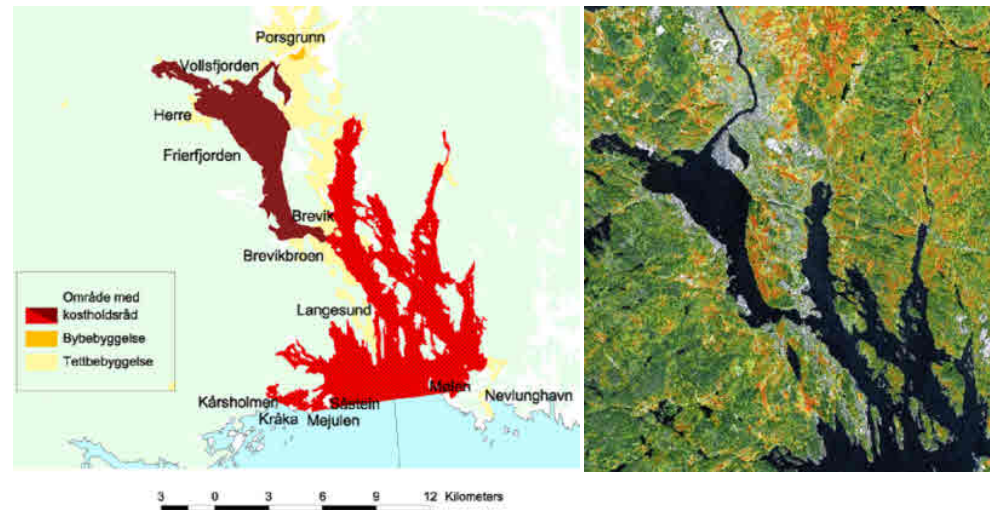


Valuing the benefits of remediating contaminated marine sediments – a case study from the Grenlandsfjord Norway

David N. Barton
Norwegian Institute for Water Research(NIVA)

5th International SedNet Conference
27-29th May, 2008, Oslo



Source: http://www.miljostatus.no/templates/pagewide_2795.aspx

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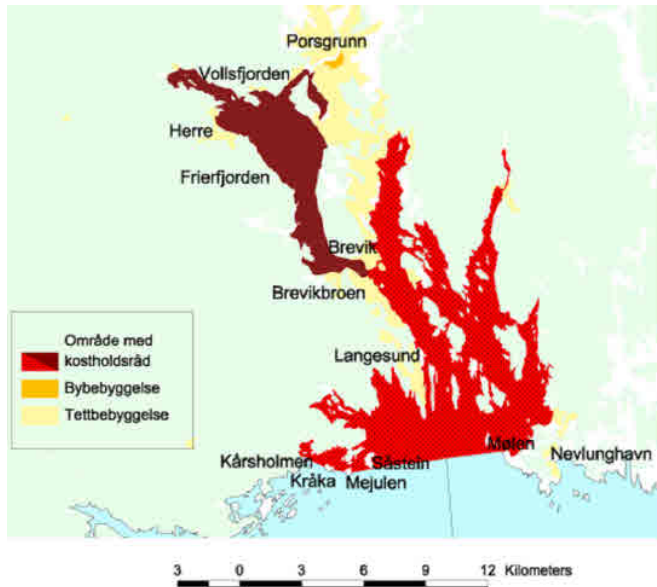
Acknowledgements

- **SEDFLEX project, Norwegian Research Council grant 139032/720 under the Profo Programme**
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- **Ståle Navrud (IØR-UMB), for assistance with survey design and data analysis**
- **Heid Bjørkeslett and Ingrid Lilleby (IØR-UMB) for conducting the household surveys**

