Valuing benefits of reaching the MSFD targets by applying the 'Choice Experiment' Method

Latvian study report

Project	GES-REG
Work package	WP5
Name of the task/ activity	Task. 5.3: Coordinating methodologies and improving information base for the cost of degradation (CoD) analysis. Activity 5.3.2: Improving information base for the CoD analysis – conducting economic valuation studies in Estonia and Latvia.
Preparation date	December, 2013
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List of abbreviations

BAU   "Business-as-usual" (scenario)

CAPI   Computer-Assisted Personal Interviews

CAWI   Computer-Assisted Web Interviews

CBA   Cost-Benefit Analysis

CE   Choice Experiment (method)

CSB   Central Statistical Bureau (of Latvia)

CV   Contingent Valuation (method)

GES   Good Environmental Status

LHEI   Latvian Institute of Aquatic Ecology

MSFD   Marine Strategy Framework Directive (2008/56/EC)

OCMA   Office of Citizenship and Migration Affairs (Latvia)

PAPI   Paper-Assisted Personal Interviews

SP   Stated Preference (methods)

WTP   Willingness To Pay

Contents

Introduction

The study has been implemented as part of the GES-REG project[1] WP5 on the "Economic and Social analysis" (ESA) for the MSFD. WP5 of the project aims to support development of cost-effective and socio-economically efficient programmes of measures for reaching 'Good Ecological Status' (GES) in the central and north-eastern sub-basins of the Baltic Sea.

The study aims to provide estimates of benefits of improving the marine environment and achieving GES to support the ESA of the MSFD programs of measures (to be prepared by Member States till the end of 2015). Due to the need to value such multi-attribute environmental good as the marine environment quality the 'Choice Experiment' (CE) method was applied for valuing the marine environment improvements. This is the first application of this method in Latvia for environmental valuation. Thus, along with improving the information base for the ESA the study provided a good opportunity for capacity building on the environmental valuation in Latvia.

The study was conducted in close collaboration with the Latvian marine scientists (from the Latvian Institute of Aquatic Ecology) for defining the marine environmental problems and scenarios for valuation. The marine environment problems valued in this study are seen as the most priority ones for the Latvian marine waters where a gap till GES for 2020 is likely. Thus additional measures are required and assessment of benefits of their implementation would support justifying their costs. The marine environmental problems addressed by this study are (i) decline of marine biodiversity, (ii) reduced water quality due to nutrients pollution and (iii) establishing of alien species. The used valuation scenarios aim to be consistent with the 'business-as-usual' (BAU) scenario and GES according to the MSFD needs.

The report is aimed to both the environmental economists as well as non-specialists in the environmental valuation. It aims to discuss relevant issues, results and lessons of the study in light of its policy context and objective (using the results for the ESA of the MSFD programs of measures). It first provides brief overview on the policy and environmental context of the study and choice of the valuation method (the sections 1 and 2). The section 3 discusses experience and results from developing "attributes" to characterise the marine environment problems and scenarios of changes for the valuation. The section 4 provides overview on process and the main results of developing survey materials and data collection. The section 5 discusses results of the study, in particular, concerning individuals' preferences to the proposed marine environment improvements and derived estimates of welfare changes, which are used to characterise national benefits from the valued marine environment improvements. The report ends with conclusions and recommendations in light of future use of the results for the ESA of the MSFD programs of measures.

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[1] The project "Good Environmental Status through Regional Coordination and Capacity Building" (GES-REG) is co-financed by the European Regional Development Fund under Central Baltic INTERREG IV A Programme 2007-2013. Its overall aim is to support coherent and coordinated implementation of the Marine Strategy Framework Directive (MSFD, 2008/56/EC) in the central and north-eastern sub-regions of the Baltic Sea – in the Gulf of Finland, northern part of the Baltic Proper and Gulf of Riga.

1. Policy and environmental context of the study

The MSFD sets reaching 'good environmental status' (GES) in 2020 as its overall objective. The first assessment on the current state and gap between it and GES (characterised by 11 descriptors) was prepared as part of the MSFD reporting requirements for 2012 (the so-called national "Initial Assessment" report according to the Art.8 of the directive).

Where the gap between the current (BAU scenario[2]) state and GES is expected, additional measures are required to close the gap. The program of measures for reaching GES must be developed by Member States till the end of 2015. The MSFD requires conducting the cost-effectiveness analysis and impact assessment, including the cost-benefit analysis (CBA), to underpin inclusion of additional measures in the program of measures. Assessment of benefits of implementing measures will help for justifying efforts (costs), but also may indicate possible need for exemptions of implementing measures (due to disproportionate costs[3]).

It is expected that the program of measures is elaborated addressing specific marine environment problems (or descriptors), which is due to the need for characterising the state, setting objectives and assessing their achievement in line with the (11) descriptors, as well as the previous historical practice of planning protection of the sea (e.g. according to the environmental "segments" of the Baltic Sea Action Plan for the Helsinki Convention). It means that the "thematic approach" is expected also for the ESA of the program of measures. The study was implemented with a general policy aim to **provide estimates of the benefits of implementing additional measures and reaching GES** for those marine environment problems in the Latvian marine waters where failing GES for 2020 is expected.

The Latvian marine waters are shown in the figure 1.1. They belong to two basins of the Baltic Sea – the Gulf of Riga and the Central Baltic Proper. The map distinguishes coastal and transitional water bodies delineated according to the "Water Framework Directive" requirements (2000/60/EC) and the open sea water bodies. The second map in the figure shows 5 statistical regions of Latvia (from where the nationally representative sample of the study is drawn).

Results from the "Initial Assessment" showed that only for part of descriptors the definition of GES was possible. For many descriptors there is lack of indicators and data to describe GES. Also information about the current state is incomplete. Thus the assessments of risk of failing GES were possible for limited number of descriptors and indicators.

In order to obtain more comprehensive overview for the Latvian marine waters these assessments were complemented with expert knowledge to identify the marine environment themes (descriptors) with likely risk of failing GES for 2020 (see also the table 1.1.). Marine scientists (from LHEI) were asked to review all 11 descriptors and identify those where failing GES is likely. In

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[2] According to the MSFD, the risk of failing GES (for 2020) needs to be assessed against the "business-as-usual" scenario (not the current state). The BAU scenario takes into account (i) future development (e.g. till 2020) of the marine uses causing pressures on the marine environment and (ii) effect of implementation of various existing (and forthcoming) policy measures with an impact on the marine environment (besides the MSFD). If the assessment shows that there is gap between the BAU and GES states, additional measures need to be identified and implemented to ensure closing the gap and reaching GES.

[3] The 'disproportionate costs' are seen in the case when the costs of measures outweigh the benefits of implementing them (for reaching GES).

addition, they were asked also to assess information sufficiency for characterising GES and the current state, what is relevant for building environmental basis of any environmental valuation study.

According to this assessment **the priority descriptors – where the additional measures might be required to achieve GES in 2020 for the Latvian marine waters are: Biological diversity (D1), Non-indigenous species (D2), Eutrophication (D5) and Sea floor integrity (D6)**. At the same time limitations in the information base for characterising the current state and GES for most of them (D1, D2, D6) were also noted. However, due to the policy need to provide the benefit estimates, all these descriptors were considered in the valuation study.
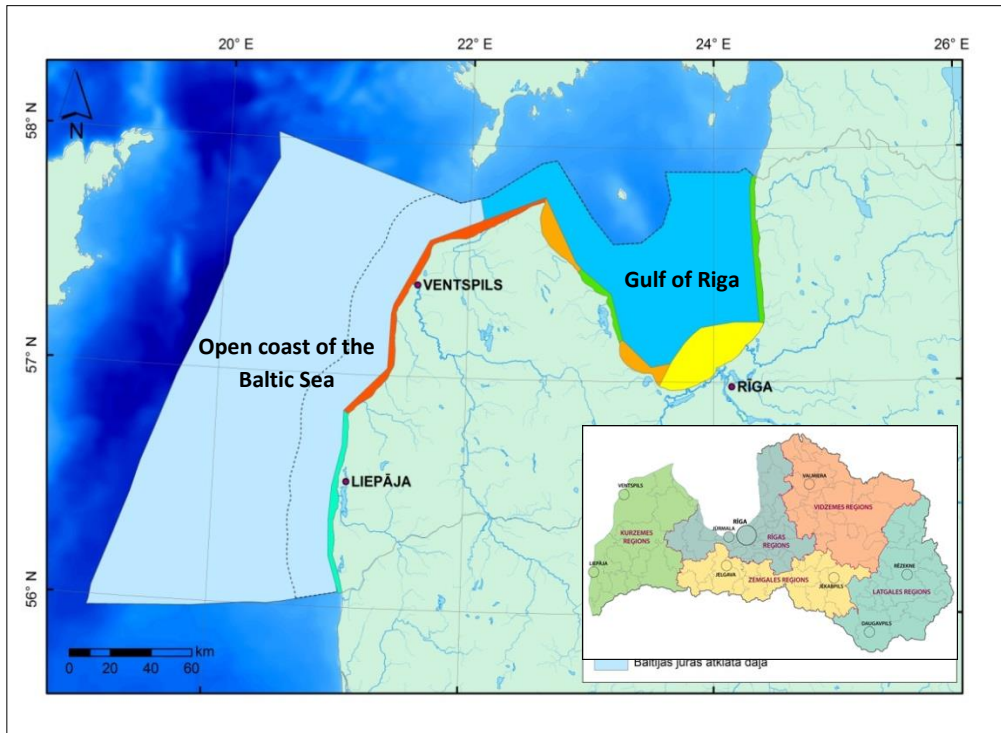

Figure 1.1. The Latvian marine waters (the large map) and the (5) statistical regions of Latvia (the small map).

Table 1.1. Descriptors of the MSFD with likely risk of failing GES in the Latvian marine waters (Source: Based on the results of the national "Initial assessment" and assessment by marine scientists from LHEI).

Scale for the risk assessment (risk of failing GES): 1 – "Definitely yes"; 2 – "Rather yes"; 3 – "Rather no"; 4 – "Definitely no". Red colour indicates priority descriptors where additional measures for achieving GES might be required.

Descriptors of MSFD	Risk of failing GES	Comments for the assessment
Biological diversity (D1)	2	The current knowledge doesn't allow assessing the actual status sufficiently (due to lack of biological information). Thus the BAU policies' measures might turn not to be sufficient to ensure GES.
Non-indigenous species (D2)	2	Impacts of alien species on the ecosystem are not sufficiently known. Thus the BAU policies' measures (incl. forthcoming ones) addressing them might not be sufficient to reach GES.
Fish and shellfish (D3)	3	
Food webs (D4)	3	
Eutrophication (D5)	1	There is uncertainty if the BAU policies' measures could be sufficient to cope with the eutrophication problem. There are many on-going and planned (BAU) policies for reducing nutrients' pollution, although their implementation (in the given timeframe) is not always certain and there is a need to improve efficiency of their implementation. For instance, recent data shows increasing trend for riverine P load in Latvia during the last years, in spite of efforts (implemented measures) for reducing nutrients' loads. (Reasons for it need to be further investigated.)
Sea floor integrity (D6)	2	Caused by negative impacts on bottom biology due to trawling, human induced changes in sediment processes causing e.g. smothering of habitats (due to dredging and storage of dredged ground material, coastal erosion).
Hydro-graphic conditions (D7)	2	This assessment ("2") is very uncertain since criteria and indicators for this descriptor were not defined yet.
Contaminants (D8)	3	
Contaminants in fish/shellfish (D9)	4	
Marine litter (D10)	3	
Energy introduction (incl. noise) (D11)	4	

2. Choice of economic valuation method – the "Choice Experiment" (CE)

A range of 'stated preference' (SP) techniques have been developed for eliciting consumers' preferences and measuring 'willingness-to-pay' (WTP) for environmental goods and services. These techniques involve asking respondents to consider one or more hypothetical options and to express their preferences for them through surveys. The most general and widely accepted classification of SP techniques is that between 'contingent valuation' (CV) and 'multi-attribute valuation' (MAV) techniques[4]. (Merino-Castelló A., 2003)

MAV techniques are a family of the survey-based methodologies for modelling preferences for goods, where goods are described in terms of their attributes and the levels that these take. Two different types of MAV techniques are suggested (Merino-Castelló A., 2003):

- 'preference-based approaches' which require the individual to rate the given one alternative ('contingent rating') or to rate the strength of preference to one among two alternatives ('paired comparison');
- 'choice-based approaches' which make the consumer to choose one among several alternatives ('choice experiment') or to rank a series of alternatives ('contingent ranking').

In Latvia so far only the CV method was applied for valuing the water quality improvements. Three original economic valuation studies have been conducted with such purpose by applying this method: (1) valuing shallow groundwater quality improvements in the Riga city[5], (2) valuing river and lake water quality improvements in the sub-basin of the river Ludza[6] and (3) valuing benefits of reducing eutrophication in the Baltic Sea for Latvia as part of the BalticSUN study[7].

In this study the 'choice experiment' (CE) method was chosen due to the following considerations:

- The CE method was seen as more flexible for valuing such multi-attribute environmental good as the marine environment quality in light of the MSFD (when the state is characterised by 11 descriptors).
- All previous studies in Latvia with CV method show rather low WTP values comparing to similar studies in other countries. This may arouse a question if the CV method allows

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[4] For instance, Bateman et al (2002) uses the concept of 'choice modelling' instead of 'multi-attribute valuation' (MAV) techniques. However, we use the term 'multi-attribute valuation' here in order to distinguish further between 'preference-based' and 'choice-based approaches' (to which the 'choice experiment' method belongs).

[5] Pakalniete K., Bouscasse H., Strosser P. (2006) "Assessing socio-economic impacts of different groundwater protection regimes. Latvian case study report." BRIDGE project (EU 6th Research Framework Program).

[6] Pakalniete K., Lezdina A., Veidemane K. (2007) "Assessing environmental costs by applying Contingent Valuation method in the sub-basin of the river Ludza. Latvian case study report." ENCO-BALT project.

