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Impacts of changes in water quality on recreation behavior and benefits in Finland

J. Vesterinen [a,*], E. Pouta [a], A. Huhtala [a], M. Neuvonen [b]

[a] MTT Agrifood Research Finland, Luutnantintie 13, 00410 Helsinki, Finland
[b] Finnish Forest Research Institute, Jokiniemenkuja 1, 01370 Vantaa, Finland

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ABSTRACT

The implementation of the European Union Water Framework Directive (WFD) requires nationally generalizable estimates of the benefits of protecting inland and coastal waters. As an alternative to benefit transfers and meta-analyses, we utilize national recreation inventory data combined with water quality data to model recreation participation and estimate the benefits of water quality improvements. Using hurdle models, we analyze the association of water clarity in individuals' home municipalities with the three most common water recreation activities – swimming, fishing and boating. The results show no effect on boating, but improved water clarity would increase the frequency of close-to-home swimming and fishing, as well as the number of fishers. Furthermore, to value the potential benefits of the WFD, we estimate the consumer surplus of a water recreation day using a travel cost approach. A water policy scenario with a 1-m improvement in water clarity for both inland and coastal waters indicates that the consumer surplus would increase 6% for swimmers and 15% for fishers. In contrast to previously estimated abatement costs to improve water quality, net benefits could turn out to be positive. Our study is a promising example of applying existing national recreation inventory data to estimate the benefits of water quality improvements for the purposes of the WFD.

1. Introduction

The EU Water Framework Directive (WFD), adopted by the European Commission (2000), aims to harmonize water protection in the EU countries. Its goal is to ensure that all aquatic ecosystems achieve 'good ecological status' by 2015. However, the objectives set out in the Directive are not intended to be met for every water body at any cost: the implementation should avoid costs that are disproportionate to the achievable benefits. The need to find a balance between costs and benefits has created demand for both benefit and cost studies connected with the WFD in several European countries (Bateman et al., 2006; Hanley et al., 2006).

As inexpensive approaches, meta-analysis and benefit transfer have been appealing methods to generate value estimates for planning national environmental policies (Hanley et al., 2006). However, one problem associated with the use of single-site studies in benefit transfer is the uniqueness of the valuation situations; it is often "interesting hot-spot areas" that are chosen for analysis (Hoehn, 2006). Lindhjem and Navrud (2008) have shown that using benefit transfer studies from another country, even a culturally similar one, increases transfer error considerably. We suggest an alternative approach that draws on national recreation inventory data to produce nationwide valuation information. Especially in countries with few transferable studies, existing recreational inventory data (Dehez et al., 2008; Cordell et al., 2005) combined with water quality data may provide an accessible and reliable basis for producing nationally consistent benefit estimates. Particularly in water-rich countries, such as the Nordic countries and the US, recreation is considered one of the most important reasons for conserving water bodies (Söderqvist, 1998) and is estimated to account for over 60% of the total benefits from water protection (Rodgers et al., 1990). We illustrate the usability of inventory data for the valuation of recreational benefits from water protection in Finland, the country often called "the land of a thousand lakes".

Water quality improvements have been valued using the travel cost method on the Swedish coast, which has water conditions similar to those in Finland.[1] (Sandström, 1996; Soutukorva, 2005). In these studies, carried out before the implementation of the WFD,

* Corresponding author. Tel.: +358 9 56 08 63 04; fax: +358 9 56 08 62 64.
E-mail addresses: janne.vesterinen@mtt.fi (J. Vesterinen), eija.pouta@mtt.fi (E. Pouta), anni.huhtala@mtt.fi (A. Huhtala), marjo.neuvonen@metla.fi (M. Neuvonen).

[1] More recent Nordic stated preference studies with WFD-relevance include Eggert and Olsson (2009) and Laitila and Paulrud (2008).

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water quality was valued as an attribute affecting an individual's choice of destination site or region, as is often done in the analysis of water recreation demand (e.g. Parsons et al., 2003; Egan et al., 2009). However, an abundance of water recreation opportunities has an effect on the applicability of various types of recreation demand models. When modeling water recreation demand in a water-rich country like Finland, the focus should be on understanding the conditions enabling everyday, close-to-home water activities – ones forming a significant proportion of recreation – rather than the choice of remote sites. Site choice approaches are limited when the aim is to evaluate the effects of a water policy affecting citizens' everyday living environment on a national scale. National-level policies require a wider focus than the demand for water quality at a single lake or in particular small regions, and it is on the national scale that EU-wide policies such as the WFD seek to improve water quality. Assessing the impacts of policy on the national level makes it particularly important to link water quality to general recreation behavior (Ribaudo and Piper, 1991). Site-based approaches would be difficult in this kind of setting since the WFD is intended to affect many lakes in various regions simultaneously. In contrast, national recreation inventory data can provide a solution to evaluate the effects of policy, as the data encompass participation in activities, frequency of participation, and information on the respondents' home municipality. To the best of our knowledge, there has been only one study to date that has analyzed water recreation in relation to close-to-home water quality (Ribaudo and Piper, 1991).

