ARE PREFERENCES STATED IN WEB VS. PERSONAL INTERVIEWS DIFFERENT?

A Comparison of Willingness to Pay Results for a Large Multi-Country Study of the Baltic Sea Eutrophication Reduction

Ewa Zawojska and Mikołaj Czajkowski

University of Warsaw, Department of Economics, Poland

ezawojsk@utk.edu

Stated preference (SP) methods

- Used to determine public's preferences, especially towards non-market goods
- Survey-based
- Administered by various modes: mail, phone, web, in-person
- Provide estimates of benefits for cost-benefit analysis

What are the social benefits from reducing eutrophication of the Baltic Sea?

- Ahtiainen et al. (2014):
  "Benefits of meeting nutrient reduction targets for the Baltic Sea …"
  Journal of Environmental Economics and Policy, 3(3), 1-28
- A large multi-country study – all Baltic Sea countries; 10,000 observations
- The largest international valuation research about the marine environment
- The first one to include all nine littoral countries

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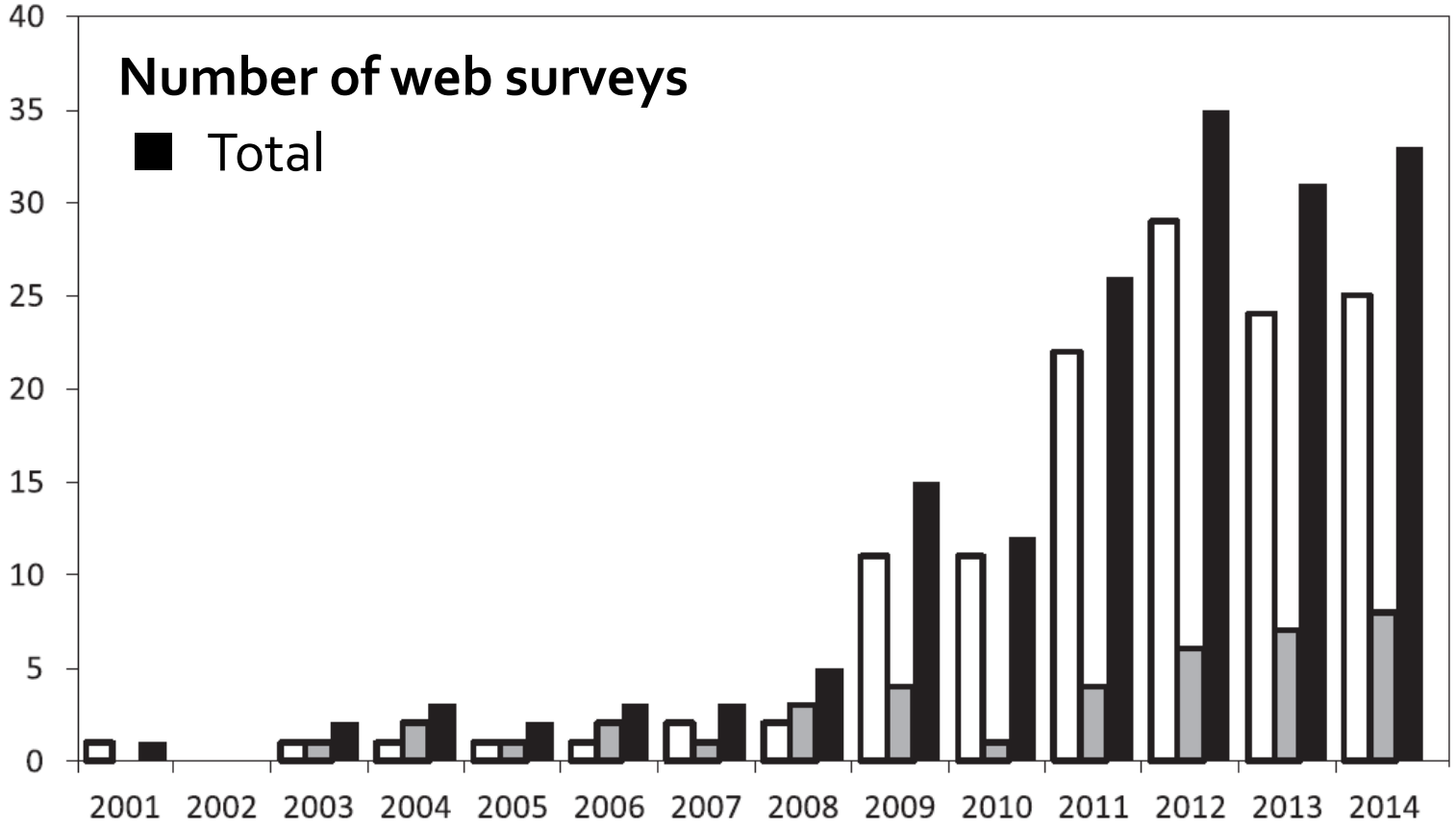
- A large multi-country study – all Baltic Sea countries; 10,000 observations
- The largest international valuation research about the marine environment
- The first one to include all nine littoral countries
- In different countries, different survey modes were used: web and/or in-person interviews
- **(How) did the data collection mode affect the survey results?**
- Ahtiainen et al. (2014) do not examine the mode effect

Web and in-person SP surveys

- In-person interviews have been long acknowledged as best practice.
- Internet allows researchers to administer surveys cheaper and faster.
- Web surveys are gaining more and more popularity.