[7] The study was implemented in 2011 as part of the Baltic Sea scale research project. The survey in Latvia was funded by the BalticSTERN Secretariat (at the Stockholm Resilience Centre, Stockholm University). See Ahtiainen H., Hasselström L., Artell J., Angeli D., Czajkowski M., Meyerhoff J., Alemu M., Dahlbo K., Fleming-Lehtinen V., Hasler B., Hyytiäinen K., Karlõseva A., Khaleeva Y., Maar M., Martinsen L., Nõmmann T., Oskolokaite I., Pakalniete K., Semeniene D., Smart J., and Söderqvist T. (2012) Benefits of meeting the Baltic Sea nutrient reduction targets - Combining ecological modelling and contingent valuation in the nine littoral states. MTT Discussion Papers 1/2012.

measuring lower bound of the WTP. There are evidences from other studies that the CE method gives higher values than CV method when the same goods are valued.[8] Application of the CE method was thought to provide additional knowledge on this issue thus also would strengthen the information base used for policy making in Latvia.

- There is previous experience in Latvia with applying the CV method, but no experience on applying the CE method. The GES-REG project served good opportunity for the national capacity building to acquire application of this method for environmental valuation.

'Choice Experiment' (CE) is one of the 'stated preference' 'choice-based' techniques and has become an increasingly popular approach to estimate the values of non-market goods and services. CE has been advocated as a flexible and cost-effective technique for determining the costs and benefits of public projects. (Kragt M., Bennett J., 2008)

In the CE, respondents are given a series of questions (choice sets), where each question shows the outcomes of alternative (hypothetical) policy scenarios. The outcomes are described by different levels of 'attributes' or the marine environment characteristics, used to depict the good that is being valued. Respondents are asked to choose their preferred option from the range of alternatives. In choosing between alternative options, respondents are expected to make a trade-off between the levels of the 'attributes'. Since a monetary attribute (cost) is included in the choice sets, it allows calculating the individual's marginal willingness-to-pay (WTP) or implicit price for a change in each of the environmental attributes. (Kragt M., Bennett J., 2008)

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[8] For instance, Eggert H., Olsson B. (2003) and Olsson B. (2004); Scottish Agricultural College, DEFRA (2008).

3. Developing attributes and their levels in valuation scenarios

This section discusses experience from developing the attributes and scenarios used in the study, as well as presents their final design as used in the study.

3.1. Defining scope of the attributes in the context of MSFD descriptors

In light of the defined marine environment themes for valuation in the study (as described in the section 1), three environmental **attributes** were included in the study – in relation to:

1. improving state of the marine biodiversity and sea floor integrity,
2. improving water quality in relation to nutrients pollution and eutrophication,
3. reducing invasions and negative impacts of non- indigenous species.

There are methodological issues that need to be considered when applying the CE method (e.g. optimal number of attributes, preventing correlations between attributes). Preventing **correlations between the attributes** appeared as challenge in light of the objective of the study (valuation covering the given themes/Descriptors). **It comes from overlap of the MSFD descriptors**.

For instance, the focus group discussion as part of the study showed that respondents are aware of the cause-effect relationship between water quality in relation to nutrients pollution and eutrophication and the biodiversity. It led to situation that many respondents followed to changes in the water quality attribute only (and price) ignoring proposed changes in the biodiversity attribute when comparing alternatives and making their choices (assuming that it is good for the biodiversity also if the water quality improves). Similarly also the alien species were seen as impacting (negatively) state of the biodiversity.

To prevent the correlation between the attributes **scope of each attribute** was carefully elaborated:

- The **attribute on water quality** was narrowed to "water quality for recreation at the sea" focusing only on the water quality aspects relevant for the recreational use (e.g. aesthetic[9]). It was characterised by specific indicators. The indicators discussed initially included (i) water clarity (transparency), (ii) extent of algae blooming, (iii) amount of algae washed ashore. The first two (the algae blooming in particular) was seen as impacting the ecosystem more widely, thus also the biodiversity. Due to this, the indicator on algae blooming was excluded. Since the focus group discussion showed that more educated people might be aware also about the link of water transparency to state of the ecosystem (and biodiversity), this indicator was focused on "visual quality" (stressing its aesthetic aspect). Final list of indicators is presented in the next chapter.

- The **attribute on alien species** was narrowed to their negative impacts on humans only excluding the negative impacts on the ecosystem (and biodiversity). A term "invasive" alien

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[9] A common approach for valuation studies involving water quality for recreation is to use indicators in relation to bathing water quality standards. However, this concern mainly micro-biological quality of water, which is not a problem for the Latvian marine waters overall, thus was not considered in the study.

species[10] was introduced since this is common term for the alien species causing the socioeconomic impacts.

- The **attribute on biodiversity[11]** was formulated in a way covering all biological groups of the ecosystem[12] and all types of direct and indirect impacts (from human activities/pressures) on them. In this way the wider impacts of eutrophication and alien species on the ecosystem are covered by this attribute.

Results of the survey show that all attributes have been important overall for the respondents when making their choices. Thus, the approach for formulation of the attributes worked well in terms of avoiding correlations between them, which could otherwise lead to ignorance. Result from a special follow-up question included in the questionnaire after the choice questions is provided in the information box bellow.

Box 3.1. Importance of each attribute for respondents when making the choices among alternatives.

The follow-up question after completing the choice questions: *"Q37. How important for your choices each of the marine environmental problem and the payment was?"*

Data from the main survey (with sample of 1247 respondents).

N=649 (The question was asked only to those who selected alternatives with environmental improvements in any of the choice sets. Respondents not WTP or choosing "no additional actions" scenario in all the choice sets were not asked this question).

Distribution of the response (as % of the total) by answer options:

Attributes	"Very important" and "Rather important"	"Neither important nor unimportant"	"Rather unimportant" and "Fully unimportant"	TOTAL (%)
Reduced number of native species	**78.1**	17.7	4.2	100
Water quality for recreation at the sea	**90.4**	7.1	2.5	100
New harmful alien species' establishing	**67.6**	23.2	9.2	100
Payment	**74.5**	16	9.5	100

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3.2. Policy scenarios for valuation

To elicit individuals' preferences and WTP for the environmental improvements, respondents are presented with a range of alternatives or scenarios for choosing. Each scenario is characterised by the attributes taking specific "state levels" in various scenarios. According to the policy objective of the study three **policy scenarios** were used:

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[10] To avoid complex terminology they were named as "harmful alien species" in the survey.

[11] Called as "variety of native species" in the survey – to make the difference between the two attributes on native and alien species more visible and to avoid complex terminology.

[12] All groups of organisms are included – benthic (plants and animals), fish, birds and mammals.

1. "no additional actions" scenario, which means no additional measures, thus also no additional costs, comparing to the current level (this is the reference scenario against which the alternative scenarios are valued),

2. "planned additional actions" scenario, which is the BAU scenario according to the MSFD needs and involves additional costs of measures of the BAU policies,

3. "action plan for reaching GES", which involves implementation of all measures (of the BAU policies, as well as the necessary additional measures) for achieving GES.

According to the MSFD requirements for the economic analysis of additional measures, **the study aims to provide estimates of welfare changes (benefits of the marine environment improvements) comparing the 2ⁿᵈ (BAU) and 3ʳᵈ (GES) scenario (to be the results used for the CBA of additional measures).**

3.3. Description of attributes and their levels in the valuation scenarios

To elaborate **attributes' levels in each scenario**, the best available information and knowledge for the Latvian marine waters was mobilised. Formulation of the levels of attributes in the scenarios was developed based on extensive discussions with marine scientists (from LHEI).

The work involved identifying the most appropriate **indicators** for characterising changes in each attribute and specifying **their levels in the used scenarios**. The main principles followed for setting the indicators were that:

- they allow scientifically sound characterisation of changes (concerning each valued environmental problem) in the used scenarios,

- there is enough knowledge and information to specify levels for them in each scenario[13], preferably – in a quantitative manner,

- they would be seen linked to own welfare by people and are simple enough to be understandable for people.

The work was relatively simple for the attribute on **water quality for recreation**, since there is good provision of both – indicators and data series for using them. Also because this marine environment problem is familiar to people. As noted, two indicators were used for characterising this attribute – "visual quality" of water and frequency and amount of algae washed ashore.

Concerning the **biodiversity** the main negative changes (impacts) observed in the Latvian marine waters are (i) declining occurrence of species in the areas where they naturally should be present (spatial distribution area) and (ii) changes in species' composition. The second impact was seen as rather complex to build a simple indicator that could be understandable for people. Thus the first impact was chosen for the study. It should be noted that none of the species has disappeared fully from the Latvian marine waters. Thus, although being a relatively simple indicator (which could be understood by people), the number of species as such could not be used as the indicator. The spatial distribution area was used as basis for the indicator, and the GES level was defined as presence of species in all their "natural areas" (the areas naturally suitable for each species). The indicator was

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[13] As noted earlier, there are considerable knowledge and information gaps, also concerning the included descriptors and the indicators used for characterising state in relation to them (for the biodiversity and alien species in particular).

specified as <u>areas with reduced number of species</u> where the GES level is "no such areas". The levels in scenarios were specified quantitatively. For the reference and BAU scenarios they were developed based on expert knowledge of marine scientists (e.g. it was estimated that currently reduced number of species is observed in around 30 % of the Latvian marine areas).

Concerning the **invasive species** mainly data on trend of establishing such species (in terms of number) in the Latvian marine waters are available, but data for characterising their impacts are rather scarce. Although the focus group discussion indicated that the number as such does not demonstrate the problem for people sufficiently, the limited information base didn't allow elaborating an indicator about the impacts. Thus the indicator was built on <u>frequency of establishing new invasive species</u> but illustrations on impacts of selected invasive species were used for describing the problem. Each level was explained quantitatively (see also the table below). For the reference scenario it was specified based on data of the past trend and for the BAU scenario – based on expert knowledge.

Table 3.1. Description of the attributes and their levels in the valuation scenarios that was presented to respondents.

Environmental attributes	Alternative scenarios for changes in state of the marine environment by 2020		
	"No additional actions"	"Planned additional actions"	"Action plan for reaching GES"
Reduced number of native species reduction % of their natural areas ("natural areas" are areas where these species naturally should be present)	**(on) Large areas** (the state if no additional action is taken) **30 %**	**(on) Small areas** **10-20 %**	**No such areas** **0 %** (species are present in all their natural areas)
Water quality for recreation (in coastal waters in summers) visual quality algae washed ashore	**Bad** (the state if no additional action is taken) Water is unclean every summer. It can be seen through less than 3 m in the Gulf of Riga and 4 m in the Baltic Sea (on average). Every summer in large amounts.	**Moderate** Water is unclean every 2-3'rd summer. It can be seen through at least 3 m in the Gulf of Riga and 4 m in the Baltic Sea (on average). Every 2-3'rd summer in small amounts.	**Good** Water is mainly clean (unclean in rare summers). It can be seen through at least 4 m in the Gulf of Riga and 4.5 m in the Baltic Sea (on average). Only after large storms.

	Alternative scenarios for changes in state of the marine environment by 2020		
Environmental attributes	**"No additional actions"**	**"Planned additional actions"**	**"Action plan for reaching GES"**
New harmful alien species' establishing one new species on average	**Often** (the state if no additional action is taken) (in) 5 years	**Rarely** (in) 15-20 years	**In exceptional cases** not more often as (in) 50 years

The GES level for the indicators was derived from the definition of GES according to the MSFD.[14] The indicators' level for "no additional actions" scenario was specified based on available information for the Latvian marine waters[15] and expert knowledge of the marine scientists (for the biodiversity attribute). The BAU level was specified based on experts' knowledge of the marine scientists following principles of the BAU development according to the MSFD needs.[16]

3.4. Main data and information sources

The listed below are the main data and information sources that were used for developing attributes, their levels in the scenarios and describing the valued environmental problems in the survey (see the annex 1 with the questionnaire used in the survey).

Latvian national report for the Art. 8, 9 and 10 of the MSFD (2012). LHEI. Available at: http://www.lhei.lv/lv/jurasdirektiva.php.

In relation to the biodiversity attribute:

EC Birds and Habitats directives' (79/409/EEC and 92/43/EEC) standard data forms.

BALANCE Interim Report No 23 (2007) „The modelling of Furcellaria lumbricalus habitats along the Latvian coast".

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[14] The GES of invasive species was slightly adjusted to ensure credibility of the scenario. According to the MSFD requirements the GES means no new species establishing ("0" in terms of the number), thus the level in terms of frequency of establishing new invasive species was specified initially as "never". But the focus group discussion showed that such situation is perceived as infeasible by people (there is always uncertainty in the real life).

[15] The Latvian national report for the Art. 8, 9 and 10 of the MSFD (2012). LHEI (available at: http://www.lhei.lv/lv/jurasdirektiva.php) and other data and information sources (see the next chapter for more information).

[16] General principle for the BAU development requires accounting (i) impact of expected development of the marine uses causing pressures and (ii) effect of implementing the BAU policies for reducing the pressures and improving the state. The BAU scenario levels were specified taking into account work done for the national "Initial Assessment" and as part of the GES-REG project (a specific task on the BAU development). Since further work may be expected nationally over coming years to improve assessments for the BAU scenario (for developing the MSFD program of measures), the BAU scenario levels used in the study should be examined against the BAU scenario assessments used for the MSFD program of measures.

Zachary T., Long, John F. Bruno and J.Emmett Duffy (2011) „Food chain length and omnivory determine the stability of a marine subtidal food web" // Journal of Animal Ecology, 80, 586–594 doi: 10.1111/j.1365-2656.2010.01800.x

Cullen-Unsworth L.C. (2013) „Seadrass meadows globally as a coupled social-ecological system: Implications for human wellbeing" // Marine Pollution Bulletin (available online: http://dx.doi.org/10.1016/j.marpolbul.2013.06.001.

In relation to the attribute on water quality for recreation at the sea:

Monitoring data sets (internal information of LHEI) for Secchi depth (water transparency), chlorophyll a biomass (a unit of mass of algae, link with algal blooming) for the Latvian sea basins.

Internal information of LHEI from observations on algae washed ashore (for instance, from a study for the GES-REG project on innovative monitoring methods where algae washed ashore are gathered and their species' composition is analysed for monitoring composition of algae species in the sea).

HELCOM thematic assessment on eutrophication (2009).

