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RESEARCH ARTICLE

Re-meander, rewet, rewild! Overwhelming public support for restoration of small rivers in the three Baltic Sea basin countries

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Baltic Sea is one of the World's most oxygen-depletes seas, so the region requires urgent mitigation measures to significantly reduce nitrogen and phosphorus inputs from land through rivers, which cannot be achieved without large-scale restoration of wetland buffer zones. The manuscript summarizes the findings of the discrete choice experiment aimed at assessment of the preferences of Danish, German, and Polish citizens toward ecosystem services of lowland small rivers of the Baltic Sea basin. Our results suggest that respondents in all the studied countries are willing to pay substantial amounts to improve water quality in rivers and the Baltic Sea, as well as to restore naturally meandering rivers and natural riparian vegetation. *Wild marshes* and *Wetland agriculture* were equally valued as the most desirable options. Respondents systematically cared about the appearance of small rivers in their neighborhood. We conclude that re-meandering, rewetting of floodplains, and restoration of wild marshes (i.e. natural wetland vegetation) or development of wetland agriculture could gain a lot of public support in Europe.

Key words: Baltic Sea, discrete choice experiment, ecosystem services, restoration, small rivers, willingness to pay

Implications for Practice

- Restoring rivers and riverside wetlands is the required way to reduce the water eutrophication.
- Taking no actions and hence facing a prospective deterioration of Baltic Sea water quality would systematically be entailing very large social costs in Denmark, Germany, and Poland.
- A well-targeted policy to facilitate the restoration of riverside wetlands is highly needed in Europe and can gain a lot of public support.

Introduction

Restoring degraded ecosystems and recovering their lost services is central to the global change mitigation and adaptation agenda, as articulated in the UN Resolution on a Decade of Ecosystem Restoration and the IPCC Report on Climate Change and Land (Shukla et al. 2019). However, to meet sustainability challenges we need to consider scaling up ecosystem restoration by orders of magnitude, moving it from a niche within national environmental policies to a broad socio-economical context (Friberg et al. 2017). This is, in its core, a social–ecological challenge (Fischer et al. 2021). The mainstreaming of ecological restoration in democratic-liberal systems will not happen without broad public support and, more importantly, a sense of shared responsibility, common interest, and empowerment among stakeholders who need to bring about meaningful changes in land governance through socio-ecological innovations (Teasdale et al. 2020). How citizens perceive and value restoration, and how their attitudes are shaped by awareness of the potential benefits, should therefore be a major concern for policy and decision makers and restoration planners. Hereby, we tackle this question referring to the particularly sensitive case of riverine wetlands, the loss of which has driven many European countries to problems with water quality and scarcity,

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significant biodiversity losses, and the recovery of which seems essential for future sustainable livelihoods.

For centuries, small rivers in Europe's lowlands have been regulated and drained, as a result of which most of them are now artificially straightened and riparian ecosystems are transformed into agricultural and forestry land. The mass transformation of small rivers brought up negative consequences in terms of ecosystem services supply. Biodiversity declined both within the aquatic ecosystem and on adjacent wetlands, wider losses were related to disruption of migration corridors. Flood risk of downstream areas increased due to diminished catchment retention and accelerated discharge, whereas capacity for water purification declined due to the drainage of wetlands and channelization of rivers.

Along with the fact that a large part of Europe has been transformed into arable land (almost 50% of the area of Poland and Germany, and more than 60% in Denmark), the lack of natural buffer zones along rivers means that agricultural fertilizer runoff is a significant nutrient source for ground and surface waters. The excess of nutrients becomes a serious problem as soon as the nutrient-rich water enters a lake, dam reservoir, or a coastal zone of the sea, causing algal and cyanobacterial blooms and oxygen depletion. The supply of large quantities of dead organic matter triggers intensive bacterial decomposition marked by emission of methane and toxic hydrogen sulfide. The repeated oxygen deficits over the following years lead to the creation of so-called dead zones, in which animals, including fish, in deeper water layers are almost absent. The naturally shallow and geographically inland Baltic Sea faced severe eutrophication (Rönnberg & Bonsdorff 2004) caused by nutrient pollution influx from the mainland rivers exacerbated with a limited inflow of the cleaner marine and oceanic water. Every year more than 580,000 ton of nitrogen and 29,000 ton of phosphorus reach the Baltic Sea through rivers, of which 46 and 36%, respectively, originate from agricultural sources (HELCOM 2018). In result, 97% of the Baltic Sea area is affected by eutrophication, and 12% is in the worst category of eutrophication (HELCON 2018). The anaerobic zones have increased more than 10-fold since 1900, from 5,000 to 60,000 km^2, owing Baltic Sea the name of world's largest marine dead zone (Jokinen et al. 2018).