Menegaki et al. / Journal of Choice Modelling 18 (2016) 18–50

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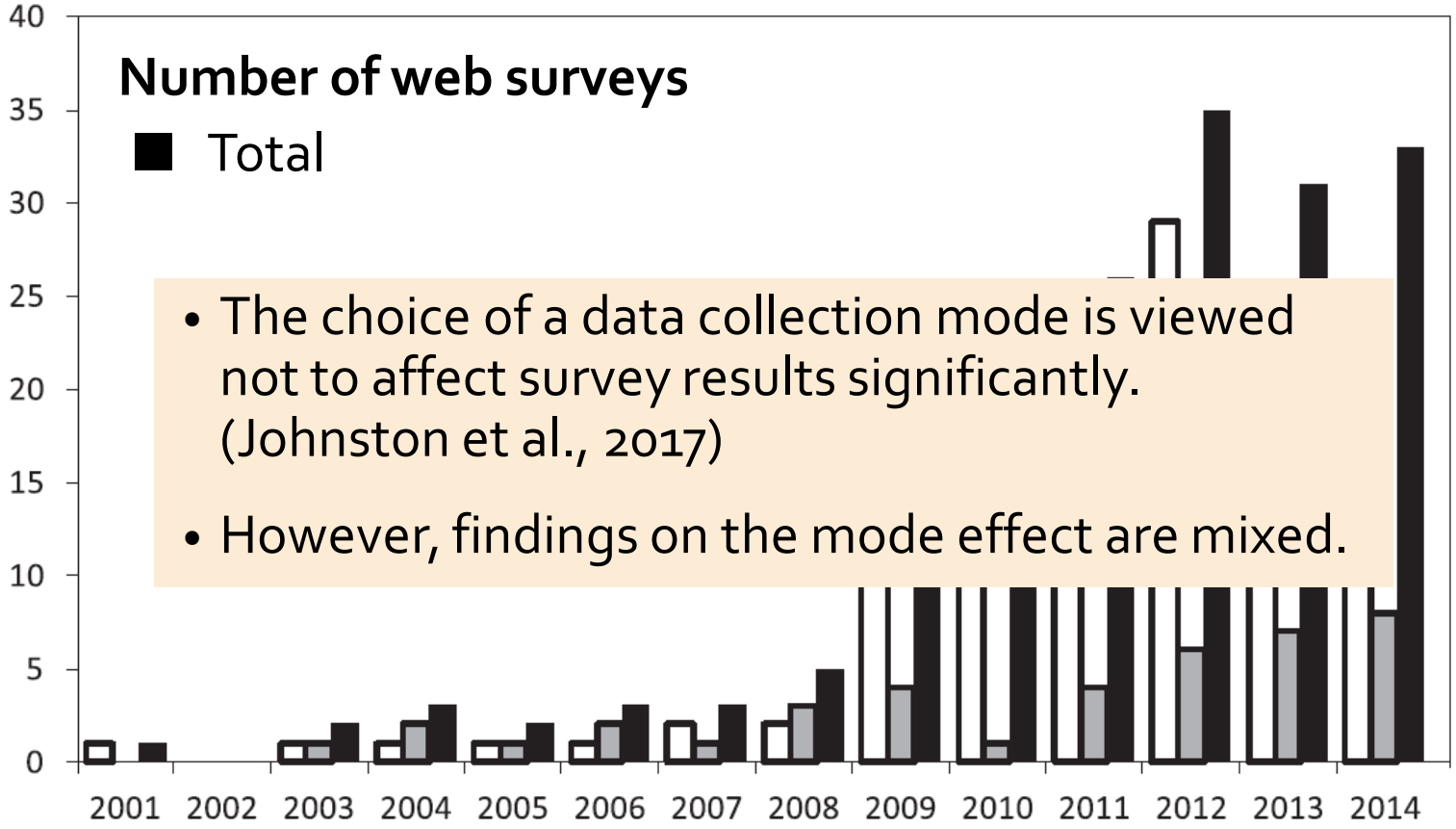

- The choice of a data collection mode is viewed not to affect survey results significantly. (Johnston et al., 2017)
- However, findings on the mode effect are mixed.

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Comparisons of web and personal SP surveys

Author(s)	Difference in values between modes	
Balderas Torres et al. (2013)	Yes	Web < Personal
Bell et al. (2011)	Yes	Web < Personal
Canavari et al. (2005)	Yes and No (depending on a question format)	Web > Personal
Cardamone et al. (2014)	No	
Covey et al. (2010)	No	
Lee et al. (2016)	Yes	Web < Personal
Lindhjem and Navrud (2011)	No	
Marta-Pedroso et al. (2007)	Yes	Web < Personal
Mjedle et al. (2016)	Yes	Web < Personal
Mulhern et al. (2013)	No	
Nielsen (2011)	No	
Ščasný and Alberini (2012)	No	
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7 Yeses
8 Noes

Mixed evidence on the mode effect

and

A substantial rise in the use of web surveys for valuation

Importance of investigating the effect of the web mode on respondents' behaviour

Sources of differences between the modes

WHO and HOW respond

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Sample selection

"Pure" mode effect

- Social desirability
- Information processing
- …

Sources of differences between the modes

WHO and HOW respond

Sample selection

(We weigh the observations from web and in-person samples to account for possible socio-demographic differences.)