In relation to the alien species' attribute:

LHEI (2012) National assessment for HELCOM (with data and characterization of alien species in the Latvian marine waters).

Minde A. (2012) "Indicator sheet Abundance and impact of non-native fish species (round goby example)". MARMONI project. Available at: http://marmoni.balticseaportal.net/wp/indicator.

Ojaveer H. et.al. (2007) "Chinese mitten crab Eriocheir sinensis in the Baltic Sea – a supply-side invader?" // Biol Invasions (2007) 9; 409-418.

HELCOM (2013) „HELCOM ALIENS 2 - Non-native species port survey protocols, target species selection and risk assessment tools for the Baltic Sea". Available at: http://www.helcom.fi/stc/files/Publications/HELCOM_ALIENS_2-FinalReport.pdf.

Information about parasite Paragonimus Westermani (carried by crabs): http://www.parasitesinhumans.org/paragonimus-westermani-lung-fluke.html.

NOBANIS – European Network on Invasive Alien Species. Gateway to Information on Invasive Alien species in North and Central Europe (information about parasites carried by alien species): http://www.nobanis.org/MarineIdkey/Parasites/IntroParasites.htm.

4. Developing survey materials and data collection

Development of the survey materials and the data collection involved the following stages:

1. Preparing initial survey materials and conducting a focus group discussion (in December of 2012),
2. Revising the survey materials and conducting a pilot survey (in September of 2013),
3. Refining the survey materials and conducting the main survey (in October of 2013),
4. Analysis of the survey results (incl. statistical modelling).

4.1. Focus group discussion

The focus group discussion was organised in December of 2012. 8 persons representative to the general population of Latvia formed the focus group. The participants were selected based on the following criteria:

- they are residents of Latvia,
- the group is representative to the general population of Latvia aged 18-74,
- used stratification parameters: sex, age, nationality, education and region of Latvia.

Results of the discussion were used to improve the survey materials, in particular:

1. to improve description of the marine environment problems for valuation,
2. to refine formulation of attributes and their levels in the scenarios,
3. to refine other elements of the survey materials (e.g. information that should be provided in the questionnaire to support credibility of the scenarios, the payment mechanism).

In relation to the **description of marine environment problems for valuation** the focus group discussion showed, for instance, that:

- The current damage to the marine biodiversity and the environmental improvements in the policy scenarios (BAU and GES) are relatively marginal that people could capture the problem. It is also because the marine biodiversity is rather "intangible" feature for people and there is a need to provide information on how (changes in) the biodiversity links to human welfare. Since such information is rather scarce (in terms of quantitative data/assessments for the Latvian marine waters), the questionnaire was complemented with general explanations for the contribution of biodiversity in humans' welfare.

- There is not enough awareness of presence and negative impacts of alien species concerning the marine ecosystem thus there were doubts if this should be seen as serious marine environment problem. A number of alien species as such was not seen as sufficient justification for the problem. It was concluded that their negative impacts need to be characterised that the problem could be understood better. Thus the survey materials were considerably improved afterwards by including information about the negative impacts of these species.

The results allowed also **improving formulation, specification and verbal description of attributes and their levels.** It was relevant in particular concerning the water quality attribute. As noted, the focus group participants noticed cause-effect link between the water quality and status of the marine biodiversity. Thus the water quality attribute was narrowed afterwards focusing only on aesthetic water quality for recreation at the sea. The focus group discussion allowed also identifying where verbal descriptions of the attributes and their levels in scenarios needs to be improved (were refined for all the attributes afterwards), also what kind of quantitative specification of the attributes' levels need to be added.[17]

4.2. Pilot survey

The pilot survey was conducted in September of 2013. Sample consisted of 100 respondents representative to the general population of Latvia aged 18-74. Interviews were conducted by 16 interviewers (PAPI at respondents' residence places). The pilot survey aimed to test the survey materials before they are applied in the main survey, in particular:

- if the provided information is seen as understandable and credible,
- if the formulation of attributes and their levels work as expected,
- to collect information for improving efficiency of the choice set "design" (called as 'experimental design'[18], which is the basis for constructing choice sets),
- to refine specific questions in the questionnaire (e.g. follow-up questions after choice tasks to obtain explanations for respondents' choices),
- to refine the questionnaire technically (formulation of questions, answer options, instructions for skips over questions etc.).

Some lessons from the pilot survey:

- Length of the questionnaire and complexity and length of texts in various parts of the questionnaire was noted as problem. Part of respondents dislikes reading massive texts or finds texts as too complex. Thus it is important to make the descriptions of environmental problems, possible actions and scenarios for valuation as simple and concise as possible.
- Part of respondents replying with "No" on the WTP in principle question[19] are tended to mind against completing the choice questions which follow afterwards (since they are not willing to contribute financially into improving the marine environment they don't see sense in asking them to choose among alternative options involving also additional payment). It was discussed for the main survey if the choice questions should be asked to such respondents. To minimise such negative reactions it was decided to allow skipping the choice questions in such cases for web-based interviews (CAWI) only[20]. However, the pilot survey

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[17] Full results of the focus group discussion are provided in a special report.

[18] The way the levels of alternatives are set and structured into choice sets is called as the 'experimental design'.

[19] The questionnaire included such question before asking to complete the choice questions. The question was *"Would you personally be willing to pay anything to improve the Latvian marine environment quality concerning the described problems?"* with answer options "Yes", "No", "Not sure/Hard to say".

[20] Both interviewing modes were used for the main survey – CAWI and CAPI.

results showed that around 15 % of the respondents saying "No" on WTP in principle, chose policy options (with environmental improvements and additional payment) in the choice questions afterwards. Thus the collected responses from personal interviews (CAPI), where the choice tasks were asked to all, aimed to provide more precise data about and explanation for the (actual) choices of such respondents.

- Part of respondents faces difficulties to understand how the choice questions need to be completed. Clear instructions need to be provided in the questionnaire (in particular for CAWI where there are no interviewers who could help with the explanation).

- The number of choice questions was also matter for the discussion. The pilot survey (where 12 choice sets were presented to respondents) indicated that respondents can mind to completing too many choice questions.[21] General principles suggest that more choice sets (more data on observed choices in various choice situations) improve robustness of the results. To minimise negative reactions against too many choice questions it was decided to keep 12 choice sets (questions) for the main survey (as it was in the pilot survey).

- The used 'payment mechanism' *("a special Baltic Sea tax"*) caused strong negative reactions (as it was observed already from the focus group discussion and previous studies in Latvia). Due to the national socioeconomic and political context there is very strong opposition indeed to everything what concerns taxes. After the pilot survey it was decided to use more "neutral" term "payment" instead of "tax" (*"a special Baltic Sea payment"*).

4.3. Main survey

The main survey was conducted in October of 2013 with aimed sample size 1200 responses and the sample being representative to the national population.

4.3.1. Questionnaire

Final questionnaire applied in the main survey included the following sections (see also the annex 1 for full questionnaire):

1) Respondents' use of the sea for leisure activities. This section aimed to collect relevant information about respondents' use of the sea that can be used later for various policy analyses to characterise benefits of the marine water use (e.g. number of the "beneficiaries" and recreation visits overall and for various leisure activities, data for travel cost analysis). It also aimed to provide data on water use characteristics possibly relevant to explain respondents' WTP for the proposed marine environment improvements.

2) Description of the environmental problems of the Latvian marine waters (decline of native species' variety, reduced water quality for recreation at the sea, negative impacts of establishing of harmful alien species), incl. also questions on respondents' prior knowledge about and perception of these problems.

3) Action programs for improving state of the Latvian marine waters in relation to the described problems. This section aims to explain the scenarios and the levels attributes may take in them, as

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[21] A one of reasons could be also that these respondents have difficulties to understand how the choice questions need to be completed (since when they capture it, completing the choice tasks comes rather easily). This confirms relevance of the previous point (on clear instructions).

well as to learn individual importance of improving the state and willingness to contribute in it financially.

4) Choice of action programs, including choice sets and follow-up questions explaining the choices. The follow-up questions aimed to collect information about reasons for non-WTP (e.g. when selecting always the option "No additional actions"), importance of each attribute for the choices and data on other issues behind the choices (e.g. which Latvian sea basins were considered when making the choices).

5) Information about respondents to collect data about socio-demographic and personality characteristics of respondents that could possibly be relevant to explain respondents' WTP, as well as for characterising the samples representativeness.

Two slightly different versions of the questionnaire were developed – for the CAPI and CAWI modes. Differences between both versions were related to specifics of each interviewing mode. The only essential difference between both versions was in the way the choice questions are asked to those who respond negatively on willingness to contribute financially in principle. As noted, the questionnaire included a question on "WTP in principle" before asking the choice questions (the question was *"Would you personally be willing to pay anything to improve the Latvian marine environment quality concerning the described problems?"* with answer options "Yes", "No", "Not sure/Hard to say"). It was decided do not ask the choice questions to those saying "No" in CAWI to minimise drop out cases. But the choice questions were asked to all respondents in CAPI to obtain more detailed data on behaviour of those who state non-WTP in principle.

Latvian and Russian versions of the questionnaire were used in the survey. Full questionnaire (translated to English) is provided in the annex 1.

4.3.2. "Choice card" and choice sets

Final design of the "choice card" used in the main survey is presented in the table below.

Table 4.1. The "choice card" used in the main survey (example).

	Program A	Program B	No additional actions
Reduced number of native species	No such areas	(on) Small areas	(on) Large areas
Water quality for recreation	Bad	Good	Bad
New harmful alien species' establishing	Rarely	In exceptional cases	Often
Your yearly payment	5 LVL	2 LVL	0 LVL
Your choice:	○	○	○

Levels for the price attribute were initially selected based on results (WTP values) of previous valuation studies in Latvia in relation to the water ecosystems (the BalticSUN study in Latvia in particular). They were tested in the pilot survey. There was no need to change anything for the main survey (see the following information box).

12 choice sets (versions of the "choice card") were used in the questionnaire. Combinations of the attributes' levels in the scenarios (Programs) for the choice sets – the so-called **'experimental design'**

was developed using NGENE software.[22] The 'experimental design' was changed during the main survey to increase number of the combinations asked to respondents (thus, responses for 24 choice sets were collected overall during the main survey). Larger number of the applied combinations increases robustness of the obtained results. However it was learned during the first stages of the survey (incl., the focus group discussion) that too many choice tasks per respondent may make the choice exercise too complicated for respondents.[23] Thus 12 choice tasks per respondent and changing the design during the survey were found as optimum solution (instead of asking more choice tasks to each respondent).

Box 4.1. Coding of attributes and their levels used in the study.

RS (reduced species) - reduced number of native species:

    0 - no change ("on large areas"),

    1 - average improvement ("on small areas"),

    2- major improvement ("no such areas");

WQ (water quality) - water quality for recreation:

    0 - no change ("bad"),

    1 - average improvement ("moderate"),

    2 - major improvement ("good");

IS (invasive species) - new harmful alien species' establishing:

    0 - no change ("often"),

    1 - average improvement ("rarely"),

    2 - major improvement ("in exceptional cases");

C (costs) - yearly payment per person (LVL): 0, 2, 5, 10 LVL.

Order in which the choice sets were presented to various respondents was changed (randomly) in the main survey to prevent possible ordering effect.

4.3.3. Implementation of the main survey

General information about implementation of the main survey

- Survey mode: CAWI and CAPI. Internet interviews (CAWI) for respondents aged 18-54 and personal interviews at respondents' place of residence (CAPI) for respondents aged 35-74.

  The total sample interviewed by both modes is representative to the total population of Latvia (in age group 18-74). The internet interviews are more cost-effective than the personal interviews. However, according to international standards[24] they are recommended when

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[22] 'Efficient Bayesian design' was used (a design optimized for Bayesian priors, which considers optimising priors taking uncertainty into account).

[23] Complexity of attributes and their levels from the perspective of respondents also was taken into account, since all this needs to be grasped when making choices among alternatives in the choice tasks.

[24] ICC/ESOMAR International Code on Market and Social Research recommends appropriate scientific principles for the research (ESOMAR 2008). According to these principles, it is important that the sampled individual do not differ from the general population by relevant characteristics. If any part of general

internet use in the general population is above 60 % to ensure that the sample (reached via the internet) represents correctly the general population. Such level of internet use in Latvia is not characteristic for age group above 55 years[25], thus using CAWI only for whole sample (18-74) is not recommended. A combined approach was used to reduce costs of the data collection but ensure representativeness of the sample at the same time (50 % of interviews were conducted by each mode).

- Sampling method: stratified random sampling combined with quota sampling method.
- The stratification parameter: territorial (covering all regions of Latvia – Riga, Pieriga, Kurzeme, Zemgale, Vidzeme and Latgale).
- Geographical scale of sampling: national.
- Quota sampling based on the following parameters – nationality, gender, age, place of residence (national geographical coverage), education level.
- Sampling unit: individuals.
- Age of sampled individuals: 18-74 years.
- Survey language: Latvian and Russian.
- Sample size: 1247 valid (fully completed) interviews (641 CAPI and 606 CAWI).
- Response rate (can be obtained from CAPI interviews only): 43 % (1499 contacted persons / 641 fully completed interviews; 858 persons refused participating). It doesn't include number of persons contacted but not meeting the quota (n=1622).
- Dates of fieldwork: CAPI interviews were conducted from the 7th to 21st of October, CAWI interviews – from the 9th to 29th of October of 2013.
- The survey company: TNS LATVIA. The CAPI interviews were conducted by 46 interviewers.

Representativeness of the sample

Statistical data for the general population are taken from:

- Central Statistical Bureau of Latvia (CSB) about households' size (in 2013) and education (based on Labour force survey in 2012);
- Office of Citizenship and Migration Affairs of Latvia (OCMA) about number of the total population, sex, age, nationality and population distribution by regions (data to 01.01.2013);
- TNS Latvia data from *TNS Latvia Digital / Spring 2013* about internet use (in the period 04.02.2013 - 12.05.2013).

Total population in Latvia in the age group 18-74: 1 657 204 inhabitants.

Sex	Sample, %	OCMA data, %
Male	43.9	47.4
Female	56.1	52.6
	100	100

population is not sufficiently represented in the sample, errors in the sample cover and obtained data may occur.