Deterioration of coastal and inland waters of Baltic Sea basin is reflected in the results EU monitoring: less than good ecological status has been assigned to more than 90% of coastal waters of south-west Baltic and 60–80% of inland waters in Poland, 50–70% in Denmark, and >90% in Germany (European Environment Agency 2018). Eventually, due to decades or centuries-long persistence of heavily modified agricultural landscapes, uncultivated riverine landscapes are threatened with vanishing from the collective memory of European citizens (Brown et al. 2018) together with a broad range of associated recreational, esthetic, intrinsic, and other cultural services of riverine ecosystems.

This situation exposes an urgent need for restoring riverine ecosystems, which is in fact the most technically feasible solution reducing agriculturally driven eutrophication of the Baltic Sea as well as a cost-effective means for coping with multiple environmental problems (Jabłońska et al. 2020; Walton et al. 2020). Although preferences in favor of riverine ecosystem services restoration are ubiquitously found in the literature (e.g. Loomis et al. 2000; Kenwick et al. 2009; Acuña et al. 2013; Vermaat et al. 2015), quantification and valuation of cultural ecosystem services face many methodological issues, leading toward their frequent omission in quantitative analyses (Milcu et al. 2013). The corresponding preferences and benefits for different stakeholder groups are ambiguous (e.g. Heldt et al. 2016) and dependent of their location. For instance, farmers encountering harvest and profits losses might be reluctant toward the restoration programs in their vicinity even despite economic incentives (Dworak et al. 2009; Buckley et al. 2012). A "softer" approach associated with rivers' restoration might be seen by the public as offering a lower level of flood protection than the "hard" engineering solutions, which prevailed in the past (Tunstall et al. 2000).

A set of methods to measure the value of cultural ecosystem services, or more generally, non-marketed goods and services exists (Freeman et al. 2014). A frequently used method is discrete choice experiments (DCE) embedded in questionnaires and allowing respondents to trade off multiple elements in a policy choice involving biodiversity conservation or other public goods (Carson 2012). Until now, several studies used DCEs to elicit the economic value of riverine ecosystem services (e.g. Willis & Garrod 1999; Holmes et al. 2004; Kragt & Bennett 2009; Zander & Straton 2010; Rayanov et al. 2018). Likewise, DCEs have been used to put an economic value on water quality in the Baltic Sea. On the basis of meta-analyses covering 76 empirical studies conducted in the Baltic Sea countries, Sagebiel et al. (2016) found predominance of the valuation studies addressing and isolating eutrophication reduction and seaside recreation over other marine ecosystem services. However, according to our knowledge, there were no holistic studies to date that linked small river management in farmland landscapes to downstream and Baltic Sea water quality.

This is the first study that within the same valuation framework disentangles local benefits of small rivers' restoration from national benefits (i.e. overall river water quality at the national level), and from international benefits (i.e. the water quality improvement in the Baltic Sea). As a result, our study enables direct comparison of different cultural ecosystem services provided by restored rivers, as well as their inter-country comparison across the wide gradient of socio-economic contexts since the same questionnaire was administered in Denmark, Germany, and Poland. Such a comparison is highly relevant from a EU policy perspective given the potential upscaling of small rivers' restoration across the countries varying substantially in terms of GDP per capita, levels of agriculture intensification, and associated landscape transformation.

Methods

The Questionnaire

The survey questionnaire was prepared as a result of interdisciplinary consultations involving the biologists, non-market valuation economists, paludiculture specialists as well as trial in-depth interviews (see Supplement S1 for the questionnaire master copy in English). The questionnaire was tested on four focus groups with lay persons prior the main survey.

Assuming that the majority of respondents rarely consider issues of conservation management and governance in their everyday life, nor have they necessarily got substantial knowledge in this sphere, we chose to dedicate some portion of the survey scenario to knowledge statements allowing any respondent to make informed and rational choices. The survey scenario began with familiarizing respondents with causes, mechanisms and results of water eutrophication. The respondents were informed

Table 1. Attributes, levels and their description in the discrete choice experiment.

