CHAPTER 9
Aesthetic issues

Aesthetic issues play an important role in the public's perception of a recreational water area, for example public opinion surveys about desirable seaside resort characteristics have found that some 10% of respondents cite the importance of a clean beach (Oldridge, 1992). The principal aesthetic concern is revulsion associated with obvious pollution of the water body, turbidity, scums or odour (which may relate to inadequate levels of dissolved oxygen, see chapter 10). Pollution may cause nuisance for local residents and tourists as well as environmental problems and may lessen the psychological benefits of tourism (WHO, 1980). In this chapter, the aesthetic parameters that affect the acceptability of a recreational water area are described.

9.1 Aesthetic parameters

The general aesthetic acceptability of recreational water can be expressed in terms of criteria for transparency, odour and colour. It has been suggested that values for light penetration, colour and turbidity should not be significantly increased over natural background. The aesthetic value of recreational water areas implies freedom from visible materials that will settle to form objectionable deposits, floating debris, oil, scum and other matter, substances producing objectionable colour, odour, taste or turbidity, and substances and conditions that produce undesirable aquatic life (Department of National Health and Welfare, Canada, 1992).

9.1.1 Transparency and colour

Safety hazards associated with turbid or unclear water depend on the intrinsic nature of the water itself. Ideally water at swimming areas should be clear enough for users to estimate depth, to see subsurface hazards easily and to detect the submerged bodies of swimmers or divers who may be in difficulty (see chapter 2). Aside from the safety factor, clear water fosters enjoyment of the aquatic environment. The clearer the water, the more desirable the swimming area (National Academy of Sciences, 1973). The principal factors affecting the depth of light penetration in natural waters include suspended microscopic algae and animals, suspended mineral particles, stains that impart a colour (iron, for example, may impart a reddish colour to water), detergent foams and dense mats of floating and suspended debris, or a combination of these factors.

There are two measures of colour in water—true and apparent. The true colour of natural water is the colour of water from which turbidity has been removed (i.e., filtered water). Natural minerals give true colour to water; for example, calcium

carbonate in limestone regions gives a greenish colour, ferric hydroxide, red. Organic substances, tannin, lignin and humic acids from decaying vegetation also give true colour to water (Reid & Wood, 1976). Apparent colour is an aesthetic quality and cannot be quantified. It is usually the result of the presence of coloured particulates, the interplay of light on suspended particles and such factors as reflection of the bottom or sky. An abundance of (living) blue-green algae (cyanobacteria) may impart a dark green hue; diatoms give a yellow or yellow-brown colour; some algae impart a red colour. Zooplankton, particularly microcrustaceans, may occasionally tint the water red (Reid & Wood, 1976). The causes of colour in marine waters are not thoroughly understood, but dissolved substances are one of the contributory factors. The blue of the sea is a result of the scattering of light by water molecules, as in inland waters. Suspended detritus and living organisms give colours ranging from brown through red and green. Estuarine waters have a different colour to the open sea; the darker colours result from the high turbidity usually found in such situations (Reid & Wood, 1976). This characteristic colour can also impact on coastal recreational waters receiving estuarine input, where public perception may be that the colour change represents some form of pollution as illustrated in Box 9.1.

BOX 9.1 AESTHETIC REVULSION RELATING TO WATER COLOUR PRODUCED BY A NON TOXIC ALGAL BLOOM

Within the monitoring programme for bathing waters of Catalunya (NE Spain), which is the responsibility of *l'Agència Catalana de l'Aigua—Departament de Medi Ambient-Generalitat de Catalunya*, a persistent problem was detected at La Fosca beach (Costa Brava) characterised by the discoloration of water. Water that appeared to be clean in the early morning became green-brown by late morning and remained so into the evening. This generated numerous complaints from the public who assumed the problem to be related to wastewater and sewage inputs. An intensive monitoring programme was conducted, this included:

- sanitary inspection of the beach and sewage system to search for unauthorised outlets;
- inspection of possible inland water influence;
- study of the temporal and spatial variations of the microbial water quality;
- analysis of physico-chemical parameters;
- study of sediments and flora, and finally;
- an investigation of phytoplankton.