[25] Source: TNS Latvia Digital / Spring 2013 (04.02.2013 - 12.05.2013).

Age	Sample, %	OCMA data, %
18-24	12.3	12.8
25-34	18.8	20.3
35-44	24.1	18.6
45-54	19.1	19.2
55-64	11.1	16.5
65-74	14.6	12.7
	100	100

Households' size	Sample, %	CSB data, %
Average size of households	2.88	2.43

National education levels used in the survey	Sample, %	CSB data, %
Primary school or incomplete compulsory education (up to 8 – 9 classes)	1.1	1.1
Compulsory education (8 – 9 classes)	9.2	14.7
General secondary education (completed high school, gymnasium)	26.3	26.6
Vocational secondary education (completed vocational school, technical college)	34.2	32.6
Higher education (obtained highest academic or professional education (bachelor)), including completed college, master studies, doctoral studies	29.1	25
	100	100

Nationality	Sample, %	OCMA data, %
Latvian	60.5	58.2
Other	39.5	41.8
	100	100

Region	Sample, %	OCMA data, %
Riga and Pieriga	50.9	49.7
Vidzeme	10.5	10.2
Kurzeme	12.8	13.1
Zemgale	11.5	12.1
Latgale	14.4	14.9
	100	100

Income data for respondents were collected by using 10-category scale. Afterwards the data were grouped according to (constructed) quintiles[26] in order to make comparison with statistics available for the total population. The intervals for quintiles were built based on statistics for the total

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[26] Each quintile includes 20 % of households after ranking them in ascending order based on disposal income per household's member. Mean is then calculated for each quintile. The means were used to construct quintiles from the survey data obtained according to 10-category scale.

population about each quintile's mean income (the interval values were set based on middle between the means).

Income categories used in the questionnaire*		Grouping of data by quintiles	Sample, %
1	less than 50 LVL	1st (less than 100 LVL)	15.8
2	51-100 LVL		
3	101-150 LVL	2nd (101 – 150 LVL)	10.6
4	151-200 LVL	3rd (151 – 200 LVL)	21.9
5	201-250 LVL	4th (201 – 350 LVL)	26.8
6	251-300 LVL		
7	301-350 LVL		
8	351-400 LVL	5th (351 LVL and more)	24.9
9	401-500 LVL		
10	more than 501 LVL		

* For income per person per month (including all kind of income, after taxes).

1 EUR = 0.7028 LVL.

If a sample is representative, 20 % of the respondents should fall in each quintile. However distribution of the respondents by quintiles may not be fully regular because the developed groups are quite rough quintiles since the intervals are constructed from the available 10-category scale. Also because data for 15 % of the respondents are not available (when respondents didn't want to provide information about their income) thus their distribution by income groups (quintiles) is not known.

It can be concluded overall that female, inhabitants in age group 35-44 years, with higher education and higher income are slightly over-represented in the sample. This may explain also why the data shows higher internet use in the sample overall comparing to the reference data (see the next table).

Use of internet in each age group	Sample, %	TNS Latvia data*, %
18-24	96.8	96.3
25-34	97.9	93.2
35-44	88.0	82.1
45-54	80.3	61.5
55-64	60.4	48.5
65-74	18.7	23.1
Overall in the population 18-74	76.3	69.2

* in the period 04.02.2013 - 12.05.2013

5. Main results of the study

This section summarises the main results of the study. The chapter 5.1 concerns respondents' relation to the sea and the chapter 5.2 – the first results from analysing individuals' preferences and willingness to pay for improving marine environment quality in relation to the included problems.

5.1. Respondents' relation to the sea

5.1.1. Use of the sea for leisure activities

The first part of the questionnaire aimed to collect relevant data on respondents' use of the sea for various future analysis and policy needs. For instance, the data would allow estimating a total number of beneficiaries in Latvia for the water quality improvements in relation to recreational use of the sea (also a number in relation to various leisure activities), a number of leisure visits per year (the total and for various activities, for the Latvian marine waters overall and for each sea basin). The collected data also would support future 'travel cost' analysis. Further analysis of the data is required to derive these estimates. Since it was out of the scope of this study, only selected summary data from this part of the questionnaire are provided further.

Almost all respondents (95 %) have ever visited the Latvian sea coast to spend leisure time here and 62 % of the respondents have visited the sea in the last 12 months. The most frequent leisure activities during these visits have been *"Being at the beach or seashore for walking, sunbathing, picnicking"* and *"Swimming"* (in around 85 and 60 % of the visits of last year respectively). Other leisure activities are little popular (in less than 10 % of the visits). Leisure has been the only purpose for more than 70 % of the total visits. The Gulf of Riga has been visited more often than the open coast of Baltic Sea (in around 65 % of the total visits), what can be explained by the fact that it is more populated (almost 50 % of the inhabitants live in the city of Riga and Pieriga region located in this sea basin, there is also the coastal city Jurmala – the largest resort city in the Baltic States).

Table 5.1. Statistics on the respondents' leisure activities at the Baltic Sea (N=774, respondents who visited the sea for leisure in the last 12 months).

	Mean of the sample
How many times did you visit the Latvian sea coast in the last 12 months to spend leisure time here? (Q02) *Number of visits*	15.6 [**Me – 5**, Mo – 1, Min/Max – 1/300]
In which activities and how often did you usually take part on your leisure visits at the sea? (Q03) *From 0 to 10, where: 0 'Didn't take part', 10 'Took part always'*	
– Swimming (in the sea) (Q03.1)	**6.2**
– Being at the beach or seashore for walking, sunbathing, picnicking (Q03.2)	**8.6**
– Angling (Q03.3)	0.8
– Boating (Q03.4)	0.8
– Water sports (e.g. diving, wind surfing, water skiing) (Q03.5)	0.4
– Going on a cruise (Q03.6)	0.9
– Other (Q03.7)	0.6

5.1.2. Perception and attitude to the marine environment problems

Only around 20 % of the respondents noted that the current water quality limits their leisure possibilities and they might visit the Latvian marine waters for leisure more often if the water quality improves.

Table 5.2. Extent to which respondents feel limited in their leisure activities due to the current marine environment quality (in %; N=1247).

"To what extent you agree to the following statements?"	*"I fully agree" and "I rather agree"*	*"I neither agree nor disagree"*	*"I rather disagree" and "I fully disagree"*	*"Don't know"*
"Current quality of the Latvian marine waters limits my leisure possibilities" (Q13.2)	**19.2**	15.4	58.4	6.9
"I had visited the Latvian marine waters for leisure more often if the water quality become better than it is now" (Q13.3)	**22.5**	14.9	52.8	9.7

The respondents had been relatively less familiar with the problem of alien species, but more than 60 % had heard about the problem of declining biodiversity. Nevertheless, after being presented with description of the problems, the majority believes that the described problems of marine environment are important and even more note as important personally that the situation would be improved. The water quality for recreation is seen as the most important one of the presented problems and the problem of harmful alien species as the least important.

Table 5.3. Respondents' knowledge and attitude to the valued marine environment problems (in %; N=1247).

	Reduced number of native species	Water quality for recreation	New harmful alien species' establishing
"Have you heard prior to this survey about this problem?" (Q14, Q16, Q18)			
"Yes"	**62.1**	**72.1**	**40.5**
"No"	30.5	20.6	53.9
"Don't know/Hard to say"	7.4	7.3	5.6
"To what extent you personally view the mentioned as a problem in the Latvian marine waters?" (Q15, Q17, Q19)			
"A very big problem" and *"Rather big problem"*	**73.5**	**78.7**	**65.0**
"Neither big nor small problem"	12.4	10.9	15.6
"Rather small problem" and *"Not a problem"*	5.3	4.9	7.4
"Hard to say"	8.8	5.5	12.0
"How important it is for you personally that the situation will be improved?" (Q20, Q21, Q22)			
"Very important" and *"Quite important"*	**74.3**	**86.3**	**72.9**
"Neither important nor unimportant"	18.9	9.9	18.6
"Quite unimportant" and *"Fully unimportant"*	6.8	3.8	8.5

5.2. Respondents' preferences and 'willingness-to-pay' (WTP) for the marine environment improvements

5.2.1. General willingness to pay

Before asking the choice questions the respondents were asked if they would be willing to contribute financially in principle to improve the marine environment quality in relation to the described problems.[27] 42.7 % of respondents stated that they are not willing to pay, 35 % replied that they are not sure (see also the next table).

Interesting conclusion comes from comparing this result with the previous study concerning the marine ecosystem – the BalticSUN[28], where similar WTP in principle question was asked. Comparison of responses of both studies is provided in the table below. The BalticSUN study valued benefits of reducing eutrophication in the Baltic Sea. Proportion of those saying "No" on WTP in principle is similar in both studies. However distribution of other responses between answer options "Yes" and "Not sure" differ considerably. Share of those stating "Yes" is considerably larger in the BalticSUN study, while large proportion of responses of this study is composed by the option "Not sure/Hard to say". This could be explained by respondents' familiarity with the valued environmental problems leading to larger (initial)[29] confidence concerning the problem of eutrophication (which is related closely to water quality) but less confidence when it concerns the problems valued in this study (in relation to the biodiversity and alien species).

Table 5.4. Distribution of the respondents' responses on the general WTP question in this study and the BalticSUN study (in %).

Answer options	Frequency (%) in this study (N=1247)	Frequency (%) in the BalticSUN study (N=701)
Yes	22.4	41.5
No	42.7	45
Not sure / Hard to say	35.0	13.5
	100	100

In CAWI respondents replying negatively ("No") on the WTP in principle question were not asked to go through the choice questions. But in CAPI also these respondents were asked the choice questions what allows comparing their stated (non) WTP and actual choices in the choice tasks.[30] It can be seen from the CAPI responses that 82 % of those saying "No" selected the "No additional actions" option afterwards in all choice sets but 18 % selected one of the alternative programs (with additional payment) in some sets. From those saying "Not sure" on WTP in principle 45 % selected the "No

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[27] Q23: *"Would you personally be willing to pay anything to improve the Latvian marine environment quality concerning the described problems?"*

[28] The study was implemented in 2011 as part of the Baltic Sea scale research project. The 'Contingent Valuation Method' based on the WTP survey was used in this study.

[29] It should be noted that the total share of respondents stating "zero value" that is calculated based on WTP/choice questions (depending on the study), which follow after the WTP in principle question, differ. It is discussed latter in this chapter.

[30] Each choice set included the „No additional actions" option with no additional payment. Thus the respondents not being WTP could select this option in all the sets.

additional actions" option afterwards in all choice sets and 55 % selected one of the alternative programs (see also the table below).

Table 5.5. Characterisation of the respondents' WTP based on their stated WTP in principle and actual choices in choice questions (N=641, since only in CAPI the choice questions were asked to all respondents).

Answer on the WTP in principle question (Q23)		Distribution of respondents (in %) within each group by selected options in the choices sets	
Answer options	Frequency (%)	"No additional actions"	Alternative programs*
Yes	21	9	91
No	50	82	18
Not sure / Hard to say	29	45	55
	100		

* Program A or B in the choice sets involving additional payment.

The total calculated share of the respondents selecting "No additional actions" option in all the choice sets is 45 % (for the whole sample). If this is assumed as the share of those attaching "zero value" to the proposed improvements (WTP=0), it should be taken rather as its upper bound since part of the respondents had "protest reasons" for making such choices[31] (reasons for non-WTP are analysed in the next chapter).[32] Such proportion is lower comparing to what has been observed in previous water ecosystems-related studies in Latvia.[33]

The CAPI provide also interesting data concerning those who said "No" in the WTP in principle question but selected alternative program in any of choice questions afterwards (N=58). They were asked reason for such choice behaviour in a follow-up question.[34] The results indicate that around 40 % of such respondents **didn't account the payment when choosing the alternative programs** (see also the next table). This result requires attention since such choice behaviour is not assumed when using this valuation method. Further analysis of the data is needed to understand better how the choices were made and how to interpret the results in light of estimating WTP.

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[31] Part of respondents states non-WTP due to social or political reasons even if they attach value to the proposed environmental improvements. For instance, when they don't want to pay because they don't trust that the collected money would be spent for the purpose, or they don't believe that the program for achieving the proposed improvements would be implemented or would work. Thus the actual WTP of such respondents may be positive (>0), and it is usually considered in the analysis what value to apply to these respondents.

[32] It is rather the upper bound also because a conservative assumption was applied concerning CAWI responses of "No" in the WTP in principle question. There are no choice responses from these respondents since the choice questions were not asked to them. Similar proportion was assumed as for CAPI responses (where the data exists), where 82 % of the respondents stating "No" on WTP in principle question selected "No additional actions" option in all the choice sets. At the same time choices of other respondents' groups in CAWI (saying "Yes" or "Not sure") indicate that selecting "No additional actions" option is lower among CAWI respondents than CAPI. (This can be explained by differences in the respondents' socio-demographic characteristics sampled for each mode – see the chapter 4.3.3 for more information.)

[33] For instance, in the BalticSUN study the respective share in the Latvian survey was 55.2 %.

[34] Q36.3. *"You said "No" in the question about willingness to pay, but chose Program A or B afterwards. What was the reason that you changed your mind? Please choose only one – the most important from the following reasons."*

Table 5.6. Reasons for choosing the alternative programs in the choice questions although stating non-WTP in principle (in Q23). (N=58, based on CAPI responses).

Answer options	No of responses	Frequency (%)
I want the marine environmental quality to improve, but the option "No additional actions" doesn't include improvements	5	8.6
Amount of payment in the proposed option(s) was acceptable to me	10	17.2
The choice situations allowed me to understand better the improvements in marine environment quality	5	8.6
I didn't take into account amount of payment, only improvement in the marine environment quality	6	10.3
My initial decision was not thought through	1	1.7
I don't think I would have to pay anything anyway	19	32.8
I had more time to think	3	5.2
I changed my mind	3	5.2
Other reason (please specify)*	6	10.3
TOTAL	58	100

* All responses indicate that the respondents would like to see the proposed environmental improvements but stated "No" in the WTP in principle question due to "protest reasons".