I. Attributes at the Country Level

Attribute I.1—Water Quality in the Rivers on the Country Level

Levels	*Bathing Possibility*
Good (improvement)	Without limits
Medium (current state)	Recreational use by adults only—not suitable for children
Bad (worsening)	Water is not suitable for bathing

Attribute I.2—Water Quality in the Baltic Sea

Levels	*Cyanobacteria Blooms Risk and Range*	*Prohibition of Bathing*
Good (improvement)	Rare, locally	1–3 days a year
Medium (current state)	Possible almost every summer, medium extent	4–10 days a year
Bad (worsening)	Possible every summer, widespread	11–20 days a year
Very bad (strong worsening)	Possible every summer, extremely widespread	The water is not suitable for bathing

II. Attributes at the Local Level (i.e. Within 20 km Radius from Respondent's Home)

Attribute II.1—Riverbed Shape and Dynamics

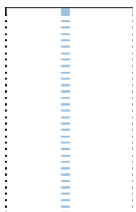
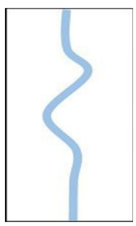
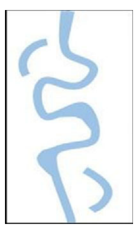
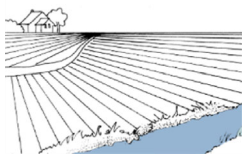
			Explanation: Potential for Supporting of		
Levels	*Photo Depicting a Given Riverbed Type*	*Icon Representing a Given Riverbed Type*	*Riverine Water Purification*	*High Biodiversity*	*Water Retention Upstream and Flood Defense Downstream*
Regulated straightened riverbed			— Very low	— Very low	— Very low
Regulated curvy riverbed			 Medium	 Medium	 Medium
Naturally meandering riverbed			 High	 High	 High

Table 1. Continued

Attribute II.2—Riparian Vegetation Type					
			Explanation: Potential for Supporting of		
Levels	*Photo Depicting a Given Vegetation Type*	*Icon Representing a Given Vegetation Type*	*Riverine Water Purification*	*High Biodiversity*	*Water Retention Upstream and Flood Defense Downstream*
Low-intensity agriculture			 Low	 Low	 Low
Intensive agriculture			— Very low	— Very low	— Very low
Wild marshes (i.e. natural wetland vegetation)			 High	 High	 High
Wetland agriculture (see Wichtmann et al. 2016 and Ziegler 2020 for the concept of wetland agriculture/ paludiculture)			 High	 High	 High
III. Cost					
Attribute III—Annual Change in Your Income as a Result of the Program Implementation					
The levels of change in income were country specific			Germany: 0, 25, 50, 100, 200, 300 (in EUR) Poland: 0, 50, 100, 200, 400, 600 (in PLN) Denmark: 0, 175, 350, 700, 1,400, 2,100 (in DKK)		

that the increasing use of fertilizers as well as regulation of rivers are responsible for a considerable increase in water eutrophication and that addressing the eutrophication problem requires tighter restrictions limiting use of fertilizers, improvement of industrial and municipal wastewater treatment, and restoration of the natural river valleys, including re-meandering of the riverbeds and restoration of wetland buffer zones along the rivers (c.f. Walton et al. 2020).

In the core part of the questionnaire (the DCE, Table 1), two types of non-monetary attributes were defined: those describing changes at the local level and those describing changes at the national/international level. Selection of the program attributes and their levels followed expert consultations and focus groups, aimed to ensure adequate representation of the ecological conditions on the ground and their correct understanding by laypersons. Simple qualitative categorization of water quality levels in regard to recreational use of rivers and Baltic Sea (i.e. "very bad" and "bad" vs. "good" and "very good") was followed by explanation of each category through particular characteristics of recreation (e.g. duration of algae blooming or age groups eligible for bathing/swimming). While the local-level attributes expressed visual characteristics of the small rivers and their consequences for biodiversity, flood protection, and water purification locally, country-level attributes indicated water quality in the rivers on the countries' level and down in the Baltic Sea. As the country-level attributes were said to be also attainable by other means than restoration of small rivers, the attributes of those two levels were considered independent from each other.