"Pure" mode effect

- Social desirability
- Information processing
- …

Our research questions

1. Do web and in-person surveys lead to different value estimates?

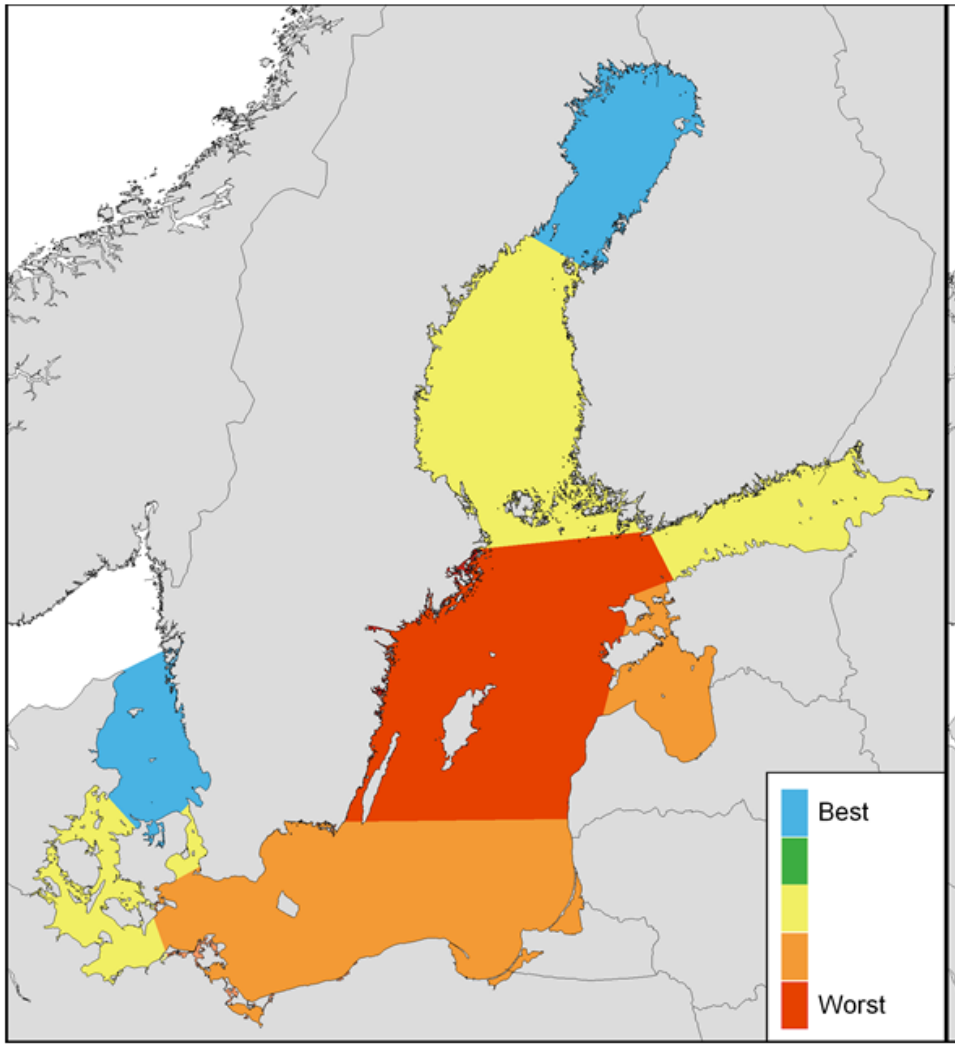
2. What are the values of the eutrophication reduction of the Baltic Sea for every littoral country if the mode effect is controlled for?