5.2.2.   Reasons for not being WTP

The questionnaire included various follow-up questions after completing the choice sets with the aim to collect information explaining the respondents' choices. The respondents stating "No" in the WTP in principle question (in CAWI) and/or choosing "No additional actions" option in all choice questions (in both CAWI and CAPI) were asked a follow-up question on reasons for not being WTP.

Frequencies of selecting various reasons are presented in the next table. The most frequently named reasons are "I can't afford to pay" (in 42.6 % of the cases), mistrust that the money will be used for the purpose (25.1 %) and that the program would work (11.7 %).

All the reasons may be grouped into two groups – indicating that:

1. respondents attach "zero value" to the proposed marine environment improvements (reasons 1, 2, 5 and 6 in the next table),

2. respondents may attach positive value to the proposed improvements but are not WTP due to "protest reasons" (reasons 3,4 and 7 in the next table) .

From all respondents with non-WTP (N=598) the "protest" responses compose almost the half (47 %). When the mean WTP of the sample is estimated assuming WTP=0 for such respondents, it is conservative approach and indicates rather the lower bound of WTP.

Table 5.7. Reasons for non-WTP (N=598).

Respective questions in the Questionnaire:

"What was the reason that you answered "No" [in the WTP in principle question Q23]?" (CAWI; Q36.1)

"What was the reason that you chose the option "No additional actions" in all the choice questions?" (CAWI and CAPI; Q36.2)

[1] *Attaching "zero value" to the proposed environmental improvements or "protest response".*

Answer options	Frequency (%)	Type of the reasons [1]
1. The current level of the marine environmental quality is satisfactory	1.7	*Zero*
2. I can't afford to pay	**42.6**	*Zero*
3. I do not believe a program to improve the marine environmental quality would work	**11.7**	*Protest*
4. I am prepared to pay for improving the marine environmental quality, but not by extra mandatory payment	3.7	*Protest*
5. I do not care about state of the Baltic Sea	1.0	*Zero*
6. Other problems are more significant	5.7	*Zero*
7. I do not believe the money will be used for the purpose	**25.1**	*Protest*
8. Other reason (please specify)	8.5	*Zero and Protest* *
	100	

* 76.5 % of these responses (39 out of 51 in total) are "protest responses".

Statistical modelling can be used to investigate explanatory variables of being (or not) WTP. They may relate to respondents' socio-demographic and sea use characteristics, perception and attitudes to the marine environment quality and the improvements proposed for valuation.

The first results of such analysis[35] indicate that probability of not being WTP increases, for instance, with the respondents' age, seeing the current sea water quality as good enough, with distance from/not using the sea (for instance if respondents' residence place is in the Latgale region, which is the farthest non-littoral region of Latvia, although also with the lowest welfare level overall). However further statistical analysis (modelling) of the data is needed, which was not possible within the scope of this study.

5.2.3. Modelled preferences (choices) and WTP estimates

The CE valuation method aims to measure individuals' **welfare improvement (in terms of utility) related to the environmental improvements**. It allows estimating the individuals' **marginal utility** related to the valued improvements comparing to the reference situation (the "No additional actions" scenario in the given case). The utility is estimated by **'willingness-to-pay' (WTP) for the proposed environmental improvements**.

Statistical modelling of the data is needed:

---

[35] With applying Binary choice (binary logit) model for modelling probability of not being WTP depending on various explanatory variables.

1. to estimate respondents' **preferences** for the valued environmental improvement levels (choices for various attributes' levels)[36] and

2. to derive **estimates of WTP** for the valued environmental improvements (as mean WTP per individual[37]).

The **multinomial logit model** was used for the statistical analysis of the data.[38] It is commonly used for modelling the CE data. Due to limitations of this study other models were not tested. This should be done as further work to investigate the most appropriate model.

According to this model the utility is explained as:

$$U_{ij} = \beta\, X_{ij} + \varepsilon_{ij}$$

where

i individual, j alternative (program),

X_{ij} attributes of alternatives (RS, WQ, IS in the given case),

β marginal utilities associated with these attributes,

ε_{ij} error term (including unobserved attributes of alternatives).

In light of estimating the samples' mean WTP, it was necessary to decide on the approach how to deal with the missing data from CAWI for those respondents stating non-WTP in principle (in Q23) to which the choice questions were not asked. Two approaches were tested:

1. Assuming that these respondents chose "No additional actions" option in all choice questions. To be the data from both interviewing modes consistent, also the choice data of the respective respondents (stating "No" in Q23) from CAPI were corrected the same way. Output is the mean WTP estimate accounting "zero responses" and can simply be multiplied by general population for obtaining aggregated WTP.

   Model run with such data resulted in negative marginal utility of the alternative programs (the BAU and GES scenarios). This is due to large proportion of the sample choosing "No additional actions" option and thus high utility of this option comparing to the marginal utility of the alternative programs.[39]

2. Running the model based on data without respondents not being WTP ("No" in Q23). Output is the mean WTP of those who are WTP (WTP>0). By such approach the utility of "No additional actions" option is not accounted when estimating the mean WTP. It needs to be accounted afterwards when calculating mean WTP of whole sample (by weighting the mean with proportion of those WTP[40]). This approach led to better result in terms of statistical confidence (e.g. "statistical significance" of β_X) and understandability of estimated mean WTP. Thus it is reported here as (preliminary) result.

---

[36] See the chapters 3.2, 3.3 and 4.3.2 for more explanations on the attributes and their levels in the valued scenarios.

[37] The mean of sample can afterwards be multiplied by general population to obtain aggregated WTP.

[38] The analysis was performed with NLOGIT 5 software.

[39] Respondents stating „No" in Q23 compose almost 43 % of the sample.

[40] 0.57 in the given case.

At first the model allows estimating **probability of choosing specific attributes' levels (the choices).** Respective result is presented in the information box bellow. "Choice" is the dependant variable, the independent variables are attributes' levels.

The estimated model parameters (β for the attributes' variables) are "statistically significant"[41] except <u>for the "No additional actions" scenario (β for SQ) and the GES scenario concerning the biodiversity attribute (β for RS2). The model doesn't confirm that the marginal utility is different from 0 for these two variables</u>. Concerning the former (SQ) it can be explained by excluding from the data most responses choosing this scenario (respondents stating "No" in Q23). Interpretation concerning the GES scenario of biodiversity attribute (RS2) is that respondents prefer "No additional actions" scenario over the GES scenario (there is no marginal utility from achieving GES). Such result can be explained by various reasons.

- It could be the case indeed that the respondents didn't attach further marginal value to improving the state over the BAU scenario, which would already ensure that species are present in 80-90 % of their natural areas. Since GES scenario involves additional payment they prefer SQ (species are present in 70 % of their natural areas) over the GES scenario (in 100 % of their natural areas).

- Other reason could be that the GES scenario (100 %) is perceived as infeasible (since there is always uncertainty in the real life). Such perceptions appeared during the focus group discussion concerning the invasive species' attribute, for which the initial formulation of the GES level was "Never" (for the frequency of establishing new invasive species).

- Finally it might be explained also by difficulties for people to capture the formulation of the attribute (presence of species in their natural areas) and its levels (large/small/no such areas with reduced number of species). There were indications from the focus group discussion and the pilot survey that this creates difficulties for some people. Although the marine biodiversity issue as such is also relatively less "tangible" for people, in particularly since limited information (on evidences and assessments) can be provided to characterise value of and negative impacts on the marine biodiversity.

Box 5.1. Output data of the model (multinominal logit model) on modelling the respondents' preferences for the valued environmental improvements (the attributes' levels in the valued scenarios).

<u>Explanation of the variables:</u>

Choice (dependent variable).

SQ (status quo) – "No additional actions" scenario.

RS (reduced species) – reduced number of native species: **RS1** – moderate improvement, corresponds to the BAU scenario; **RS2** – large improvement, corresponds to the GES scenario.

WQ (water quality) – water quality for recreation: **WQ1** – moderate improvement, corresponds to the BAU scenario; **WQ2** – large improvement, corresponds to the GES scenario.

IS (invasive species) – new harmful alien species' establishing: **IS1** – moderate improvement, corresponds to the BAU scenario; **IS2** – large improvement, corresponds to the GES scenario.

COST (costs) – yearly payment (per person per year, LVL).

---

[41] The „zero-hypothesis" (that β = 0, which would mean 0 marginal utility) can be rejected with 95 or 99 % probability (depending on the variable).

Output of the model:

```
Discrete choice (multinomial logit) model
Dependent variable               Choice
Log likelihood function      -8941.00100
Estimation based on N =   8580, K =   8
Inf.Cr.AIC  =  17898.0 AIC/N =    2.086
R2=1-LogL/LogL* Log-L fncn R-sqrd R2Adj
Constants only  -9415.8279  .0504 .0500
Response data are given as ind. choices
Number of obs.=  8580, skipped    0 obs
--------+-------------------------------------------------------------
        |                 Standard           Prob.     95% Confidence
  CHOICE| Coefficient      Error      z     |z|>Z*       Interval
--------+-------------------------------------------------------------
     SQ|    -.04175         .05456    -.77   .4441    -.14868    .06518
    RS1|     .08295**       .03759    2.21   .0273     .00928    .15662
    RS2|    -.01073         .03827    -.28   .7792    -.08573    .06428
    WQ1|     .73440***      .03943   18.63   .0000     .65712    .81167
    WQ2|     .86645***      .04169   20.78   .0000     .78474    .94816
    IS1|     .16159***      .03808    4.24   .0000     .08695    .23622
    IS2|     .23003***      .03832    6.00   .0000     .15493    .30513
   COST|    -.12242***      .00532  -23.00   .0000    -.13286   -.11199
--------+-------------------------------------------------------------
***, **, * ==> Significance at 1%, 5%, 10% level.
```

The coefficients of independent variables (attributes' levels) are used to calculate mean WTP. **Marginal WTP for any of the attributes' levels** can be calculated according to:

$$Mean\ WTP = -\frac{\beta_X}{\beta_C}$$

where β_C is the coefficient of the cost attribute and β_X is the coefficient of the environmental attribute.

The calculated mean WTP estimates are provided in the box 5.2.

Box 5.2. Output data of the model (multinominal logit model) for estimating marginal utilities of the attributes' levels (in terms of mean WTP, LVL per person per year).

1 EUR = 0.7028 LVL.

Output of the model: mean WTP for each of the attributes' levels (see the column "Function" in the table below)

```
|-> WALD
        ; fn1 = b_sq/-b_cost
        ; fn2 = b_rs1/-b_cost
        ; fn3 = b_rs2/-b_cost
```

```
            ; fn4 = b_wq1/-b_cost
            ; fn5 = b_wq2/-b_cost
            ; fn6 = b_is1/-b_cost
            ; fn7 = b_is2/-b_cost $
-------------------------------------------------------------------------------
WALD procedure. Estimates and standard errors for nonlinear functions and
joint test of nonlinear restrictions.
Wald Statistic            =    1288.42006
Prob. from Chi-squared[ 7] =       .00000
Functions are computed at means of variables
--------+----------------------------------------------------------------------
        |                  Standard          Prob.        95% Confidence
WaldFcns | Function          Error      z    |z|>Z*          Interval
--------+----------------------------------------------------------------------
 Fncn(SQ) |  -.34103          .44088     -.77  .4392     -1.20515     .52308
 Fncn(RS1)|   .67756**        .30693     2.21  .0273       .07598    1.27914
 Fncn(RS2)|  -.08763          .31323     -.28  .7797      -.70155     .52629
 Fncn(WQ1)|  5.99892***       .38712    15.50  .0000      5.24018    6.75765
 Fncn(WQ2)|  7.07759***       .37739    18.75  .0000      6.33793    7.81726
 Fncn(IS1)|  1.31991***       .31007     4.26  .0000       .71219    1.92764
 Fncn(IS2)|  1.87901***       .32398     5.80  .0000      1.24403    2.51399
--------+----------------------------------------------------------------------
***, **, * ==>  Significance at 1%, 5%, 10% level.
-------------------------------------------------------------------------------
```

Output of the model: mean WTP for the BAU scenario (comparing to SQ) considering all included environmental attributes (see the column "Function" in the table below), LVL per person per year.

```
|-> WALD for BAU; fn1 = (-b_sq+ b_rs1+b_wq1+b_is1)/-b_cost$


-------------------------------------------------------------------------------
WALD procedure. Estimates and standard errors
for nonlinear functions and joint test of
nonlinear restrictions.
Wald Statistic            =     474.18079
Prob. from Chi-squared[ 1] =       .00000
Functions are computed at means of variables
--------+----------------------------------------------------------------------
        |                  Standard          Prob.        95% Confidence
WaldFcns | Coefficient      Error      z    |z|>Z*          Interval
--------+----------------------------------------------------------------------
 Fncn(BAU)|  8.33742***       .38288    21.78  .0000      7.58700    9.08785
--------+----------------------------------------------------------------------
Note: ***, **, * ==>  Significance at 1%, 5%, 10% level.
-------------------------------------------------------------------------------
```

Output of the model: mean WTP for the GES scenario (comparing to SQ) considering all included environmental attributes (see the column "Function" in the table below), LVL per person per year.

```
|-> WALD for GES; fn1 = (-b_sq+ b_rs1+b_wq2+b_is2)/-b_cost$


-------------------------------------------------------------------------------
WALD procedure. Estimates and standard errors for nonlinear functions and
joint test of nonlinear restrictions.
Wald Statistic            =     637.29821
Prob. from Chi-squared[ 1] =       .00000
```

```
Functions are computed at means of variables
--------+-------------------------------------------------------------
        |                    Standard              Prob.      95% Confidence
WaldFcns |   Function         Error       z      |z|>Z*          Interval
--------+-------------------------------------------------------------
 Fncn(GES)|  9.97520***        .39514    25.24   .0000      9.20074  10.74966
--------+-------------------------------------------------------------
***, **, * ==>  Significance at 1%, 5%, 10% level.
--------------------------------------------------------------------
```

The first output table shows mean WTP for each of the attributes' level (see the column "Function"), the second and third table shows overall mean WTP for the BAU and GES scenarios (RSx + WQx + ISx) comparing to the "No additional actions' option.

As with the results for modelling choices, the obtained WTP estimates are "statistically significant"[42] except for the "No additional actions" scenario (Fncn (SQ)) and the GES scenario concerning the biodiversity attribute (Fncn (RS2)), for which the "zero-hypothesis" that WTP=0 cannot be rejected[43].

