estuarine (nearshore) environment. For further information see Federal Water Pollution Control Administration, The National Estuarine Pollution Study, U.S. Department of the Interior, Washington, DC (November, 1969). Prior to that a few regional efforts had been undertaken. See for instance, Stevens, D. M. "Solid Waste Disposal and San Francisco Bay," San Francisco Bay Conservation and Development Commission, San Francisco, CA, 1966.

porating elements of water quality perceptions into existing water quality classifications.

Different pollution taxonomies have been developed over the years (MYERS and HARDING, 1983). The simplest divide pollutants into two—biodegradable and persistent. While this division is the oldest and most common, it is no longer effective from either a management or scientific perspective. Two other systems have evolved, and while neither answers all the objectives raised against the early classification, they do represent improvements for certain applications. One is based on the environmental target most affected and divides the pollutants into those impacting or interacting with (a) the physical, (b) chemical, and (c) biological environments. Another classification scheme divides the pollutants on the basis of their composition defined by their origin and/or morphology (MYERS and HARDING, *op.cit.*). These pollutants are divided depending upon their physical characteristics, biochemical origin, or whether they are made up of organic compounds. This classification does not take into consideration the impacts which they may have on the receiving environment. The discussion which follows represents a combination of all three classifications and is based primarily on their potential for being recognized by the using public.

The first group includes some of the oldest water quality parameters starting with DO, BOD-5, suspended solids (SS), bacterial counts, nutrients (principally carbon, phosphates and nitrogen) and ecological assemblages which may be indicative of the overall ecological health of the system (BOESCH and ROBERTS, 1983). The second group of pollutants consists of the heavy metals and includes mercury, cadmium, lead, copper, manganese, silver, iron and chromium. These parameters have largely been added since the mid 1970s as a growing number of federal, state and local agencies have become increasingly concerned about the possible adverse health impact upon the population. The last group is by far the largest and includes a host of organic compounds which are increasing very rapidly (METCALF, 1977). Only a cursory review is presented here emphasizing those aspects which relate to the users' knowledge, perception and attitude towards these effluents.

Physical and Biological Parameters

The environmental impacts caused by the bio-physical parameters are more readily perceived by the users of the nearshore marine environment. Organic loads are often evident by sight and smell. Furthermore, the contribution of significant continuous organic loadings may depress oxygen levels which may result in major changes in the ecosystem. If the depression in oxygen levels is significant and continuous, the more valuable finfish may avoid the area, creating an abandoned niche in the food chain which eventually may be occupied by a less valuable species. The near elimination of finfish in the New York Bight dumpsite is one example of the qualitative change in the food chain in a marine location (PEARCE, 1972).

In instances where the organic loadings come from sewage treatment outfalls (STP), or runoff from livestock pens or fields and residential developments serviced by individual septic systems (ISS), the water column may be contaminated with fecal coliform bacteria, viruses and fungi. However, effluent from human and warmblooded animals may not necessarily pose a health threat to those who come in direct contact with the contaminated water. In fact, the majority of bacteria associated with this type of waste appears not to be pathogenic. Fecal coliform bacteria are used only as an indicator variable which may be associated with the much rarer infectious bacteria and viruses which give rise to salmonella poisoning, hepatitis and even cholera (CABELLI and MORRIS, *op.cit.*). From the user's perspective, this type of water pollution is invisible and can only be inferred indirectly by association with floating garbage, discoloration of the receiving waters, *etc.* Since the identification of elevated fecal coliform and other pathogenic agents can only be detected in the laboratory by trained technicians, these conditions are for all intents and purposes invisible to the user groups. Consequently, the most common reaction by the public is to disregard such threats unless public announcements are made relative to the prevailing conditions.

The nutrients, principally nitrogen (N) and phosphorus (P), and to a much lesser extent carbon (C), are also invisible. They enter the receiving waters in several forms where nitrogen especially may become indirectly an environmental contaminant by stimulating algae growth (MUELLER and ANDERSON, *op.cit.*). This may become so plentiful that it turns into a nuisance, especially when decaying. In such instances the reactions to the pollutants are indirect. What the users may object to is the floating algae resulting from the introduction of the nutrients.