The programme (which cost US$35,000 at 1994–1996 prices) unequivocally ruled out wastewater or sewage inputs. The discoloration was eventually attributed to a non-toxic dinoflagellate *Alexandrium taylori* (Delgado et al., 1997). Once the origin of the problem was identified a series of press conferences and a local publicity campaign was undertaken to inform the public. *A. taylori* had not previously been identified in the Mediterranean. Since its identification at La Fosca, however, it has been reported at other Mediterranean locations (Garcés et al., 2000).

This incident illustrates that not all water discoloration should be assumed to be due to sewage pollution. In this instance a preliminary investigation to identify dinoflagellate species would have saved both time and money.

Some regulatory authorities have recommended absolute values for transparency/colour and turbidity in recreational waters. This approach can be difficult to apply at local level because many waters may have naturally high levels of turbidity/colour. It is, therefore, more common that reference to changes from the normal situation be used to indicate potential water pollution.

9.1.2 Oil, grease and detergents

Even very small quantities of oily substances make water aesthetically unattractive (Environment Canada, 1981). Oils can form films on the surface, and some oil-derived substances, such as xylenes and ethylbenzene, which are volatile, may also give rise to odours or tastes, even though they are of low toxicity. In some countries (e.g., Canada), it has been reasoned that oil or petrochemicals should not be present in concentrations that can be detected as a visible film, sheen or discoloration on the surface, be detected by odour or form deposits on shorelines and bottom sediments that are detectable by sight or odour (International Joint Commission, 1977; Department of National Health and Welfare, Canada, 1992) (see also chapter 10). It is difficult to establish criteria for oil and grease, as the mixtures falling under this category are very complex. Tar may also present a problem on the shore; this can be removed by mechanical cleaning of the sand (see chapter 6).

Detergents can give rise to aesthetic problems if foaming occurs, particularly since this can be confused with foam caused by the by-products of algal growth (see chapters 7 and 8; Bartram & Rees, 2000 chapter 10).

9.1.3 Litter

Beach litter is derived from three main sources: marine, riverine (including torrents) and beach user discards. Visitor enjoyment of any beach is likely to be marred by litter, although litter perception varies with respect to many parameters, such as age, socioeconomic status and gender. Although not litter, as such, large accumulations of seaweed and algae are likely to be an aesthetic problem (both in terms of visual impact and odour) and also, if associated with flying and/or biting insects, a nuisance (see chapter 11).

The variety of litter found in recreational water or washed up on the beach is considerable. Some examples of unwanted recreational water flotsam and jetsam include wooden crates and palettes, cardboard cartons, newspaper, steel drums, plastic containers and foam products, rubber goods such as vehicle tyres, bottles and cans, dead animals or animal bones, human hair, discarded clothing, hypodermic syringes, needles and other medical wastes, bottle tops, cigarette butts and packets, matchsticks, fish netting and rope ends.

Litter counts have been considered as possible proxy indicators for the likelihood of gastrointestinal effects associated with swimming. For example, high incidence rates of self-reported gastrointestinal illness after bathing in sewage-polluted water have been associated with public perceptions of different items affecting the aesthetic appearance of recreational water and beaches (University of Surrey, 1987). The presence of the following items was positively correlated with the likelihood of self-

reported gastrointestinal symptoms: discarded food/wrapping, bottles/cans, broken bottles, paper litter, dead fish, dead birds, chemicals, oil slicks, human/animal excrement (particularly from dogs, cats, cattle or birds), discarded condoms and discarded sanitary towels.

9.1.4 Odour

Objectionable smells associated with sewage effluent, decaying organic matter such as vegetation, dead animals or fish, and discharged diesel oil or petrol can deter recreational water and beach users. Odour thresholds and their association with the concentrations of different pollutants of the recreational water environment have not been determined. The presence of dissolved oxygen in the water body will be of great importance in preventing the formation of undesirable amounts of odorous hydrogen sulfide (see chapter 10).