The respondents were informed that even if the restoration activities were started immediately, their effects in the case of rivers would be visible in some 10 years. Whereas in the case of the waters of the Baltic Sea the implementation of the mitigation measures right now would lead to water quality improvement only in some 30 years. The scenario was completed by the methodologically induced monetary attribute reflecting the costs of the program implementation for the respondent. The cost attribute was framed as a new annual compulsory tax, which would be imposed for all the country's citizens for the foreseeable future. The payment vehicle justification was given that financial means would be necessary for transformation of the riverbeds' shape and restoration of the riverine vegetation stripes as well as for reimbursement of the lost profits to land users in cases when re-meandering and establishment of riparian wetlands would entail shrinking of their farmland grounds.

The *status quo* was defined as medium water quality throughout the country's rivers both now and in 10 years, whereas it was stated that the lack of change now would entail growing accumulation of pollutants in the Baltic Sea, making the maintenance of the current state impossible and leading to the bad state if no action is undertaken. Regarding the local level attributes, the *status quo* riverbed type was *Regulated straightened riverbed* whereas the riparian vegetation type was set out as an *Intensive agriculture* for Denmark and Germany while *Low-intensity agriculture*—for Poland. Each choice task included the *status quo* option and two program alternatives. The *status quo*, unlike the alternative programs, did not imply any changes in the respondents' annual income. An example of a choice card is provided in Figure 1, whereas the both types of used attributes (at the local and national level) with corresponding levels are presented in Table 1.

Survey Administering

The survey was administered as computer-assisted web interviews (CAWI) on representative samples of 1,000 respondents in each country in September of 2019. The survey was prepared in the national language for each country. In total, 893 complete interviews from Denmark, 914 from Poland, and 916 from Germany were collected and included in DCE analysis (see Table 2 for summary statistics).

Each respondent was presented with 12 choice tasks. The combinations of attribute levels presented in each choice task were prepared in a way which maximized the amount of information revealed by respondents, conditional on our expectations regarding their preferences. These expectations (priors) were obtained through the pilot study conducted on a sample of 100 respondents in each country.

The final design was optimized for median Bayesian D-error of the MNL model (Scarpa & Rose 2008) based on the data from 300 interviews (100 from each of the countries). The design used Bayesian priors to account for the uncertainty associated with our imperfect knowledge of the true parameters (Bliemer et al. 2008). We randomized the order of choice tasks presented to each respondent to counter-balance possible ordering and anchoring effects (Day & Prades 2010). The same design composed of 36 choice-sets, divided into three blocks, has been used in the three studied countries.

Econometric Modeling

In a DCE exercise, individuals are asked to identify their preferred alternative i among a given set of J alternatives. The data analysis follows the Random Utility Model (RUM) (McFadden 1974). Under RUM, it is assumed that the observed choice from an individual n is the one she expects to provide her with the highest utility. The utility function, U_{ni}, can be decomposed into a systematic part, V_{ni}, and a stochastic part, ε_{ni}. The probability P_{ni} that the decision maker n chooses alternative i instead of another alternative j of the choice set is $P_{ni} = \Pr\left(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \forall j \neq i\right)$. If ε_{ni} is assumed to be an independently and identically distributed extreme value type I (Train 2009), this probability has a closed form multinomial logit (MNL) expression (1):