The last parameter included in the bio-physical group is the suspended solids (SS). As with the other 'effluents' discussed in this context, SS occurs naturally in areas where streams empty into estuaries and where bottom sediments are disturbed by either wave or tidal action. Most users object to SS because of its tendency to decrease the clarity of the water and its ability to color it in any number of tints, depending upon the origin of the sediment. Suspended solids or particles may contribute indirectly to a lower water quality in at least two ways. The individual particles which make up the suspended sediments are 'floating platforms' on which bacteria, viruses and fungi may attach themselves and be transported over a much larger area than would otherwise be possible (GRANT, 1983). The other way in which SS may contribute to a deteriorating water quality relates to the chemical reaction which may occur across the surface of the individual particles and any number of chemical compounds in the effluent stream (GRANT, *op.cit.*). While this is a relatively new area of investigation, it appears that the presence of SS in the water column may contribute to a lower water quality from both a scientific and perceptional point of view. This is supported by Moser who found color, floating debris, odor, water plants and algae to be significant detractors of environmental quality by end users (MOSER, 1984).

Trace Metals and Organic Compounds

Trace Metals and organic compounds are present naturally in both seawater and sediments, but they have become a potential problem because of their concentration in some parts of the nearshore marine environment. While the two groups of effluents originate from different sources and differ chemically, they share a number of characteristics once they enter the receiving waters. Both groups of effluents accumulate via the following three pathways: (a) through point sources, primarily sewage treatment outfalls and storm sewers; (b) from non-point sources in the form of runoff and from contaminated groundwater sources; and (c) from precipitation. There are several reasons why the impacts caused by the heavy metals and organic compounds escaped public scrutiny for so long by most public health and environmental professionals. First, the impacts are neither readily identifiable nor easily associated with specific pollutants. In this context the manager reacts to the unknown, quite similar to the end user; neither manager nor end user may be aware of the pollutant and the implication which it may have on health and wellbeing of the participant.

Secondly, the lag time between introduction of the material and environmental damage which may be caused by some of the organic compounds is often very long, sometimes on the order of several decades or more (MUELLER and ANDERSON, *op.cit.*). Thirdly, following fairly extensive research, it appears that the accumulation of trace metals in the water column resulting from municipal sewage effluent poses no serious direct threat to public health[4], and does not appear to bioaccumulate either within the planktonic or finfish communities (MEARNS, 1983). Consequently, the potential health threat related to the ingestion of fish contaminated by trace metals appear minimal, even for those trace metals which tend to biomagnify more readily which include lead, copper, zinc and manganese (BOESCH and ROBERTS, *op.cit.*).

Of much greater concern are the potential ecological changes which may be caused by untreated or insufficiently treated municipal and industrial waste. Laboratory experiments have verified avoidance type behavior in several species of finfish in waters with higher than background levels of trace metals (SPRAGUE, 1964). Extending this line of speculation further, it is not unreasonable to expect that environmental changes may occur because of changed input of both organic and inorganic effluents.

[4] The exception to this statement is the infamous incident in Japan where methyl-mercury poisoning killed or maimed many residents in the small fishing community of Minamata. This incidence was unique in that the mercury enriched effluent was methylated by microorganisms in the sediments. These microorganisms subsequently entered the foodchain through which the mercury was bioaccumulated to the point where the local fish consuming population was very severely impacted.

A related subject is the impact which these environmental changes have on those using the beach and nearshore. Several researchers have found shorebased fishing in some of the most polluted urban waterfronts. When asked why the respondents fish there, it has been found that catch is only a secondary objective for many of those fishing along urban waterfronts (BRYAN, 1976). This finding suggests that portions of the waterfront which previously have been assumed unsuitable for certain activities may well be used to support shorebased recreational activities (*i.e.* fishing) as long as such uses are not identifiably endangering the health and welfare of the participants.