Survey

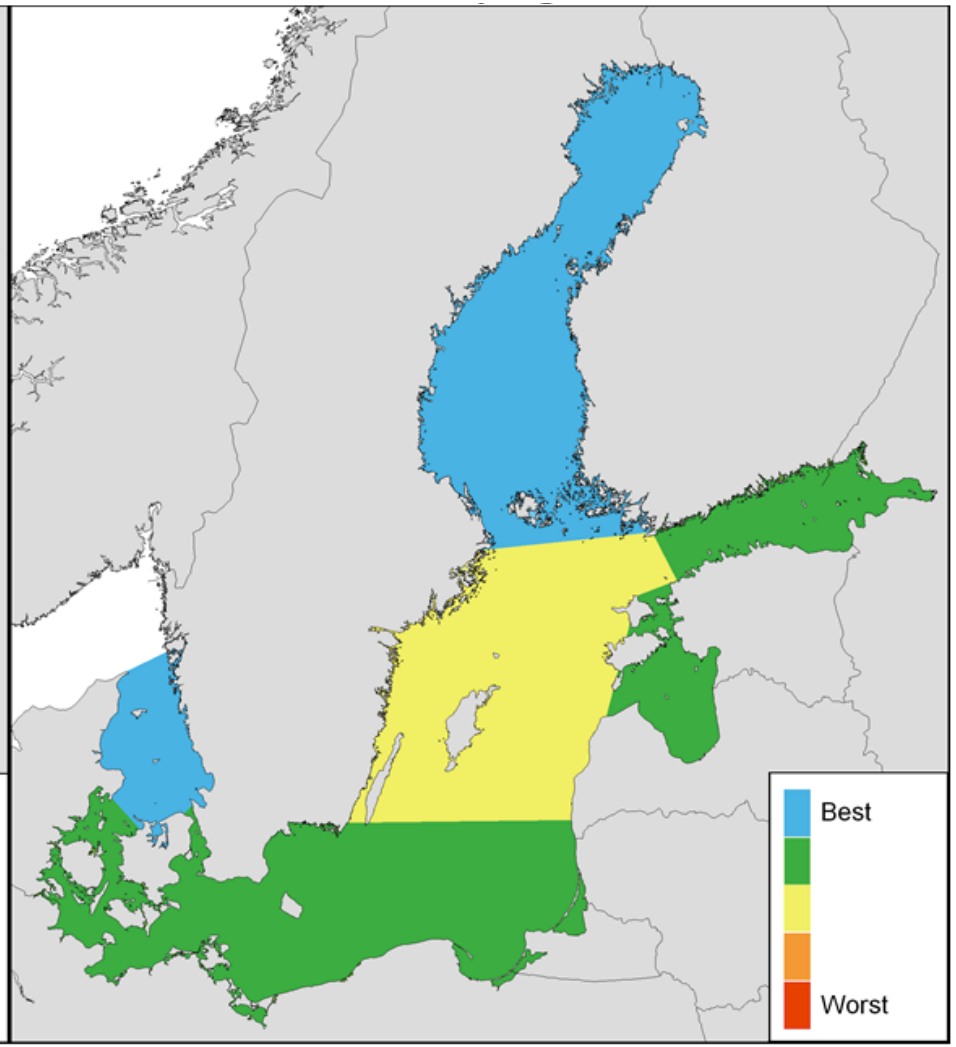
- Goal: to assess the benefits from reduced eutrophication across the Baltic Sea area.
- Eutrophication is one of the main threats to the natural environment of the Baltic Sea (HELCOM, 2010).
- Several governing frameworks in Europe have been enforced to protect the marine waterbodies:
  - the Water Framework Directive (European Parliament, 2000),
  - the Marine Strategy Framework Directive (European Parliament, 2008),
  - the HELCOM's Baltic Sea Action Plan (HELCOM, 2007).
- To justify the actions undertaken for meeting the goals of the frameworks, each Baltic Sea country needs to do a cost-benefit analysis.