9.1.5 Noise

Traffic on nearby roads, trade hawkers and indiscriminate use of beach buggies, motorbikes, portable radios and hi-fi equipment, motorboats and jet skis can all impact on tranquillity for the beach and water user; at the same time, some people thrill to noisy activities (Velimirovic, 1990). Mindful of the need for mutual respect (WHO, 1989), zoning of areas for different activities is often undertaken.

9.2 Economic consequences

The public often perceives the quality of recreational water to be very different from its actual microbial and/or chemical quality (Philipp, 1994). Some studies have shown that rivers of good microbial or chemical quality have been perceived as poor by the public because of aesthetic pollution (Dinius, 1981; House, 1993). Poor aesthetic recreational water and beach quality may, however, also imply poor microbial/chemical water quality.

The economic aspects associated with cleaning the coastline have previously been reviewed (Bartram & Rees, 2000). Local economies may depend on the aesthetic quality of recreational water areas, and many fear that environmental degradation of beaches could lead to loss of income from tourism (WHO, 1990; Godlee & Walker, 1991; Philipp, 1992). At resort beaches, litter may have an economic effect on the region. During 1987 and 1988, beach closures in New York and New Jersey, USA, due to litter accumulation, together with the public's perception of degraded beach and water quality, cost the local economy several billion dollars (Valle-Levinson & Swanson, 1991).

The upper Adriatic coast of the Mediterranean Sea was hit during the 1989 summer season by a very severe episode of eutrophication, which, together with mucilage caused by the production of viscous substances from benthic micro-algae, generated considerable concern among tourists about their health. The unpleasant sight of large tracts of this viscous amorphous substance along the shoreline resulted in a large number of beaches along the Italian coastline becoming temporarily unsuitable for bathing (WHO, 1990). There was a 40% reduction in local tourism as a

consequence of this (Philipp, 1992), and aesthetic considerations alone were sufficient to prevent would-be bathers from entering the water (WHO, 1990). The economic effects attributed to the loss of use of the environment for tourists and other economic purposes were:

- loss of tourist days;
- damage to the local tourist infrastructure (loss of income for hotels, restaurants, bathing resorts, other amenities, etc.);
- damage to tourist-dependent activities (loss of income for clothing manufacture, food industry, general commerce, etc.);
- damage to fisheries activities (reduction in fish catch, depreciation of the price of seafood);
- damage to fisheries-dependent activities (fishing equipment production and sales, fisheries products, etc.); and
- damage to the image of the Adriatic coast as a recreational resort at both national and international levels (WHO, 1990; Philipp, 1992).

A further economic factor that should be taken into consideration is the health care cost associated with beach litter, in particular hospital waste washed up on beaches (Philipp, 1991; Walker, 1991; Anon., 1994). The direct health care costs arising from discarded hypodermic syringe needles have been studied and found to be considerable (Philipp, 1993).

9.3 Marine debris monitoring

Methods to undertake marine debris surveys have been presented and discussed elsewhere (Bartram & Rees, 2000 chapter 12). The purposes of marine debris monitoring may include one or more of the following:

- to provide information on the types, quantities and distribution of marine debris (Williams & Simmons, 1997);
- to provide insight into problems and threats associated with an area (Rees & Pond, 1995);
- to assess the effectiveness of legislation and coastal management policies (Earll et al., 1997);
- to identify sources of marine debris (Earll et al., 1997);
- to explore public health issues relating to marine debris (Philipp et al., 1993, 1997); and
- to increase public awareness of the condition of the coastline (Rees & Pond, 1995).

In the United Kingdom, for example, one series of studies identified a 4-fold deterioration in coastal environmental quality during three consecutive years (Philipp et al., 1994). The results helped to justify national legislation for tighter controls on discharges from seawater sewage outfall pipes and the removal of screenings for disposal elsewhere, better provision and emptying of litter bins and improved advice for

the public (Philipp et al., 1994, 1997). In Catalunya (Spain), a programme of aesthetic monitoring was undertaken to supplement microbial water quality data (Box 9.2).