The results confirm "scope effect" concerning the water quality and invasive species' attributes – the mean WTP is larger for the GES scenario than for the BAU scenario (7.1 and 6 lats respectively concerning the water quality and 1.9 and 1.3 lats concerning the invasive species' attribute).

Concerning the biodiversity attribute the estimated mean WTP for the BAU scenario is 0.7 lats (CI 0.1-1.3 LVL, with the statistical significance at 5 % level). It was not possible to estimate mean WTP for the GES scenario with acceptable level of confidence. If it is equal to 0, it means that the "No additional actions" scenario is preferred over the GES scenario.

The estimated mean WTP for the BAU scenario overall (RS1+WQ1+IS1) is 8.3 LVL (CI 7.6-9.1). Since it was not possible to obtain confident WTP estimate for RS2, the same WTP value as for the BAU scenario (RS1) is used also to calculate mean WTP for the GES scenario (RS1+WQ2+IS2). Concerning the biodiversity problem it may be assumed that people are WTP for the GES scenario at least as much as for the BAU scenario. Hence the estimated mean WTP for the GES scenario is 10 LVL (CI 9.2-10.8 LVL), with the statistical significance at 1 % level).

The difference between both estimates (10 – 8.3 = 1.7 LVL) indicates individual marginal utility of the GES over the BAU scenario (see also the figure 5.1 for illustration). **This estimate can be used to calculate aggregated benefits of implementing additional measures for reaching GES.**

---

[42] The „zero-hypothesis" (that WTP = 0) can be rejected with 95 or 99 % probability (depending on the variable).

[43] The same explanation as for the respective output on modelling choices applies to these results also.
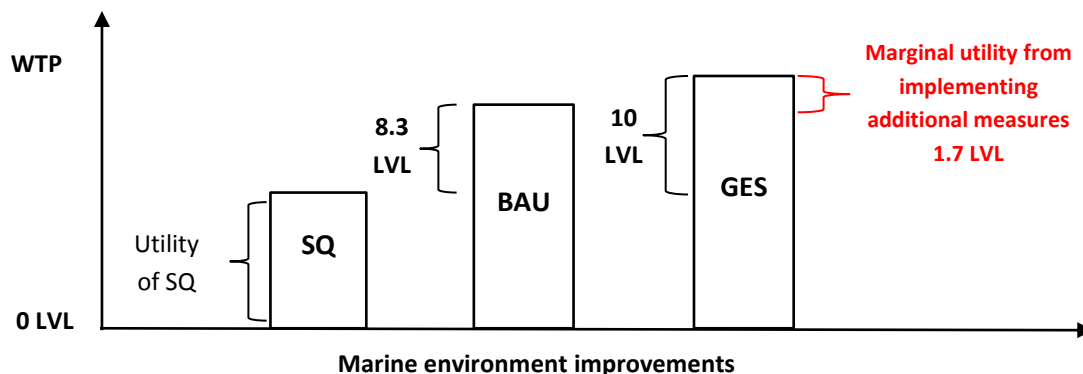
Figure 5.1. Estimating individual marginal utility from implementing the MSFD additional measures (from achieving the GES over the BAU scenario).

However it needs to be noted that **the calculated means for BAU and GES are estimated based on the sample without respondents who were not-WTP (assuming to choose "No additional actions" scenario). Thus the mean WTP of the whole sample needs to be calculated as weighted mean** of (1) those having WTP=0 and (2) having WTP>0 (the mean estimated by the model). The calculation is explained in the table below.

Table 5.8. Calculated mean WTP of the whole sample for the GES state above the "No additional actions" scenario (LVL per person per year).

	Mean WTP of each sub-sample, LVL	Share of each sub-sample, %	Weighted mean WTP of each sub-sample, LVL	Weighted mean WTP of the whole sample [CI], LVL
Sub-sample WTP=0	0	42.7	0	5.7 (CI 5.3-6.2)
Sub-sample WTP>0	9.98 (CI 9.2-10.8)	57.3	5.7 (CI 5.3-6.2)	

1 EUR = 0.7028 LVL.

The mean WTP of the whole sample for the GES scenario is 5.7 lats (CI 5.3-6.2 LVL). It indicates individual marginal utility for the GES over the "No additional actions" scenario. The individual marginal utility of the BAU scenario over SQ is 4.8 LVL (CI (4.3-5.2).

It needs to be stressed that all these should be taken only as preliminary estimates since further statistical analysis of the data is needed to improve robustness of the results and support their interpretation.

Results from the follow-up questions asked after the choice questions confirm that **all included environmental problems have been valued and that the estimates can be attributed to whole national marine waters.** All attributes have been important and taken into account overall by the respondents when making the choices, although the water quality for recreation has been the most important followed by reduced number of native species, payment and the new invasive species as the least important one (see also the box 3.1 in the chapter 3.1 for data from the respective question). Respondents have considered both Latvian sea basins almost on similar extent and both

the coastal and open sea waters when making the choices (although with small deviation towards coastal waters) (see also the next table).

By multiplying the mean WTP estimate to the general population of Latvia (1 657 204, in the age group 18-74) the aggregated benefits of achieving the BAU state are 7.93 milj. LVL per year and the GES state are 9.48 milj. LVL per year (CI 8.74-10.21). **The calculated marginal benefits of achieving GES above the BAU state for all valued environmental problems are 2.72 milj. LVL (3.87 milj. EUR).**[44] Such estimates can be derived for improvements in each valued problem separately, however due to the preliminary character of the WTP estimates this was not seen as meaningful.

Table 5.9. Parts of the Latvian marine waters considered by the respondents when making the choices. (N=649)

Questions and answer options	Mean of the sample
Q38 *"On which parts of the Latvian marine waters you thought about when making your choice? Please circle corresponding number in the following scale"* From 1 to 7, where 1 = the Gulf of Riga only, 4 = equally both the Gulf of Riga and the open coast of the Baltic Sea, 7 = only the open coast of the Baltic Sea	**3.7**
Q39 *"To what extent did you think the coastal waters or deep-sea waters when making your choice? Please circle corresponding number in the following scale"* From 1 to 7, where 1 = coastal waters only, 4 = both coastal waters and deep-sea waters equally, 7 = deep-sea waters only	**3.3**

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[44] 1 EUR – 0.7082 LVL.

6. Conclusions and recommendations

In light of the specific policy objective **the study aims to value changes in selected environmental problems of the marine environment. Such "thematic approach" aims to provide assessments of benefits that can be used for the CBA of measures to support development of the MSFD program of measures.** The study show that it can be challenging when it comes to the biodiversity since its contribution into humans' welfare is very complex and largely indirect. It is not straightforward to characterise biodiversity changes in a way people could link them to welfare, in particular if the changes are relatively marginal.

Results of the study show that Latvian inhabitants assign value to improving state and achieving GES of the marine ecosystem. **Improvements concerning all valued problems of the marine environment are seen as important.** The highest WTP value is assigned to the proposed improvements in the water quality for recreation and the least value to the proposed improvements in the state of marine biodiversity. However the assigned values need to be viewed in light of magnitude of changes concerning each environmental problem valued in the study.

For two of the valued problems – improving water quality for recreation and preventing establishment of new invasive species the WTP for GES exceeds the value assigned to the BAU scenario. This indicates marginal welfare improvements from achieving GES above the BAU state. At the same time the study faced **difficulties to value changes in the marine biodiversity**. The first results don't confirm the marginal welfare improvement from achieving GES above the BAU scenario. Two issues in light of the economic valuation should be noted:

1. If the required changes/improvements to ensure GES are seen as rather marginal, it creates difficulties to capture such marginal changes when they are valued by the 'Stated Preference' valuation methods, which are based on eliciting individuals' WTP.

2. "Intangibility" of the marine biodiversity issue as such, in particular since limited information (evidences, assessments) can be provided to characterise the value of and the impacts on it that people could see the problem and the link to welfare.

In light of the policy support it is **very important further work to develop sufficient provision of assessments to characterise the changes in state and value of the marine biodiversity,** including, quantitative evidences and assessments.

Concerning **the problem of alien species** the study showed that **provision of assessments concerning impacts of these species has to be improved to be this problem and need for improvements communicated effectively to stakeholders and wider public**. Due to the limited knowledge and assessments about the impacts it was not possible to build the respective attribute on them. At the same time there are indications that the number of species only is not seen as sufficient justification for the problem.

The used valuation scenarios aim to be consistent with the BAU scenario and GES according to the MSFD needs and have been defined based on the best available scientific data and knowledge. However since the work on developing the information and knowledge base is continuous, the assessments (the attributes' levels) for the BAU scenario used in this study should be examined against those used for the MSFD program of measures. Since the additional measures will be needed to close gap between the BAU and GES states, proper assessment of the BAU state is important to be the benefit estimates comparable with costs of the additional measures.

The results show that **only slightly more than half of the respondents is willing to contribute financially overall for improving state of the marine environment concerning the valued problems.**

Half of these respondents show assigning "zero value" to the proposed environmental improvements, however the other half, which compose almost one fourth of the population, note "protest reasons"[45] for it.

The estimated mean WTP for achieving the GES state is 5.7 LVL (8.1 EUR) per person per year (CI 5.3-6.2 LVL). But the estimated marginal WTP for the GES above the BAU state is 1.64 LVL for improvements in all valued problems. It is largely composed by the WTP for improvements in the water quality for recreation. As noted, the obtained results didn't show the marginal WTP for improvements concerning the biodiversity.

According to the preliminary results the **aggregated benefits of achieving the GES state** could be in range of 9.5 milj. LVL per year, however the aggregated marginal benefits of achieving GES above the BAU state for all valued environmental problems make less than 3 milj. lats per year (2.72 milj. LVL or 3.87 milj. EUR). **The results should be taken only as preliminary since further statistical analysis of the data is needed to improve robustness of the estimates and support their sound interpretation**.

It is expected that **results of this study will form basis of the information provision for assessing nationally the benefits of the MSFD programs of measures, at least in so far as it concerns available monetary estimates of such benefits**.

As further work it would be useful to compare the WTP estimates of this study and the BalticSUN study for Latvia, although the comparison should be done accurately since different environmental problems and impacts as well as scenarios (in terms of the current state and proposed improvements) are valued in each study. It would also be useful to compare the WTP estimates of this study with similar study conducted in Estonia as part of the GES-REG project. It also aimed to value national benefits of achieving GES in the context of MSFD, but including slightly different set of the marine environmental problems (risk of oil and chemical pollution instead of protecting the biodiversity in this study). Although this comparison also should be done carefully since previous experience with applying similar studies in both countries (including as part of the the BalticSUN) show considerable differences between the WTP estimates of both countries (with considerably higher WTP estimates for Estonia).

The results aim to be used nationally for the CBA of additional measures to achieve GES. Thus the estimated benefits need to be weighed against costs of such measures. It can be expected that the program of measures is built in a way to address specific marine environmental problems, which could relate to specific descriptors (e.g. D5 on eutrophication). However experience from implementing the study show that overlap of the descriptors creates challenge for assessing benefits in connection to them to avoid "double-counting" of benefits. In particular, when such multi-attribute environmental good as the marine environment quality is valued. Moreover, many measures may involve multiple environmental effects by improving state of the ecosystem in relation to more than one problem/descriptor. Thus the comparison of their benefits and costs will not be straightforward. It needs to be evaluated carefully to what measures the benefit estimates provided by this study can be attributed that they are comparable with costs of these measures. Required basis for such evaluation is good understanding of effects of the measures and linked changes in the ecosystem.

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[45] In particular, because of distrust that the money would be spent for the purpose and that the program would be implemented and work.

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Annex: The survey questionnaire

QUESTIONNAIRE OF THE SURVEY ON ATTITUDES OF THE SOCIETY TO ENVIRONMENTAL QUALITY OF THE LATVIAN MARINE WATERS

Good morning/…!

I'm representing a survey company "…". We are conducting a survey to learn about connection of the Latvian inhabitants to the Baltic Sea and attitude towards its environmental quality. Your answers will help for developing action program to preserve and improve the quality of the sea correspondingly to the inhabitants' opinion. You do not need special knowledge about the sea and its water quality.

The interview would take around 30 minutes. The survey is anonymous and the answers will be used only for the purpose of this study. Would you agree to answer on questions of the survey?

This map shows the marine waters of Latvia (the blue area). They include both the Gulf of Riga and the open coast of the Baltic Sea. This area will be thought further in the questionnaire when mentioning the "Latvian marine waters".