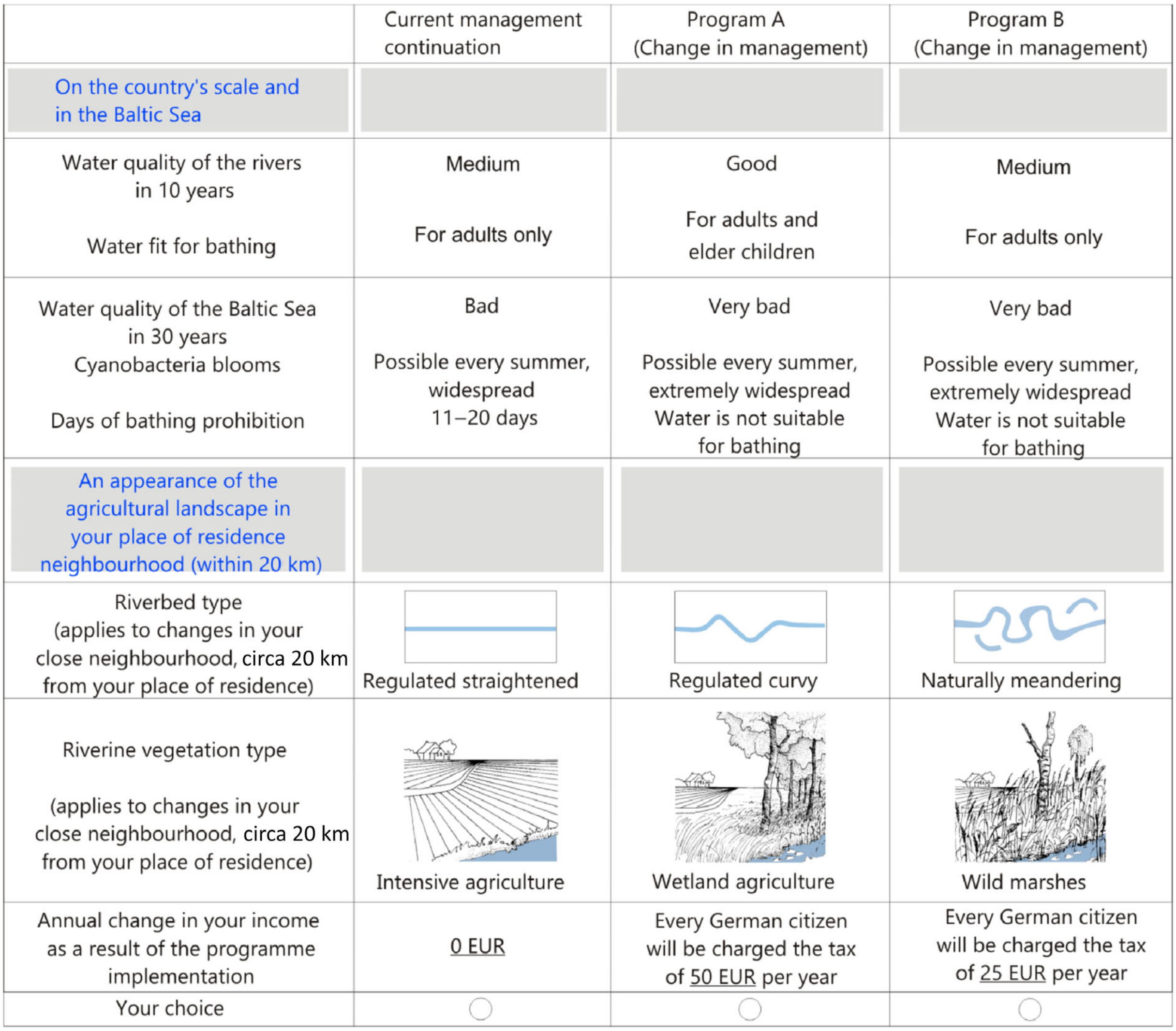
$$P_{ni} = \frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}} \tag{1}$$

where x is a vector of variables and β is a vector of parameters.

Mixed logit models (MMNL) (McFadden 1974; Train 2009) were estimated for every country involved in order to account for preference heterogeneity. MMNL is any model whose choice probabilities take the form (2):

$$P_{ni} = \int \frac{e^{\beta_n' x_{ni}}}{\sum_j e^{\beta_n' x_{nj}}} \varphi(\beta | b, \Omega) d\beta \tag{2}$$

where $\frac{e^{\beta_n' x_{ni}}}{\sum_j e^{\beta_n' x_{nj}}}$ is a standard MNL formula, $\varphi(\beta|b,\Omega)$ is the density of the random coefficients with mean b and covariance Ω. Thus, the logit expression can be treated as a special MMNL case with β being fixed. The limitation of the standard MNL that



	Current management continuation	Program A (Change in management)	Program B (Change in management)
On the country's scale and in the Baltic Sea			
Water quality of the rivers in 10 years Water fit for bathing	Medium For adults only	Good For adults and elder children	Medium For adults only
Water quality of the Baltic Sea in 30 years Cyanobacteria blooms Days of bathing prohibition	Bad Possible every summer, widespread 11–20 days	Very bad Possible every summer, extremely widespread Water is not suitable for bathing	Very bad Possible every summer, extremely widespread Water is not suitable for bathing
An appearance of the agricultural landscape in your place of residence neighbourhood (within 20 km)			
Riverbed type (applies to changes in your close neighbourhood, circa 20 km from your place of residence)	Regulated straightened	Regulated curvy	Naturally meandering
Riverine vegetation type (applies to changes in your close neighbourhood, circa 20 km from your place of residence)	Intensive agriculture	Wetland agriculture	Wild marshes
Annual change in your income as a result of the programme implementation	0 EUR	Every German citizen will be charged the tax of 50 EUR per year	Every German citizen will be charged the tax of 25 EUR per year
Your choice	○	○	○

Figure 1. Choice-card example from the German questionnaire.