Survey

Baltic Sea in 2050 without the program



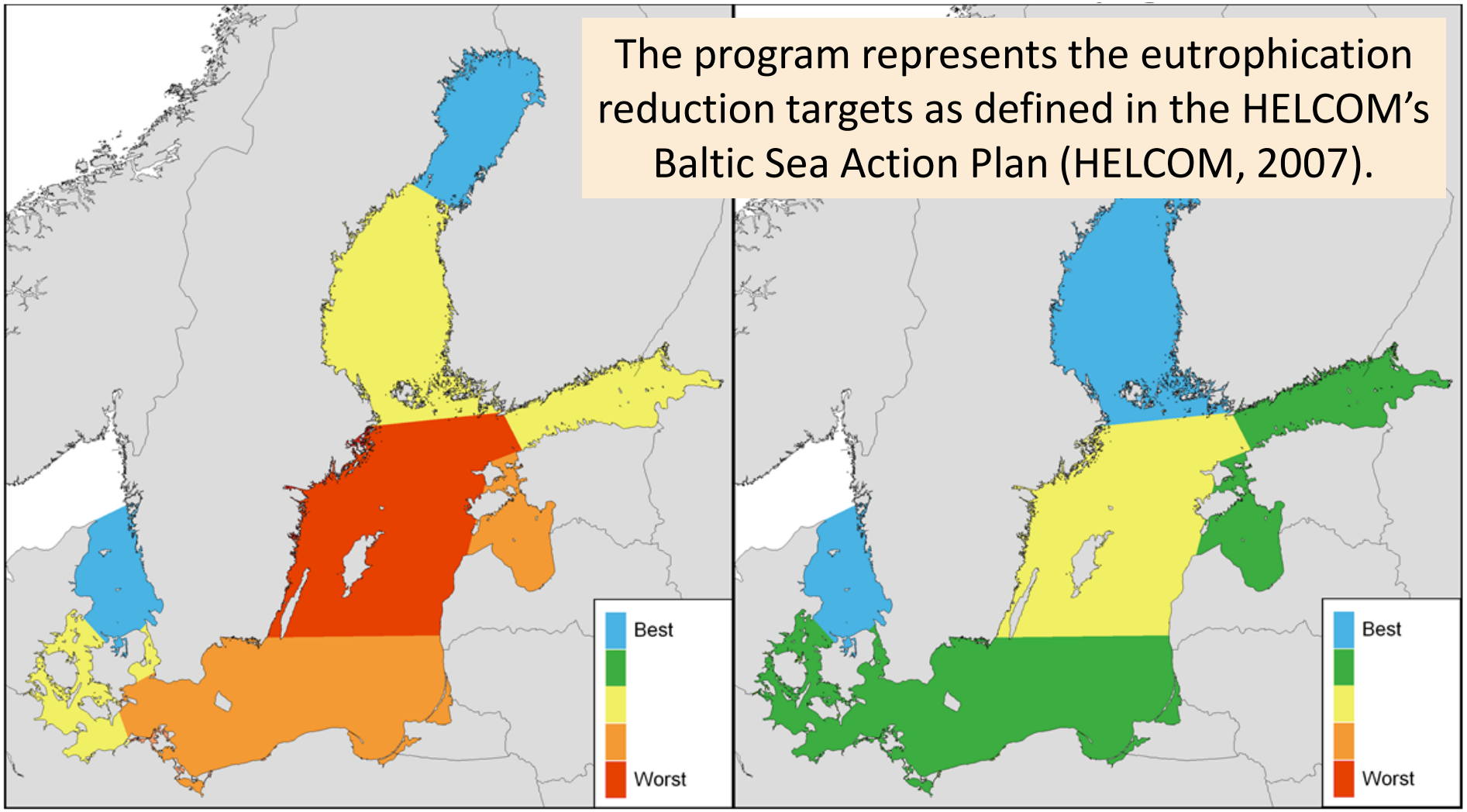
Baltic Sea in 2050 with the program



Survey

Baltic Sea in 2050 without the program

Baltic Sea in 2050 with the program



The program represents the eutrophication reduction targets as defined in the HELCOM's Baltic Sea Action Plan (HELCOM, 2007).

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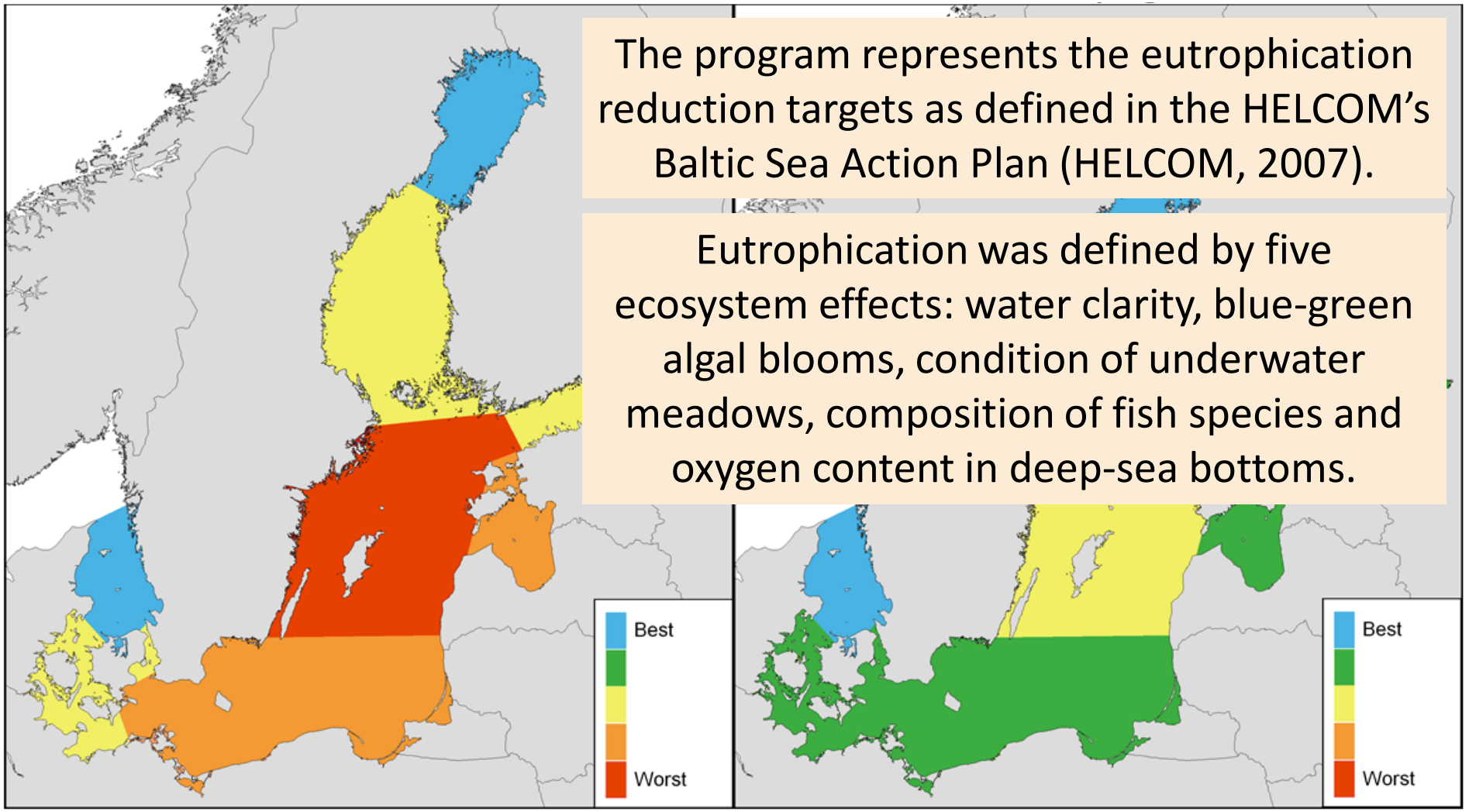

The program represents the eutrophication reduction targets as defined in the HELCOM's Baltic Sea Action Plan (HELCOM, 2007).