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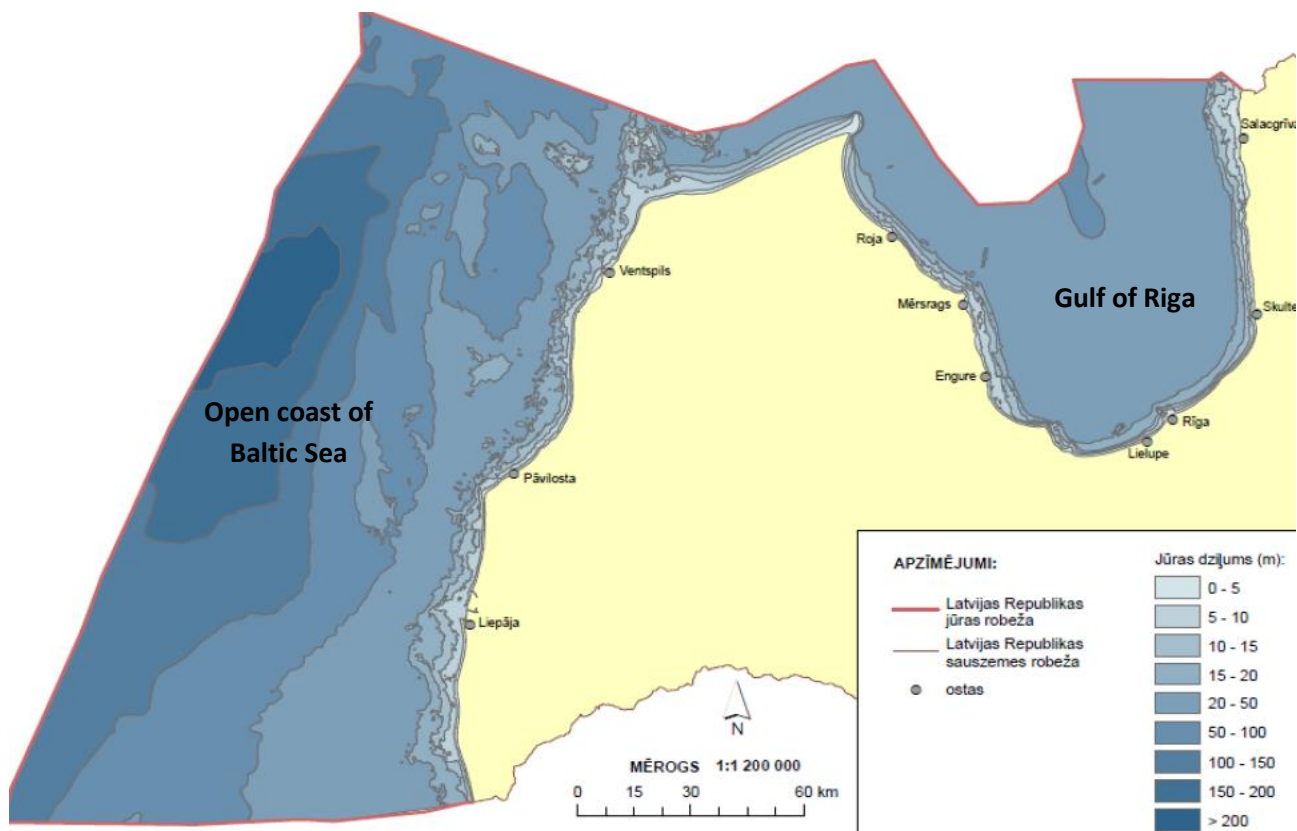
SPENDING LEISURE TIME AT THE SEA

In what follows we would like to learn about your leisure activities in relation to the Latvian marine waters.

1. Have you ever visited the Latvian sea coast to spend leisure time here?

○ Yes, in the last 12 months

○ Yes, in the last 5 years but not in the last 12 months ➔ *GO TO THE QUESTION No 13.*

○ Yes, more than 5 years ago ➔ *GO TO THE QUESTION No 13.*

○ No ➔ *GO TO THE QUESTION No 13.*

2. How many times did you visit the Latvian sea coast in the last 12 months to spend leisure time here?

[THE NUMBER OF VISITS/TRIPS IS THOUGHT HERE, A VISIT IS ACCOUNTED ALSO IF A RESPONDENT SPENT AT THE SEA PART OF THE DAY.]

Around _____ times in the last 12 months.

3. In which activities and how often did you usually take part on your leisure visits at the sea? Please, estimate how often you took part in each specific activity from all your visits at the sea in the last 12 months. Please circle corresponding number in the given scale, where 0 = I didn't take part in this activity, 5 = I took part in this activity on half of my visits at the sea, 10 = I took part in this activity on all my leisure visits at the sea.

○ Swimming (in the sea)	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10
○ Being at the beach or seashore for walking, sunbathing, picnicking	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10
○ Angling	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10
○ Boating	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10
○ Water sports (e.g. diving, wind surfing, water skiing)	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10
○ Going on a cruise	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10
○ Other (please specify): _____	Didn't take part									Took part always	
	0	1	2	3	4	5	6	7	8	9	10

The following questions will be asked concerning the majority of your leisure visits to the sea. *[E.G. MORE THAN 2/3 OF THE LEISURE VISITS.]*

4. How often did you visit each of the Latvian seacoasts? Please circle corresponding number in the given scale, where 0 = all my visits were to the Gulf of Riga seacoast, 5 = half of my visits were to the Gulf of Riga seacoast, half to the open coast of the Baltic sea, 10 = all my visits were to the open coast of the Baltic Sea.

All to the Gulf of Riga   **All to the open coast of Baltic Sea**

   0   1   2   3   4   5   6   7   8   9   10

5. How often the leisure at the sea was the <u>only</u> purpose of your visits? Please circle corresponding number in the given scale, where 0 = leisure at the sea never was the only purpose of my visits to the sea (I always had other purposes also), 5 = leisure at the sea was the only purpose in half of my visits to the sea, 10 = leisure at the sea was the only purpose of all my visits to the sea.

In none visit   **In all visits**

   0   1   2   3   4   5   6   7   8   9   10

The following questions will be asked concerning your <u>last</u> leisure visit to the sea.

6. Which Latvian sea coast you visited the last time, when you visited the sea?

   ○ The Gulf of Riga coast   ○ The open coast of Baltic Sea

7. How did you get to the seacoast? *[MORE THAN ONE ANSWER POSSIBLE]*

   ☐ By walking or bicycle ➜ *GO TO THE QUESTION 9.*

   ☐ By train ➜ *GO TO THE QUESTION 9.*

   ☐ By local public transport ➜ *GO TO THE QUESTION 9.*

   ☐ By coach ➜ *GO TO THE QUESTION 9.*

   ☐ By car or motorcycle

   ☐ Other ➜ *GO TO THE QUESTION 9*

8. How many other adults were travelling with you (do not accounting yourself and children / youth below 18 years)? _____ people.

9. What was the distance to get to the seacoast? Around _____ km.

10. About how long time you spent for travelling (one way) to the place you visited?

Around _____ : _____ hour(s) : minutes.

IF LESS THAN HOUR WAS SPENT AT THE TRAVELLING, SPECIFY APPROXIMAT MINUTES, FOR INSTANCE, „00:20", if 20 minutes.

11. Would you like it took less time from you to get to the seacoast?

   ○ Yes   ○ No   ○ Hard to say

12. How much time did you spend for <u>leisure</u> at the sea?

○ Till one day (without overnight stay) ➜ *GO TO THE QUESTION 12.1*

○ More than one day, with overnight stay ➜ *GO TO THE QUESTION 12.2*

12.1. Please specify around number of hours you spent for leisure at the sea! _____ (hours)
➜ *GO TO THE QUESTION 13.*

12.2. Please specify the number of your overnight stays! _____ (night(s))

13. To what extent you agree to the following statements?

|	I fully agree	I rather agree	I neither agree nor disagree	I rather disagree	I fully disagree	Don't know
1. Quality of the Latvian marine waters now is worse than 10 years ago.	○	○	○	○	○	○
2. Current quality of the Latvian marine waters limits my leisure possibilities.	○	○	○	○	○	○
3. I had visited the Latvian marine waters for leisure more often is the water quality become better than it is now.	○	○	○	○	○	○

ENVIRONMENTAL PROBLEMS OF THE LATVIAN MARINE WATERS

Various environmental problems characterise the Latvian marine waters. Marine scientists have defined three the most important problems that currently and also in the future will cause the most significant negative impact on the marine environment and its use if no additional action are taken for improving the situation. These problems are: (1) decline of natural species' variety, (2) reduced water quality for sea-related recreation and (3) negative impact of establishing of alien species.

In what follows each problem will be characterised. Afterwards in the questionnaire we will ask your opinion about improving state of the marine environment quality, thus it is very important that you read the following information.

1) <u>Decline of native species' variety</u>

Variety of marine plant and animal species ensures existence of the marine ecosystem and its capability to deal with undesirable, including human caused, changes. Many species are also important in human life, e.g. food, recreation (angling, bird watching) or industry.
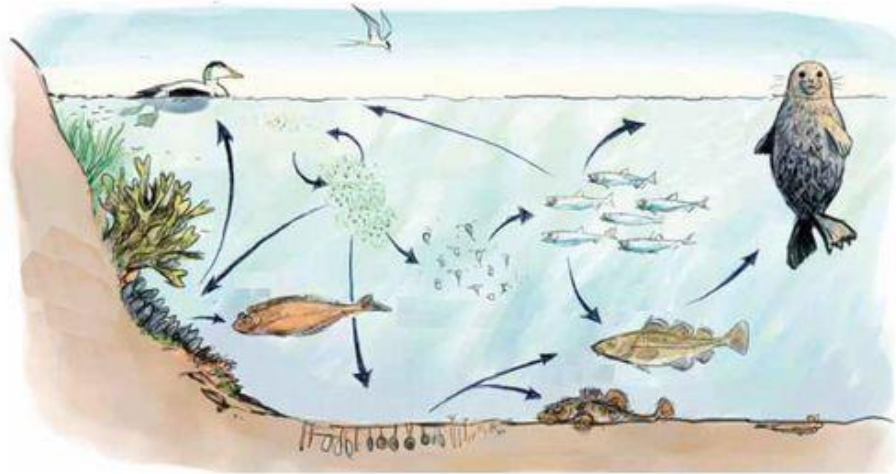
Latvian marine scientists have assessed that currently the number of species is declined in more than 30 % of the Latvian marine areas where they should be present. In good environmental state each species occurs in all areas that are suitable for its natural living conditions. Human created pollution, physical impact on plants and animals, for instance, from constructions on the seashore and in the sea, from fishing with trawls, reduce such natural areas hence species disappear from them.

This decline of species affects negatively the marine environment and opportunities for human use. For instance, there is decline in stocks of some fish species for angling and fisheries, which is source of income and work places. The marine ecosystem's capacity to secure "services" relevant for humans, for instance, oxygen production and "recycling" of human created pollution decreases. The marine flora and fauna we will pass on next generation becomes poorer.

14. Have you heard <u>prior to this survey</u> about the problem of declining native species' variety in the Latvian marine waters?

○ Yes ○ No ○ Don't know / hard to say

15. To what extent you <u>personally</u> view the mentioned as a problem in the Latvian marine waters?

A very big problem	Rather big problem	Neither big nor small problem	Rather small problem	Not a problem	Hard to say
○	○	○	○	○	○

2) <u>Reduced water quality for recreation at the sea</u>

Latvian inhabitants and tourists use the seacoast for sunbathing, swimming, various water sports' activities or just for walking along the coast.

Various human activities increases amounts of nutrients (phosphorus and nitrogen) entering the sea, for instance, from fertilizer use in agriculture, wastewaters of households and industries. It causes water quality problems for recreation at the sea, in particular:

- <u>Reduces visual quality of water</u>

Because of increased amount of nutrients, small size algae are more abundant in water. Hence the water becomes turbid. Currently the coastal water is unclear every summer – it can be seen through less than 3 m on average in the Gulf of Riga and less than 4 m in the waters of open coast of the

Baltic Sea. In good environmental state the sea bottom could be seen in summers in at least 4 m depth.

- Large amounts of algae washed ashore

Increased amount of nutrients also accelerate growth of specific kinds of algae on the sea bottom, which get stripped away and washed ashore in windy weather. They accumulate ashore and create rotting mass with unpleasant smell. Currently this happens in large amounts every summer. In good environmental state there would be practically no such algae in the sea. After large storms only rare other kind of algae would be washed ashore.

Algae on the Latvian sea coast

| the current situation | good environmental state |

16. Have you heard <u>prior to this survey</u> about the reduced water quality for recreation at the sea in the Latvian seacoast?

○ Yes ○ No ○ Don't know / hard to say

17. To what extent you <u>personally</u> view the mentioned as a problem in the Latvian marine waters?

A very big problem	Rather big problem	Neither big nor small problem	Rather small problem	Not a problem	Hard to say
○	○	○	○	○	○

3) <u>Negative impact of establishing of alien species</u>

Alien species are species which have not been observed in the Latvian marine waters before and have arrived from other seas of the world. They occupy feeding, reproduction and living grounds of the native species. Their negative impact may concern also humans. It is unpredictable in advance what species could come in and what could be their impact on marine environment and humans.

Alien species are established by human activities. Most often they arrive with ships' ballast. 11 new alien species have established in the Latvian marine waters just within the last 20 years.

There are alien species that do not cause damage. However, studies show that some species cause significant damage to the marine environment and its use – they are called as harmful alien species.

Examples of harmful alien species established in the Latvian marine waters.

Harmful alien species		Impact
Round goby Subsists on mussel, which is also the main feed for plaice.		Eat up the feed of plaice and banish plaice from its living areas. Plaice is an important species for coastal fisheries and angling. Plaice catch is declining in some coastal areas.
Chinese mitten crab Subsists on bottom animals, but also on fish in fishermen's nets.		Use to clinch in fishing nets causing inconveniences to fishermen, damaging their nets and haul (by eating up, gnawing fish). May transport parasites. Then eating them harm human health. Although, in the crabs common in the Baltic Sea this parasite is not found so far.
Bay barnacle Resides on any hard substrates – sea bottom stones, ship hulls etc.		Ship hulls get overgrown by them, and this reduces ships' speed and increases fuel usage. Thus the ship hulls are cleaned regularly, and these are additional costs. Since they reside also on the sea bottom and seashore stones, their thick lime shell can hurt while walking along the seashore and swimming.

18. Have you heard <u>prior to this survey</u> about the problem of establishment and negative impacts of alien species in the Latvian marine waters?

○ Yes   ○ No   ○ Don't know / hard to say

19. To what extent you <u>personally</u> view the mentioned as a problem in the Latvian marine waters?

A very big problem	Rather big problem	Neither big nor small problem	Rather small problem	Not a problem	Hard to say
○	○	○	○	○	○

ACTIONS FOR IMPROVING THE STATE OF THE LATVIAN MARINE ENVIRONMENT

It is possible to implement various actions aimed at reducing the described marine environmental problems. They can be implemented by households and companies, which cause the mentioned problems (for instance, by sea transport, agricultural, industrial companies). Various actions are already implemented in Latvia and other Baltic Sea countries. However they are not sufficient to ensure good marine environmental state.

In what follows states concerning each mentioned marine environment problem will be characterised that can be achieved depending on the actions implemented.

(1) Changes that could be achieved concerning the **decline of native species' variety** (depending on the implemented actions):

Reduced number of native species reduction % of their natural areas ("natural areas" are areas where these species naturally should be present)	**(on) large areas** (the state if no additional action is taken) **30 %**	**(on) small areas** **10-20 %**	**no such areas** **0 %** (species are present in all their natural areas)

20. How important it is for you personally that the situation concerning decline of native species variety would be improved?