Table 2. Descriptive statistics (mean and standard deviation) of respondents to computer-assisted web interviews in Denmark (DK), Germany (DE), and Poland (PL).

	DK	*DE*	*PL*
Age (mean ± SD)	44.38 ± 14.85	47.41 ± 14.02	43.88 ± 15.26
Gender (% of women)	49.4	50.3	49.1
Education (%)			
Primary	12.31	6.41	14.00
Secondary	18.31	16.98	20.42
Vocational	18.31	17.32	14.86
Bachelor	21.69	24.30	18.57
Master or higher	19.21	23.85	23.29
Not reported	10.17	11.14	8.86
Place of residence (%)			
Countryside	14.58	27.00	38.86
Towns, population below 49,000	28.02	18.00	24.00
Towns, population 50,000–4,99,000	28.14	23.73	25.86
Cities, population over 5,00,000	29.27	31.27	11.29
Number of respondents	893	916	914

it can represent only the systematic taste variation but not random taste variations is relaxed by assuming a mixing distribution that is not degenerated at fixed parameters. Given that we are interested in marginal rates of substitution with respect to the monetary attribute p, it is convenient to estimate parameters in willingness to pay (WTP) space (Train & Weeks 2005), that is (3):

$$U_{njt} = \alpha\left(p_{njt} + \boldsymbol{Y}_{njt}\boldsymbol{b}\right) + e_{njt} = \alpha\left(p_{njt} + \boldsymbol{Y}_{njt}\boldsymbol{\beta}\right) + e_{njt} \quad (3)$$

In this specification, the vector of parameters $\boldsymbol{\beta} = \boldsymbol{b}/\alpha$ can be directly interpreted as a vector of implicit prices (marginal WTPs) for the non-monetary attributes $\boldsymbol{Y}_{njt}$.

All distributions, except for monetary attribute, were assumed to be normal. The cost coefficient was assumed to follow log-normal distribution. This is equivalent to impose the economic theory-driven restriction that marginal utility of money is expected to be positive for all respondents. Since the integral in Equation (2) cannot be evaluated analytically, the probabilities have to be simulated. In each run, 1,000 random Sobol draws were used.

The utility function specification for each of the country-specific models of the both types included two dummy-coded variables associated with the levels of water purity in the rivers on country level in 10 years, three dummy-coded variables standing for the levels of water purity in the Baltic Sea in 30 years, two dummy-coded variables for the levels of riverbed sinuosity, three dummy-coded variables standing for the levels of riverside vegetation, a continuous monetary cost variable, and an alternative-specific constant for the *status quo*, capturing unexplained effects for choosing the *status quo* alternative. The models presented here were estimated using a DCE package developed in Matlab, and are available at https://github.com/czaj/DCE.

Results

Since all models were estimated in WTP-space, the results in Table 3 can be readily interpreted as the marginal WTP for respective attribute levels. The reported WTP values are Purchasing Power Parity (PPP)—adjusted (see Table S1 for the model fit characteristics, and Table S2 for WTP expressed in the nominal prices). Despite the fact that the Polish GDP per capita (PPP) is only about 55% of the Danish and 58% of the German (World Economic Outlook Database October 2019), the WTP estimates of the Polish respondents for contemplated improvement of ecosystem services have the comparable levels to WTP of the Danish and German respondents, and for some attributes are even higher (i.e. *Wetland agriculture* or *Wild marshes*).

