Water Quality: "in the eye of the beholder"

David Smith

How do people judge whether water is suitable for bathing, and whether a water body is "attractive" or not? And do different people tend to have more or less the same reaction to a certain water appearance? Staff from NIWA, Hamilton, have carried out a countrywide study to address these questions, and have come up with some management guidelines for assessing the recreation potential of rivers and lakes.

OVER THE PAST four years, staff at NIWA have been studying human perception of the appearance of river and lake waters. They have conducted 400 bankside interviews over most of the country to find out how water clarity (clearness) and colour are perceived by people using these waters for recreation. At the time of each interview, they also actually measured the water clarity (using the horizontal black disc technique) and assessed water colour (using Munsell colour patches as comparison; these are a type of scientifically based series of colour patches, similar to a paint chart). These measurements were the key to the study - linking people's perceptions to reality. To our knowledge, this is the first time studies like this have been conducted anywhere in the world.

Recreation at Lake Ruataniwha. The water of this lake is perceived as clear, seemingly as a consequence of its colour and its pristine alpine setting. (Photo: D G Smith)

As a consequence of these studies, we now have a good idea of people's requirements for these two important visual aspects of water, from the perspectives of bathing and aesthetics.

Figure 1

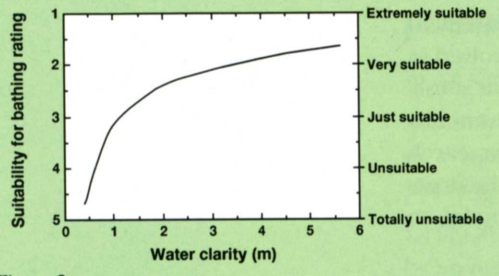

Figure 2

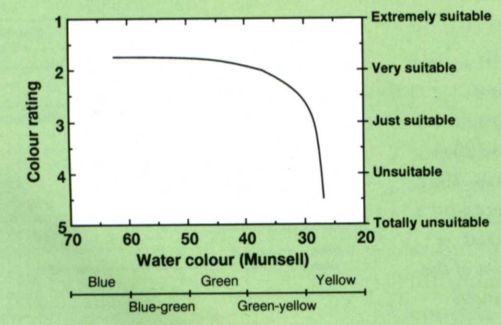

Figure 1. Water suitability for bathing (mean rating for each of 18 sites) plotted against horizontal black disc clarity.

Figure 2. Water suitability for bathing (mean rating for each of 10 sites) plotted against Munsell colour number and description.

The requirements for clarity and colour for both water uses were found to be virtually identical. Researchers also found that a water body which is considered pleasant to look at is usually considered suitable for bathing and, not surprisingly, such water tends to be used for bathing. So water appearance and bathing activity are very closely linked.

Clear, blue water preferred

Not unexpectedly, people prefer clear waters to turbid waters. Using rating scales, the researchers found that water is perceived as just suitable for bathing at a horizontal black disc clarity of 1.2 metres (Figure 1), corresponding to a Secchi depth of about 1.5 metres. At this clarity, 80% of interviewees found the water to be just suitable (or better) for bathing. This means that the remaining 20% of respondents require clearer water. So, if water managers require that, say, 90% of people should respond in this manner then the horizontal water clarity needs to be 2.2 metres (Secchi depth, about 2.75 metres). The steepness of the curve at around 1 metre of water clarity indicates that this region is critical for water managers in that a small increase in clarity can bring about substantial perceptual improvement. Above about 2 metres of clarity, the rate of perceptual improvement is much reduced - here we have entered a region of diminishing returns.

Response to colour is shown in Figure 2. Blue and green waters are preferred to yellow (brown) waters. Preference drops sharply in the yellow region of the spectrum. Water is perceived as just suitable for bathing at a Munsell colour of around 30, the boundary between green-yellow and yellow. At this colour just under 90% of respondents interviewed found the water to be just suitable (or better) for bathing.

Some "odd" results

However, despite these fairly decisive statements, several "oddities" emerged from the studies. For instance, a turbid but blue water (Lake Ruataniwha in inland South Canterbury) was perceived by interviewees as having a clarity "very suitable" for bathing, yet its clarity at the time of the survey was only 0.89 metres placing it in the "unsuitable" to "just suitable" region in Figure 1! In this instance it seems that the lake colour and its natural setting, in some way counteracted its lack of clarity so that its perceived clarity was acceptable.

Another example showed that a clear, but yellow (brown) water (the Inangahua River at Reefton) was perceived in different ways by two different groups of people. At the time of the interviews, the water of this river was fairly clear (3.5 metres), but people who were not aware of the natural cause of its very apparent yellow staining reported its clarity as much less suitable for bathing than those who were aware. When informed of the cause of the yellow staining - natural humic material from native forests - the former group then expressed a much more favourable response to the water's clarity. The knowledge enabled them, in some way, to see the water as it really was. Again, perceived naturalness seems to be important in perception of optical water quality.

So, in summary, guidance can be provided concerning management of both clarity and colour of water for bathing and aesthetics. But there are some pitfalls, and perceived naturalness may override some otherwise relatively poor optical properties. ■

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