Eutrophication was defined by five ecosystem effects: water clarity, blue-green algal blooms, condition of underwater meadows, composition of fish species and oxygen content in deep-sea bottoms.

Survey

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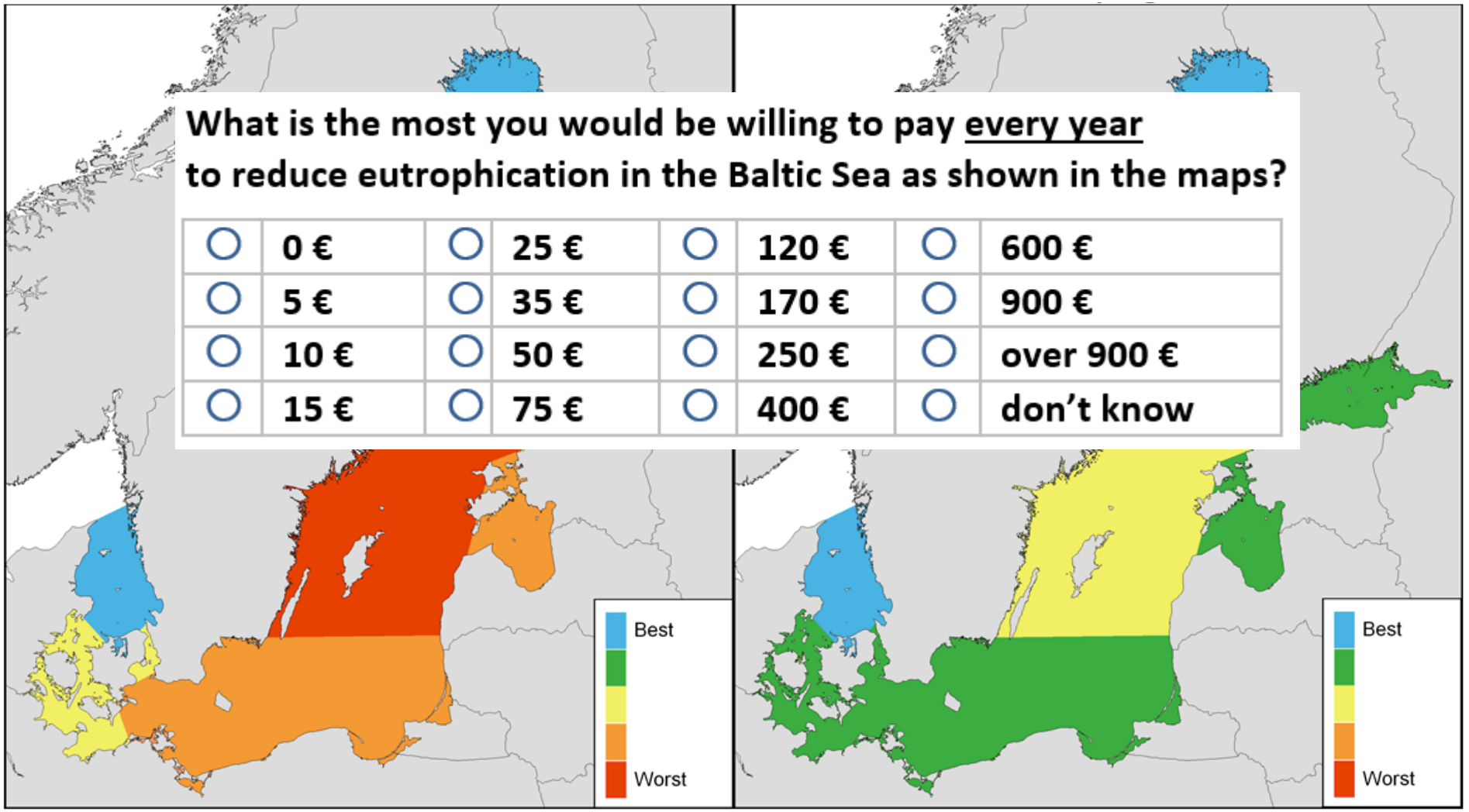