BOX 9.2 VISUAL INSPECTION AND MICROBIAL WATER QUALITY

The monitoring programme conducted in the Catalunya region of NE Spain has been implemented to provide the public with information on the aesthetic aspects of water and sand in combination with data on microbial water quality. Microbial water quality monitoring is conducted once a week, while aesthetic aspects are assessed more frequently (up to five times a week). Data is collected on the presence and amount of:

- plastics;
- sanitary residues;
- algae;
- tar;
- oil;
- litter;
- abnormal water colour; and
- anything else that may cause aesthetic revulsion.

In addition, information on how thoroughly a beach is machine cleaned and how frequently litter containers are emptied is recorded.

The aesthetic data are processed alongside the microbial water quality data and result in a combined grading for the beach. Aesthetic aspects are considered to be so important that an excellent microbial grading may be reduced to good or even poor if the beach looks bad.

Municipalities, tourist information offices, NGOs, local newspapers, TV and radio are informed weekly of the results. In addition, municipalities receive a report outlining raw microbial data for each of the evaluated parameters and the results of the visual inspection along with suggestions for improvements. This system gives confidence to the public that their concerns are being taken seriously and has also encouraged many municipalities to improve the aesthetic aspects of their bathing areas.

The reliability and validity of litter counts as measures of health protection need to be tested among different populations and in different exposure situations (Philipp et al., 1997). Beach surveys for the extent of littering are, however, useful as indicators of the need for behavioural change (WHO, 1994). To be worthwhile in the research context, litter counts, as measures of aesthetic quality and as potential indicators of the likelihood of illness associated with the use of the recreational water area, must be able to:

- classify different levels of beach and water quality and the density of different litter and waste items before and after any environmental improvements or cleansing operations;

- be useful when compared with conventional microbial and chemical indicators of recreational water and beach quality;
- differentiate the density of different pollutants deposited by the public on beaches from pollutants that originated elsewhere and were then washed ashore;
- show consistent findings when used in studies of similar population groups exposed to the same pollutant patterns; and
- show a correlation with variations in the human population density of recreational water and beaches (Philipp, 1992; IEHO, 1993; Philipp et al., 1997).

Large-scale monitoring programmes for marine debris often rely on volunteers to survey the beaches and collect data (Marine Conservation Society, 2002). It is, however, not usually possible, with staffing constraints, to verify the findings in a sample of locations before the next high tide. Tide changes can, too, be accompanied by changes in water currents and wind direction. Nevertheless, reliable data can be collected if comprehensive guidance is given to ensure comparable approaches by different groups of volunteers and if validated questionnaire methods are used in consistent and uniform ways. Internal cross-checks of such methods have been undertaken, and they have confirmed consistency of the data collected (Philipp et al., 1993).

9.4 Guideline values and management

As guidelines are aimed at protecting public health, no guideline values have been established for aesthetic aspects. Aesthetic aspects, however, are important in terms of maximizing the benefit of recreational water use.

In terms of aesthetic factors, questions frequently raised for local managerial consideration include the following (Philipp, 1993):

- Are wastes there?
- If present, where are the wastes coming from?
- Are they causing aesthetic problems?
- Could the aesthetic problems be responsible for economic losses in the local community?
- Can the effects (if any) be stopped?
- Who should control the problems?
- What will it cost, and can any loss of environmental opportunity be measured?

Mechanical beach cleaning (see also chapter 6 and Bartram & Rees, 2000 chapter 12) usually involves motorized equipment utilizing a sieve that is dragged through the top layer of the sand. The sieve retains the litter, but usually cigarettes and other small items pass through. Resort beaches use such equipment because it is fast and provides an aesthetically clean recreational areas for visitors. In areas with, for example, medical waste, sewage-related debris or other potentially harmful items, it reduces health risks for those cleaning the beach, because no manual picking up of

material is involved. The utilization of mechanical cleaning at rural beaches has been questioned, as such cleaning affects local ecology (Llewellyn & Shackley, 1996).

Other strategies for keeping beaches free of litter include providing waste bins on beaches and emptying them frequently, suggesting that recreational water users take their litter home with them and using people to manually pick up litter.

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