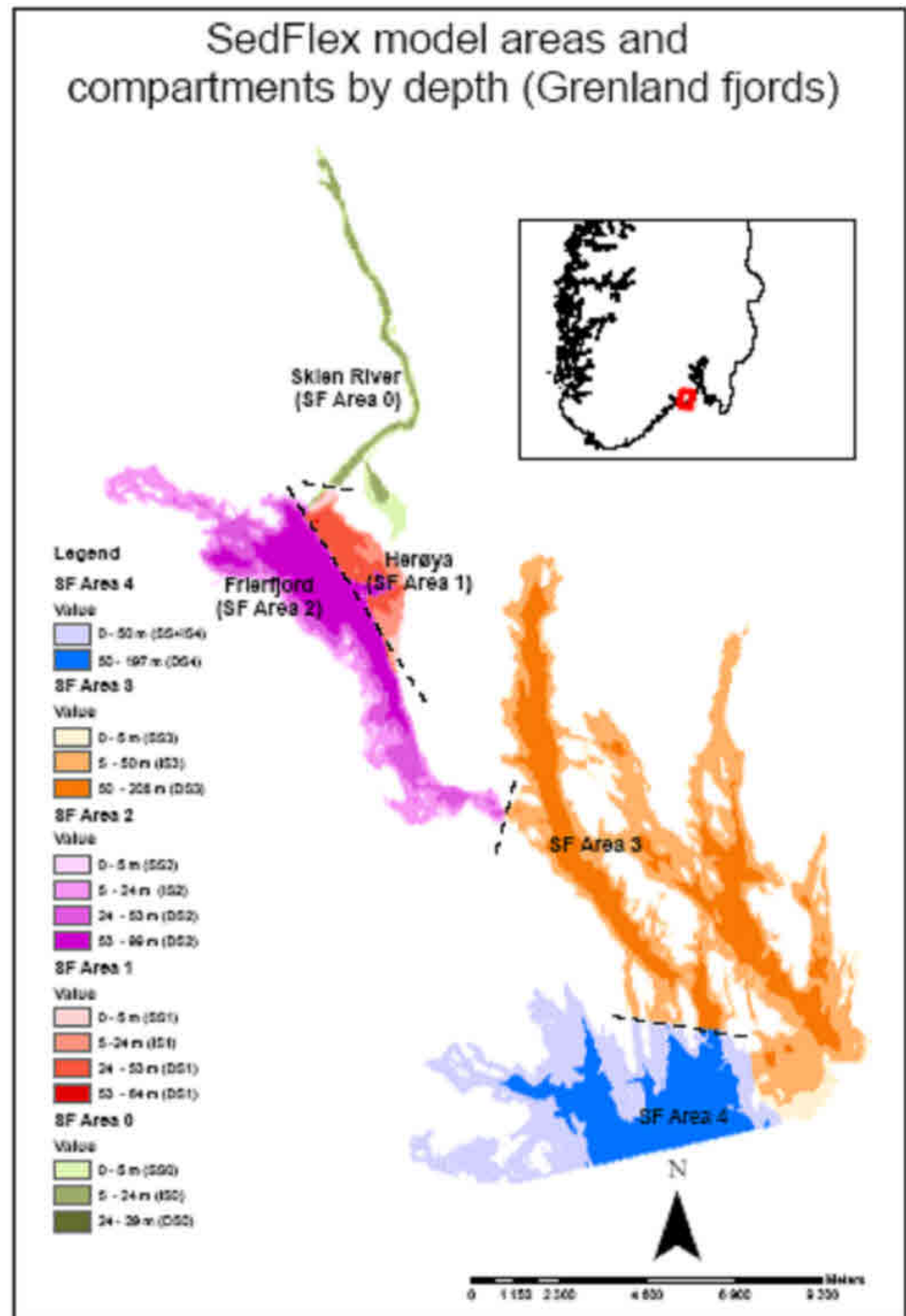
Overview

1. Contingent valuation of household willingness to pay to remove dietary health advisories around the Grenlandsfjords
2. Challenges to willingness to pay as a measure of benefits of sediment remediation measures