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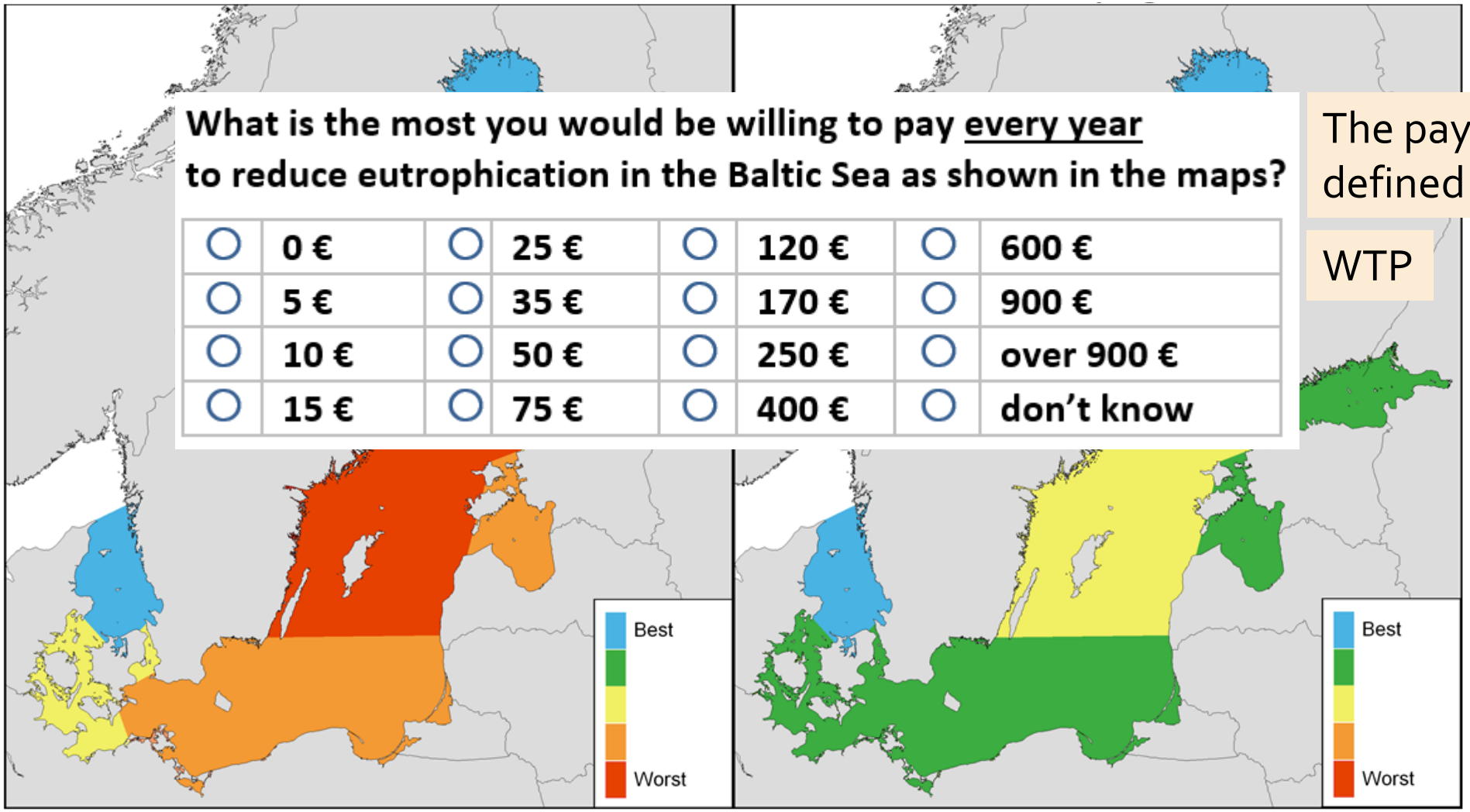

What is the most you would be willing to pay <u>every year</u> to reduce eutrophication in the Baltic Sea as shown in the maps?

○	0 €	○	25 €	○	120 €	○	600 €
○	5 €	○	35 €	○	170 €	○	900 €
○	10 €	○	50 €	○	250 €	○	over 900 €
○	15 €	○	75 €	○	400 €	○	don't know

The payment was defined as tax.

WTP

Survey

- Data collected in October-December 2011
- Two modes:
  - Computer-Assisted Web Interviews (CAWI)
  - Computer-Assisted Personal Interviews (CAPI)
- CAWI: Denmark, Estonia, Finland, Germany, and Sweden
- CAPI: Latvia, Lithuania, and Russia
- Both CAWI and CAPI: Poland

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1. We identify the mode effect based on Poland.
2. We use the relative difference in value estimates for CAWI and CAPI in Poland to recalculate the values for other countries, accounting for the mode effect.

Modelling approach

- The payment-card responses can be viewed as interval-type data.
- WTP is equal to or higher than the selected bid and lower than the next higher bid.
- We use the WTP responses to fit a parametric distribution.
- No a priori or theory-driven information about the WTP distribution.
- We try 16 commonly used parametric distributions and select the one that fits best to the data in terms of the Akaike information criterion (AIC) and the Bayesian information criterion (BIC).
- Distributions considered: Birnbaum-Saunders, exponential, extreme value, gamma, generalised extreme value, generalised Pareto, inverse Gaussian, logistic, log-logistic, log-normal, negative binomial, normal, Rayleigh, Rician, t location-scale, uniform

Modelling approach

- We calculate the value of the cumulative distribution function at the upper bound of a respondent's WTP interval and subtract the value at the lower bound of the interval.
- That gives the probability that the respondent's WTP lies within the interval.
- The value of this probability is this respondent's contribution to the likelihood function.
- We sum up each respondent's contributions and maximise the resulting function with respect to the distribution parameters.
- In addition, we supplement each distribution with a zero-inflation component to account for numerous zero WTP responses: the zero-WTP respondents are cumulated in a spike-discontinuity of the WTP distribution at zero.