The respondents in all three countries are willing to pay for water improvement with WTP values rising as water quality improves both in the rivers and in the Baltic Sea. The levels of water quality worse than *status quo* are associated with negative WTP. Consistently in all the studied countries, the WTP estimates for improvement of the water quality in the Baltic Sea are substantially larger than in the countries' rivers. The WTP

Table 3. Mixed logit models (MMNL) results, WTP for programs' implementation (expressed in terms of annual change in personal income) in PPP-adjusted EUR in 2019 prices. **, *** significance at 5, and 1% level correspondingly

	Denmark		*Germany*		*Poland*	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
Water quality in the country's rivers						
Bad river water quality in 10 years (medium river quality is the reference level)	−69.74***	47.88***	−84.24***	66.57***	−122.79***	94.16***
Good river water quality in 10 years (medium river quality is the reference level)	75.82***	154.69***	58.39***	157.36***	61.27***	142.12***
Water quality in the Baltic Sea						
Very bad Baltic water quality in 30 years (bad Baltic water quality is the reference level)	−60.83***	106.82***	−36.12***	133.50***	−106.96***	205.89***
Medium Baltic water quality in 30 years (bad Baltic water quality is the reference level)	78.55***	102.47***	109.40***	94.09***	110.71***	19.33
Good Baltic water quality in 30 years (bad Baltic water quality is the reference level)	105.63***	127.22***	164.75***	150.86***	135.57***	104.82***
Riverbed type						
Regulated curvy riverbed shape (regulated straightened riverbed is the reference level)	28.98***	59.64***	33.28***	82.17***	25.11***	71.41***
Naturally meandering riverbed shape (regulated straightened riverbed is the reference level)	52.23***	80.17***	87.65***	111.91***	66.39***	18.92
Riparian vegetation type						
Low-intensity agriculture (intensive agriculture is the reference level)	48.08***	70.96***	8.36	44.64***	42.96***	27.09**
Wild marshes (intensive agriculture is the reference level)	96.29***	115.56***	87.99***	110.56***	105.55***	44.28***
Wetland agriculture (intensive agriculture is the reference level)	102.51***	110.04***	95.64***	111.61***	108.48***	71.30***

of German respondents for the highest level of water quality in the Baltic Sea is 164 EUR and is 2.82 times higher than their WTP for the highest level of water quality in the rivers. In Poland, the WTP for the highest level of the water quality in the Baltic Sea is 135 EUR and is 2.2 higher than the WTP for the corresponding level in the rivers, whereas in Denmark the WTP is 105 EUR and is 1.4 larger than the WTP for the highest level of the water quality in the rivers.

Regarding attributes which were defined at the local level (i.e., within 20 km proximity from the respondents' homes), in all three countries estimated WTP for restoration of *Naturally meandering riverbed* significantly outperforms WTP for the introduction of the *Regulated curvy riverbed* which—in turn—is preferred over the *Regulated straightened riverbed* type. The WTP measures for *Naturally meandering riverbed* with respect to *Regulated straightened riverbed* vary from 52 EUR in Denmark to 87 EUR in Germany with WTP for Poland being equal to 66 EUR. *Intensive agriculture* is systematically considered the least preferred vegetation type in the three studied countries. Changing management type from the *Intensive agriculture* to the *Low intensity agriculture* is associated with increase in utility which is valued from 8 EUR in Germany (not significantly different the base level) to 48 EUR in Denmark.

On the contrary, *Wild marshes* and *Wetland agriculture*—the options implying the highest level of ecosystem services in our exercise—have been assigned the highest and very similar WTP in the three countries. In the three studied countries, we failed to reject the null hypothesis that the estimated mean WTP for *Wild Marshes* and *Wetland agriculture* is equal. WTP estimates for these two vegetation types vary from 88 EUR in Germany to 108 EUR for Poland.

Discussion

The results of our DCE study show that the highest WTP in each of the three analyzed countries was declared for water quality improvement in the Baltic Sea. These results are consistent with earlier studies on the Baltic Sea water quality (Ahtiainen & Vanhatalo 2012; Ahtiainen et al. 2014; Sagebiel et al. 2016). However, our results differ from earlier findings in terms of differences across countries. Markowska and Żylicz (1999) and Ahtiainen et al. (2014) found essential differences between countries of the Baltic Region in WTP for water quality improvement in the sea—WTP was several times higher in Scandinavia and Germany than in post-soviet countries. Unlike them, in our study the PPP-adjusted WTP for improvements of the Baltic Sea water quality in Poland was comparable to the respective values in Germany and even higher than in Denmark. There may be various reasons for this, such as an increase in income, or an increase of environmental awareness in Polish society.