Very important	Quite important	Neither important nor unimportant	Quite unimportant	Fully unimportant
○	○	○	○	○

(2) Changes that could be achieved concerning **water quality for recreation at the sea** (depending on the implemented actions):

Water quality for recreation (in coastal waters in summers)	**bad** (the state if no additional action is taken)	**moderate**	**good**
visual quality	Water is unclean every summer. It can be seen through less than 3 m in the Gulf of Riga and 4 m in the Baltic Sea (on average).	Water is unclean every 2-3'rd summer. It can be seen through at least 3 m in the Gulf of Riga and 4 m in the Baltic Sea (on average).	Water is mainly clean (unclean in rare summers). It can be seen through at least 4 m in the Gulf of Riga and 4.5 m in the Baltic Sea (on average).
algae washed ashore	Every summer in large amounts.	Every 2-3'rd summer in small amounts.	Only after large storms.

21. How important it is for you personally that the situation concerning reduced water quality for recreation at the sea would be improved?

Very important	Quite important	Neither important nor unimportant	Quite unimportant	Fully unimportant
○	○	○	○	○

(3)Changes that could be achieved concerning **establishing of new harmful alien species** (depending on the implemented actions):

New harmful alien species' establishing 1 new species on average	**often** (the state if no additional action is taken) (in) 5 years	**rarely** (in) 15-20 years	**in exceptional cases** not more often as (in) 50 years

22. How important it is for you personally that the situation concerning negative impacts of establishing of alien species would be improved?

Very important	Quite important	Neither important nor unimportant	Quite unimportant	Fully unimportant
○	○	○	○	○

Various actions can be implemented and with different intensity levels, what would give different improvements in the described marine environmental problems. In this survey we would like to know what do **you** think is the most important. It will help to build the action program according to the opinion of Latvian society, given possible costs.

The actions would be implemented by 2020. Similar actions will be implemented in all countries around the Baltic Sea because it is prescribed by international agreements.

Additional actions for improving the environmental state will create additional costs. Thus additional funding is necessary for their implementation. **The prepared action program would be funded by collecting special "Baltic Sea payment" from inhabitants and companies**, which would be introduced in all Baltic Sea countries.

- The payment would be mandatory and proportionate to damage to the marine environment.
- It would be a yearly payment to be paid for unlimited time, since the implemented measures will need to be maintained.
- Collected money would be used only for improving the marine environment state according to objectives of the program.

23. Would you personally be willing to pay anything to improve the Latvian marine environment quality concerning the described problems?

When you answer, please remember that:

- The "Baltic Sea payment" would leave you with less money to spend on other needs and purposes.

- The action program would provide improvements only concerning the described problems of the Latvian marine waters.

	◯ Yes	◯ No	◯ Not sure / Hard to say
For CAWI interviews	➔ GO TO NEXT SECTION	➔ GOT TO QUESTION 36.1.	➔ GO TO NEXT SECTION
For CAPI interviews	➔ GO TO NEXT SECTION	➔ GO TO NEXT SECTION	➔ GO TO NEXT SECTION

CHOICE OF ACTION PROGRAMS

In what follows several possible situations with various changes in marine environmental state and costs will be offered to you. The changes in each marine environment problem can be achieved independently, depending on the implemented actions.

In each situation you will be asked to choose one of three options – Program A, Program B or option with "No additional actions". **Please select only one option in each situation that is the most preferable to you**, considering also its costs.

One option will always be „No additional actions" with no additional costs. If you don't' want to pay, are not sure about it or don't know which option to choose, please select this option. If you had chosen this option in all situations, you afterwards will have an opportunity to explain reason for such choice.

When giving your answers, please consider each situation separately – each is separate possible situation in which you are asked to make your choice!

24. Choice task No 1. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	No such areas	(on) Small areas	(on) Large areas
Water quality for recreation	Bad	Good	Bad
New harmful alien species' establishing	Rarely	In exceptional cases	Often
Your yearly payment	5 Ls	2 Ls	0 Ls
Your choice:	◯	◯	◯

25. Choice task No 2. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Small areas	No such areas	(on) Large areas
Water quality for recreation	Moderate	Good	Bad
New harmful alien species' establishing	Rarely	Often	Often
Your yearly payment	5 Ls	5 Ls	0 Ls
Your choice:	○	○	○

26. Choice task No 3. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Large areas	(on) Small areas	(on) Large areas
Water quality for recreation	Moderate	Bad	Bad
New harmful alien species' establishing	In exceptional cases	Rarely	Often
Your yearly payment	5 Ls	5 Ls	0 Ls
Your choice:	○	○	○

27. Choice task No 4. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	No such areas	(on) Large areas	(on) Large areas
Water quality for recreation	Bad	Good	Bad
New harmful alien species' establishing	In exceptional cases	Rarely	Often
Your yearly payment	2 Ls	2 Ls	0 Ls
Your choice:	○	○	○

28. Choice task No 5. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Small areas	No such areas	(on) Large areas
Water quality for recreation	Bad	Moderate	Bad
New harmful alien species' establishing	In exceptional cases	Often	Often
Your yearly payment	2 Ls	10 Ls	0 Ls
Your choice:	○	○	○

29. Choice task No 6. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	No such areas	(on) Large areas	(on) Large areas
Water quality for recreation	Bad	Moderate	Bad
New harmful alien species' establishing	Often	Rarely	Often
Your yearly payment	2 Ls	5 Ls	0 Ls
Your choice:	○	○	○

30. Choice task No 7. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	No such areas	(on) Large areas	(on) Large areas
Water quality for recreation	Good	Bad	Bad
New harmful alien species' establishing	Rarely	In exceptional cases	Often
Your yearly payment	10 Ls	10 Ls	0 Ls
Your choice:	○	○	○

31. Choice task No 8. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Small areas	No such areas	(on) Large areas
Water quality for recreation	Good	Moderate	Bad
New harmful alien species' establishing	Often	In exceptional cases	Often
Your yearly payment	10 Ls	2 Ls	0 Ls
Your choice:	○	○	○

32. Choice task No 9. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Large areas	No such areas	(on) Large areas
Water quality for recreation	Moderate	Good	Bad
New harmful alien species' establishing	Often	In exceptional cases	Often
Your yearly payment	2 Ls	10 Ls	0 Ls
Your choice:	○	○	○

33. Choice task No 10. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Small areas	(on) Large areas	(on) Large areas
Water quality for recreation	Moderate	Bad	Bad
New harmful alien species' establishing	Often	Often	Often
Your yearly payment	10 Ls	5 Ls	0 Ls
Your choice:	○	○	○

34. Choice task No 11. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Large areas	(on) Small areas	(on) Large areas
Water quality for recreation	Good	Moderate	Bad
New harmful alien species' establishing	Rarely	Often	Often
Your yearly payment	5 Ls	2 Ls	0 Ls
Your choice:	○	○	○

35. Choice task No 12. Please choose one option that is the most preferable for you.

	Program A	Program B	No additional actions
Reduced number of native species	(on) Large areas	(on) Small areas	(on) Large areas
Water quality for recreation	Good	Bad	Bad
New harmful alien species' establishing	In exceptional cases	Rarely	Often
Your yearly payment	10 Ls	10 Ls	0 Ls
Your choice:	○	○	○

In the further questions we would like to learn about how you made your choices and what affected them.

➔ **If a respondent chose the option "No additional actions" in all the tasks,** *GO TO THE QUESTION 36.2.*

➔ **If a respondent chose Program A or B in at least one task,**

FOR CAPI INTERVIEWS:

⇨ **If the answer in Q 23 was "No"** ➔ *GO TO THE QUESTION 36.3.*

⇨ **If the answer in Q23 was "Yes" or "Not sure / Hard to say"** ➔ *GO TO THE QUESTION 37.*

FOR CAWI INTERVIEWS:

⇨ *GO TO THE QUESTION 37.*

36.1. What was the reason that you answered "No"? Please, choose <u>only one</u> – the most important from the following reasons. *[FOR CAWI ONLY – FOR THOSE WHO SAID "NO" IN Q23 AND THUS SKIPPED THE CHOICE TASKS]*

○ The current level of the marine environmental quality is satisfactory

○ I can't afford to pay

○ I do not believe a program to improve the marine environmental quality would work

○ I am prepared to pay for improving the marine environmental quality, but not by extra mandatory payment

○ I do not care about state of the Baltic Sea

○ Other problems are more significant

○ I do not believe the money will be used for the purpose

○ Other reason (please specify):_____

GO TO THE QUESTION 40.

36.2. What was the reason that you chose the option "No additional actions" in all the tasks? Please, choose <u>only one</u> – the most important from the following reasons.

○ The current level of the marine environmental quality is satisfactory

○ I can't afford to pay

○ I do not believe a program to improve the marine environmental quality would work

○ I am prepared to pay for improving the marine environmental quality, but not by extra mandatory payment

○ I do not care about state of the Baltic Sea

○ Other problems are more significant

○ I do not believe the money will be used for the purpose

○ Other reason (please specify):_____

GO TO THE QUESTION 40.

[FOR CAPI INTERVIEWS ONLY]

36.3. You said "No" in the question about willingness to pay, but chose Program A or B afterwards. What was the reason that you changed your mind? Please choose <u>only one</u> – the most important from the following reasons.

○ I want the marine environmental quality to improve, but the option "No additional actions" doesn't include improvements

○ Amount of payment in the proposed option(s) was acceptable to me

○ The choice situations allowed me to understand better the improvements in marine environment quality

○ I didn't take into account amount of payment, only improvement in the marine environment quality

○ My initial decision was not thought through

○ I don't think I would have to pay anything anyway

○ I had more time to think

○ I changed my mind

○ Other reason (please specify): _____

37. How important for your choices each of the marine environmental problem and the payment was?

	Very important	Rather important	Neither important nor unimportant	Rather unimportant	Fully unimportant
Reduced number of native species	○	○	○	○	○
Water quality for recreation	○	○	○	○	○
New harmful alien species' establishing	○	○	○	○	○
Payment	○	○	○	○	○

38. On which parts of the Latvian marine waters you thought about when making your choice? Please circle corresponding number in the following scale, given that 1 = I had in mind the Gulf of Riga only, 4 = I had in mind equally both the Gulf of Riga and the open coast of the Baltic Sea, 7 = I had in mind only the open coast of the Baltic Sea.

   Only Gulf of Riga   **Equally on both**   **Only open coast of Baltic Sea**

      1   2   3   4   5   6   7

39. To what extent did you think the coastal waters or deep-sea waters when making your choice? **Please circle corresponding number in the following scale,** given that 1 = coastal waters only, 4 = both coastal waters and deep-sea waters equally, 7 = deep-sea waters only.

   Coastal waters only   **Equally both**   **Deep-sea waters only**

      1   2   3   4   5   6   7

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INFORMATION ABOUT YOURSELF

To understand peoples' choices better, we would like to ask you a question that will allow describe how you perceive the world and what kind of person you are. The following table includes a list of personality traits characterising people.

40. To what extent do you agree or disagree the given statements applied to yourself? Please mark, on your opinion, for each pair of traits in the table the most corresponding to you option. Please mark the extent to which each pair of traits applies to you, even if one characteristic applies more strongly than the other.

I see myself as …	Disagree fully	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree fully
1. extraverted, enthusiastic	1	2	3	4	5	6	7
2. critical, quarrelsome	1	2	3	4	5	6	7
3. dependable, self-disciplined	1	2	3	4	5	6	7
4. anxious, easily upset	1	2	3	4	5	6	7
5. open to new experiences, complex	1	2	3	4	5	6	7
6. reserved, quiet	1	2	3	4	5	6	7
7. sympathetic, warm	1	2	3	4	5	6	7
8. disorganized, careless	1	2	3	4	5	6	7
9. calm, emotionally stable	1	2	3	4	5	6	7
10. conventional, uncreative	1	2	3	4	5	6	7

Further we will ask some questions about you. The information you provide in this survey is completely confidential – this information cannot be connected to you personally. It is very important that you answer on all following questions that we could use your questionnaire in the analysis of results.

41. In what year were you born? _____ [giving 4-digits number]

42. Are you
    ○ Male   ○ Female

43. What is your nationality?
    ○ Latvian   ○ Other

44. How many people live in your household, including yourself? _____ (number)

45. How many people in your household are under 18 years old? _____ (number)

46. What is your highest <u>completed </u>level of education?

- ○ Primary school or incomplete compulsory education (up to 8 – 9 classes)
- ○ Compulsory education (8 – 9 classes)
- ○ General secondary education (completed high school, gymnasium)
- ○ Vocational secondary education (completed vocational school, technical college)
- ○ Higher education (obtained highest academic or professional education (bachelor)), including completed college, master studies, doctoral studies

47. What is your current occupational status? Please choose only <u>one</u> option that best describes your occupational status.

- ○ Employed full-time
- ○ Employed part-time
- ○ Retired
- ○ Student
- ○ Home-employed/Homemaker
- ○ Self-employed
- ○ Unemployed

48. Do you ever use internet for any needs (for instance, sending and receiving e-mails, searching for information or other needs)?

- ○ Yes, in the last 7 days
- ○ Yes, in the last month but not in the last 7 days
- ○ Yes, more than a month ago
- ○ No, I don't use internet

49. To which region of Latvia the place of your residence belongs?

- ○ Riga
- ○ Pieriga
- ○ Vidzeme
- ○ Kurzeme
- ○ Zemgale
- ○ Latgale

50. What is the postal code of area you live in? LV - _____

51. What is your <u>personal</u> income level <u>per month</u>, including <u>all kind</u> of income <u>after taxes</u>? Please include all sources of income including benefits, stipends, pension etc.

Your answer will be fully confidential, but is really necessary for statistical analysis of the survey data.

PLEASE USE THE FOLLOWING SCALE OF INCOME LEVELS FOR PROVIDING YOUR ANSWER.					
Less than 50 LVL	1	201 - 250 LVL	5	401 - 500 LVL	9
51 - 100 LVL	2	251 - 300 LVL	6	More than 500 LVL	10
101 – 150 LVL	3	301 - 350 LVL	7	Respondent didn't want to state the income	11
151 - 200 LVL	4	351 - 400 LVL	8		

52. If you would like to make a comment on the survey or anything else, please do so below?

_____
_____
_____
_____
_____

THANK YOU!