$$\log L = \sum_{i=1}^{N} \left\{ yes_i \cdot \log \left[CDF\left(b_{i,k+1}, \boldsymbol{\beta}_i\right) - CDF\left(b_{i,k}, \boldsymbol{\beta}_i\right) \right] + \left(1 - yes_i\right) \cdot \log \left[CDF\left(0, \boldsymbol{\beta}_i\right) \right] \right\}$$

Results

Socio-demographic differences between the mode samples (Poland)

- Chi-squared tests; CAWI – 927 observations; CAPI – 924 observations

Characteristic	Significant difference	In CAWI (compared to CAPI)
Individual income	Yes	Higher incomes
Occupational status	Yes	More students, retired, and home-employed people
Educational level	Yes	Higher education
Household size	No	
Household members under 18	Yes	Larger diversification
Age	No	
Gender	No	

- We weigh both, CAWI and CAPI samples, to make them represent the general population of Poland.

Results

Test of the mode effect

- Data for Poland
- Birnbaum-Saunders distribution of WTP

	(A)	(B)	
	Parameter estimates	Parameter estimates	Parameter estimates for CAWI (interaction)
Shape parameter	12.992*** (0.396)	10.508*** (0.551)	4.319*** (0.773)
Scale parameter	1.118*** (0.026)	1.162*** (0.044)	-0.106*** (0.054)
Spike constant	-0.100*** (0.029)	0.269*** (0.042)	-0.742*** (0.060)
Model characteristics			
AIC/n	4.379	4.279	
BIC/n	4.388	4.296	
Log-likelihood	-4,049.478	-3,953.781	

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Test of the mode effect

Simulated WTP resulting from the fitted distribution

	Pooled CAWI and CAPI data	CAPI data only	CAWI data only
Annual mean WTP per person (EUR)	11.92 (0.71)	6.44 (0.54)	16.10 (0.94)
95% confidence interval for the mean WTP	10.66-13.43	5.50-7.61	14.28-17.92
Spike probability	0.46 (0.01)	0.61 (0.02)	0.32 (0.02)

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Results

Updated value estimates for other countries

- We recalculate the values of the eutrophication reduction provided by Ahtiainen et al. (2014).
- In contrast to Ahtiainen et al., we
  - control for the survey mode,
  - weigh the observations to make them represent the general population,
  - use the parametric distribution of WTP that gives the best fit to the data.
- The Birnbaum-Saunders distribution of WTP gives the highest sum of log-likelihood values.
- We also check other specifications:
  - the inverse Gaussian distribution – the best in terms of average values of AIC and BIC,
  - such a distribution of WTP for each country that gives the best (lowest) value of AIC.

	Results of Ahtiainen et al.		Our results	
	CAWI	CAPI	CAWI	CAPI
Poland	12.2 11.9-12.4	12.2 11.9-12.4	16.1 14.3-17.9	6.4 5.5-7.6
Denmark	31.7 28.1-35.4	---	36.4 31.8-41.5	*14.5* *12.2-17.6*
Estonia	24.0 19.5-28.5	---	28.1 23.5-33.2	*11.2* *9.1-14.1*
Finland	41.8 40.33-43.3	---	41.8 37.2-46.8	*16.62* *14.3-19.9*
Germany	25.0 23.4-26.5	---	26.7 23.8-30.1	*10.6* *9.2-12.8*
Sweden	75.7 59.8-91.6	---	84.3 75.1-94.6	*33.5* *28.9-40.2*
Latvia	---	5.5 5.3-5.6	*13.1* *11.2-14.8*	5.2 4.3-6.3
Lithuania	---	8.8 8.3-9.3	*24.4* *21.3-26.9*	9.7 8.2-11.4
Russia	---	8.5 8.1-8.9	*20.9* *17.4-24.3*	8.3 6.7-10.3

- Annual mean WTP in EUR per person (with 95% confidence interval)
- Calibrated results are in brown italics.
- The values from our calculations are not statistically different from the estimates of Ahtiainen et al. (2014).
- The two survey modes generate significantly different value estimates.

Results
Spike probabilities

- CAWI leads to smaller spike probabilities.
- Smaller shares of respondents willing to pay zero in CAWI.

	Ahtiainen et al.	Our results
Poland	0.47 (0.0001)	CAWI: 0.32 (0.0155), CAPI: 0.61 (0.0158)
Denmark	0.48 (0.0002)	0.39 (0.0164)
Estonia	0.48 (0.0005)	0.38 (0.0226)
Finland	0.37 (0.0000)	0.35 (0.0124)
Germany	0.46 (0.0001)	0.42 (0.0132)
Sweden	0.33 (0.0002)	0.20 (0.0131)
Latvia	0.52 (0.0002)	0.51 (0.0189)
Lithuania	0.50 (0.0004)	0.48 (0.0206)
Russia	0.69 (0.0001)	0.67 (0.0135)

Conclusions

- Significant differences in preferences stated by respondents in CAWI and CAPI
- In CAWI, larger value estimates and smaller spike probabilities
- Need for caution when choosing a data collection mode
- Need for accounting for differences between modes
- A potential influence of the choice of a mode on the assessment of benefits from a considered policy

- A possibly context-specific nature of a relative difference between modes

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