Our study also allows us to express in monetary terms what are the social costs of not taking action to improve water quality in rivers and the Baltic Sea. In the case of rivers, we observe a very large asymmetry in disutility associated with water quality worsening (i.e. moving from *Medium* to *Bad* level) versus water quality improvement (i.e. moving from *Medium* to *Good* level) for Poland, that is, the WTP for water quality improvement in Polish rivers is 61 EUR, whereas the WTP for deterioration is −122 EUR. This effect is moderate for Germany, that is, 58 EUR for improvement versus −84 EUR for deterioration and does not occur for Denmark where the WTP for improvement and deterioration are close to symmetry (i.e. 75 EUR vs. −69 EUR). For the Baltic Sea, if we take the current water quality (*Medium* level) as a basis, a strong asymmetry is observed in the three countries studied, that is, in Denmark the WTP for deterioration (from *Medium* to *Bad* level) is −79 EUR, while the WTP for the improvement is 27 EUR (from *Medium* to *Good* level), for Germany −109 EUR versus 55 EUR, and for Poland −111 EUR versus 25 EUR, respectively. That shows that the welfare change associated with water quality deterioration is between 2 times and 4.4 times higher in absolute terms than the WTP for water quality improvement. These results clearly indicate that taking no actions and hence facing a prospective deterioration of Baltic Sea water quality would systematically be entailing very large social costs in the three countries. The obtained results are in line with the Prospect Theory (Kahneman & Tversky 1979), which introduced the concept of loss aversion and derives from observation that people react differently to potential losses and potential gains.

In our study, we have found large support for restoration of small river ecosystems at the local level (i.e. within 20 km proximity from the respondents' homes), whereas mixed evidence is found in the literature in this respect (e.g. Brouwer et al. 2010; Kataria et al. 2012; Martin-Ortega et al. 2012; Paulrud & Laitila 2013; Schaafsma et al. 2013; Lizin et al. 2016; Logar & Brouwer 2018) as the appropriate preferences might exhibit various spatial, directional, informational, and other effects. For instance, some people might prefer more ordered landscapes in their immediate neighborhood over "chaotic" appearance of natural rivers because of their socio-cultural backgrounds (Nassauer 1989; Ryan 1998), specific ideological beliefs, or esthetical tastes.

Surprisingly, the obtained WTP values for the most preferred—and most intact in their appearance—vegetation types (i.e. *Wild marshes* and *Wetland agriculture*) in our study are higher than the WTP values for improving rivers water quality on the country level and are only slightly smaller than the WTP values for improving the Baltic Sea water quality. This surprisingly high support for restoration of small rivers in the respondents' immediate neighborhood renders their preferences a "reverse NIMBY" (Cairns 1995), whereas the NIMBYism often constitutes an essence of conservation/land use conflicts (Brown et al. 2017). While in the first turn, NIMBYism applies to infrastructure, energy or housing development projects, lack of local acceptance is also observed in case of some nature restoration and/or conservation programs (e.g. Hiedanpää 2002; van der Aa et al. 2004; Guerrin 2015). Therefore, large and highly significant WTP for restoration of natural riverine wetland vegetation and for re-meandering of the riverbeds indicates that there are large and significant positive benefits associated with restoration of small rivers across the wide gradient of socio-economic contexts. This finding is in line with other recent contributions from European countries (e.g., Bliem & Getzner 2012; Grazhdani 2013; Logar &

Brouwer 2018; Rayanov et al. 2018), and elsewhere in the world (e.g., Li et al. 2014; Vásquez & de Rezende 2018; Khan et al. 2019; Soto-Montes de Oca & Ramirez-Fuentes 2019), which contemplate rewilding or restoration of the historically human-transformed riverine ecosystems and recovery of their functions and services.

Summing up, the results of our study indicate that re-meandering, rewetting of floodplains, and restoration of wild marshes or development of wetland agriculture for small rivers of lowland Europe could gain large public support. Although the economic efficiency of small rivers' restoration lies beyond the scope of the current paper, as it would require conducting a cost–benefit analysis, our study clearly shows that benefits of restoring small rivers exceed improved water quality as they would also provide important amenities across the wide range of socio-economic contexts in terms of improved landscape quality.

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Supporting Information

The following information may be found in the online version of this article:

Table S1. MMNL results, WTP for programs' implementation (expressed in terms of annual change in personal income) in PPP-adjusted Euros in 2019 prices (extended version of Table 2 from the paper).

Table S2. MMNL results, WTP for programs' implementation (expressed in terms of annual change in personal income) in nominal Euros, 2019.

Supplement S1. The Survey Questionnaire.

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