This study illustrates the use of national outdoor recreation inventory data in assessing the welfare effects of water quality change. Improvements in water quality and thus the everyday living environment, may affect water recreation behavior in two ways: Non-users are more likely to become recreational users, and current users to increase the number of days spent on a particular activity. For some individuals the decision on the number of use days is irrelevant due to personal preferences or a lack of suitable water areas or other resources.

The first objective is to analyze the association between recreation participation for three water activities – swimming, fishing and boating – and water quality, using water clarity as the indicator. Secondly, we estimate the consumer surplus of a water recreation day and the marginal social net benefits of an exogenous improvement in water quality. To illustrate the usability of this benefit assessment, we then take the analysis a step further and compare the benefits to the associated costs.

Our approach in modeling participation econometrically is to use hurdle models, which are further used to estimate the change in the number recreation days associated with water quality change. The value of a recreation day is estimated using the travel cost method. The current information on the costs of water quality improvements is expressed in physical measures, such as the abatement of nutrient emissions, whereas benefits are gauged in terms of easily perceived quality indicators, such as water clarity. Finally, we illustrate the linkage between physical measures, water clarity and the monetary costs and benefits.

2. Water resources, recreation participation and water quality indicators

Finland, with a population of about five million, has one lake for every 26 people. There are 187,888 lakes larger than 500 square meters, and water areas cover about 10% of the country. The Baltic Sea and its extensive archipelago are also actively used for water recreation. The Finnish national outdoor recreation demand and supply inventory confirms the importance of water resources in outdoor recreation. Over two-thirds of the population swim in natural waters every year, swimming being the second most popular outdoor recreation activity after walking. Participation rates in fishing and boating are slightly above and below 50%, respectively (Pouta and Sievänen, 2001). Given the Finnish climate, with only four summer months on average, such a level of water recreation activity is almost surprising.

The main water recreation activities in Finland are swimming, fishing and boating. The water quality in a citizen's home municipality is particularly important for these activities, as the majority of one-day or shorter visits (68% for boating, 79% for fishing, 86% for swimming) take place close to home (Pouta and Sievänen, 2001). The natural resources for these activities are readily available, as the median distance from an individual's home to the nearest area suitable for swimming, fishing, or boating is only 2 km.

In the setting described, it is appealing to focus on the question how the availability and quality of recreation resources in individuals' living environment affect their participation in recreation activities. The environmental quality of a person's home region and its effect on his or her recreation behavior has been the subject of a number of recreation demand studies (Ribaudo and Piper, 1991; Boxall and McFarlane, 1995; Neuvonen et al., 2007). High provision of recreational opportunities in people's living environment has generally been found to promote active living that includes participation in recreation (Henderson and Bialeschki, 2005). The environmental quality of the recreational setting is positively associated with the level of recreational activity and the health of community members (Kaczynski and Henderson, 2007).

The water environment is part of a high-quality environment that increases physical activity and enhances human health (Bauman et al., 1999; Giles-Corti and Donovan, 2002; Humpel et al., 2004). Nearby water areas and their quality have been found to be a significant factor in hedonic property price studies (e.g. Leggett and Bockstael, 2000; Michael et al., 2000; Tyrväinen, 1997) and in landscape preference studies (e.g. Dramstad et al., 2006). However, the approaches used in this research did not focus on how water quality affects recreation on a general scale. To the 'authors' knowledge, the only study analyzing the correlation between water quality and participation in water recreation in an individual's home region is that conducted by Ribaudo and Piper (1991), which focused on fishing.

There are several types of substitution effects in the case of water recreation participation (e.g. Freeman, 1995; Hanley et al., 2003). Participation is naturally dependent on close-to-home resources. However, more distant water resources can provide a substitute; the typical Finnish substitute is a summer cottage owned by the household. Other activities are likely substitutes when the resources for those activities, such as recreation areas, forests and nature conservation areas, moderate participation in water-related activities. In the Finnish case, the high proportion of forested land and 'everyman's right – free public access to the land and waterways – provide abundant substitutes for other activities.

To analyze the effect of water quality improvement on recreation behavior, it is important to select a water quality indicator that is meaningful for both active and potential recreationists. The WFD states that water bodies are to be of good ecological status, a description that covers indicators such as fish, water plants, zoobenthos and plankton species. In the WFD current ecological status is compared to natural status, yet ecological status may not be a quality indicator easily observable by the public that would have an effect on recreation behavior. Site selection studies have used a multitude of water quality variables, from the amount of suspended solids (e.g. Egan et al., 2009; Parsons et al., 2003) and harmful bacteria in water (Parsons et al., 2003) to subjective measures of water quality (Whitehead et al., 2000; Whitehead, 2005). Both objective and subjective measures of water quality