CONCLUSION

Research has implicated both organic and inorganic effluents with many adverse impacts to both society and the ecosystem. While experts have repeatedly verified the adverse biochemical impacts on ecological resources, most of these are not perceived regularly by the general public as being particularly alarming (BELTON and ROUNDY, 1986). The only exception occurs when a particular visual pollution event takes place or where residual effluents can be seen on the shore or in the water. The average user of the nearshore is often oblivious to the potentially adverse effects which a given effluent may have on his or her use of the environment, especially if these are not visually evident (UDD *et.al.* 1987). For all intents and purposes, the presence of heavy metals are invisible to the users and, as such, they may not be aware of the potential health threat. A related problem concerns the lack of knowledge concerning a specific environmental contaminant and the manner in which the user perceives environmental quality. Both previous and ongoing research by this and other authors (HEATWOLE and WEST, 1985; DAVID, 1971; and DINIUS, 1981) have shown that the vast majority of the users associate shore and nearshore effluent with what can be directly perceived by the senses. Why then the opposition to locating sewage outfalls in the open water? While no studies have specifically addressed this issue as it pertains to public perception it is hypothesized that where public opposition has surfaced the public has objected to the *perceived idea* of effluent as opposed to the ecological impacts *experienced* from outfall generated effluent.

Many users do not perceive the scientifically based regulations as valid. High levels of mercury, lead and other heavy metals, numerous organic compounds and even elevated *E.coli* counts are not in and by themselves significant detractors for many recreational fishermen and other passive and active users of the coastal environment. This is so even in instances where waters have been identified as polluted and where the responsible authorities have posted the beach and shore for specific activities such as fishing and bathing. Past and ongoing research related to the awareness of environmental contaminants by the shorebased fishing community as one group which may be particularly exposed to an environmental hazard strongly suggests that fish resources are being consumed by a significant number of the population with little or no regard to the potential health hazards present (SLOVIC, *et.al.*, 1979). This is a problem of some importance to coastal resource managers and health officials in many areas and is a problem which has largely been ignored, even though some preliminary information is beginning to appear on this topic.

The survey of both science and perceptional studies concerned with environmental quality clearly indicates that wide discrepancies exist between the social (behavioral) scientist and the physical and bio-chemical scientist in terms of how to define or describe estuarine quality. This suggest the existence of a two-pronged management dilemma. First, it may be that management has failed to communicate effectively the potential dangers related to certain inappropriate uses of coastal marine resources. Clearly, society has an obligation to protect the public in instances where the resource use presents an unacceptable risk to the exposed population. Consequently, it is not suggested that the existing surveillance efforts in any way be curtailed. Secondly, in light of the wide discrepancy between how coastal and estuarine water quality is measured scientifically and how the water quality is perceived by the users, there is a need to either identify variables which will measure water quality scientifically and perceptionally, or barring that, identify a number of additional water quality parameters which are meaningful to the users.

A corollary problem concerns the manner of communicating the information to the exposed public. Traditional signing has generally not been effective in preventing unsafe or ineffective usage of coastal resources (WILLIAMS and WILLIAMS, 1988). Would the internationally accepted traffic signs serve as a model for the creation of a universally agreed upon environmental signs?

The suggested water quality variables included below are not intended as a comprehensive list. Specific parameters should be selected on the basis of how each included user group perceives optimum estuarine quality conditions. Such parameters would have to be identified through detailed analysis of specific user groups. Preliminary variables could include, besides suspended solids and secchi dish measurements (both of which are routinely measured), bottom conditions, *i.e.* slope, bottom cover (stone, sand, mud or gravel, *etc.*), vegetation (*i.e.* size, whether rooted, floating, submerged or emergent), color of the water, and an index of floatables. This latter parameter could perhaps be based on kind of materials (organic versus inorganic) or size. It is quite likely that considerable overlap exists among different user groups related to perceived nearshore quality, although ranking of the parameters in terms of importance is likely to vary between and among different users.

ACKNOWLEDGEMENTS

The preparation was funded in part by the Narragansett Bay Project. Professors Richard Burroughs, David Fisher, and Celeste Lamson made many valuable comments on earlier drafts.

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