Grenland fjords

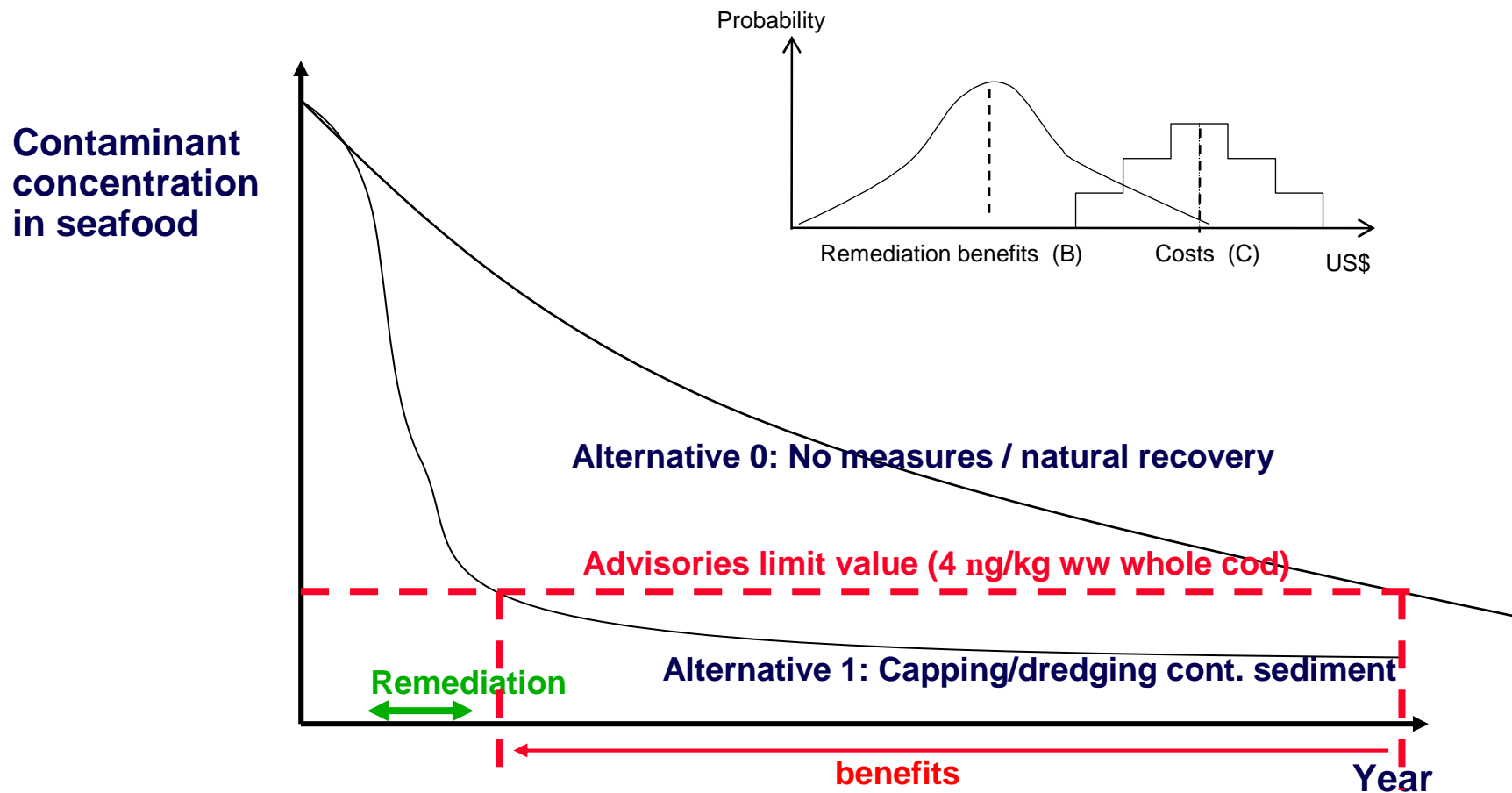


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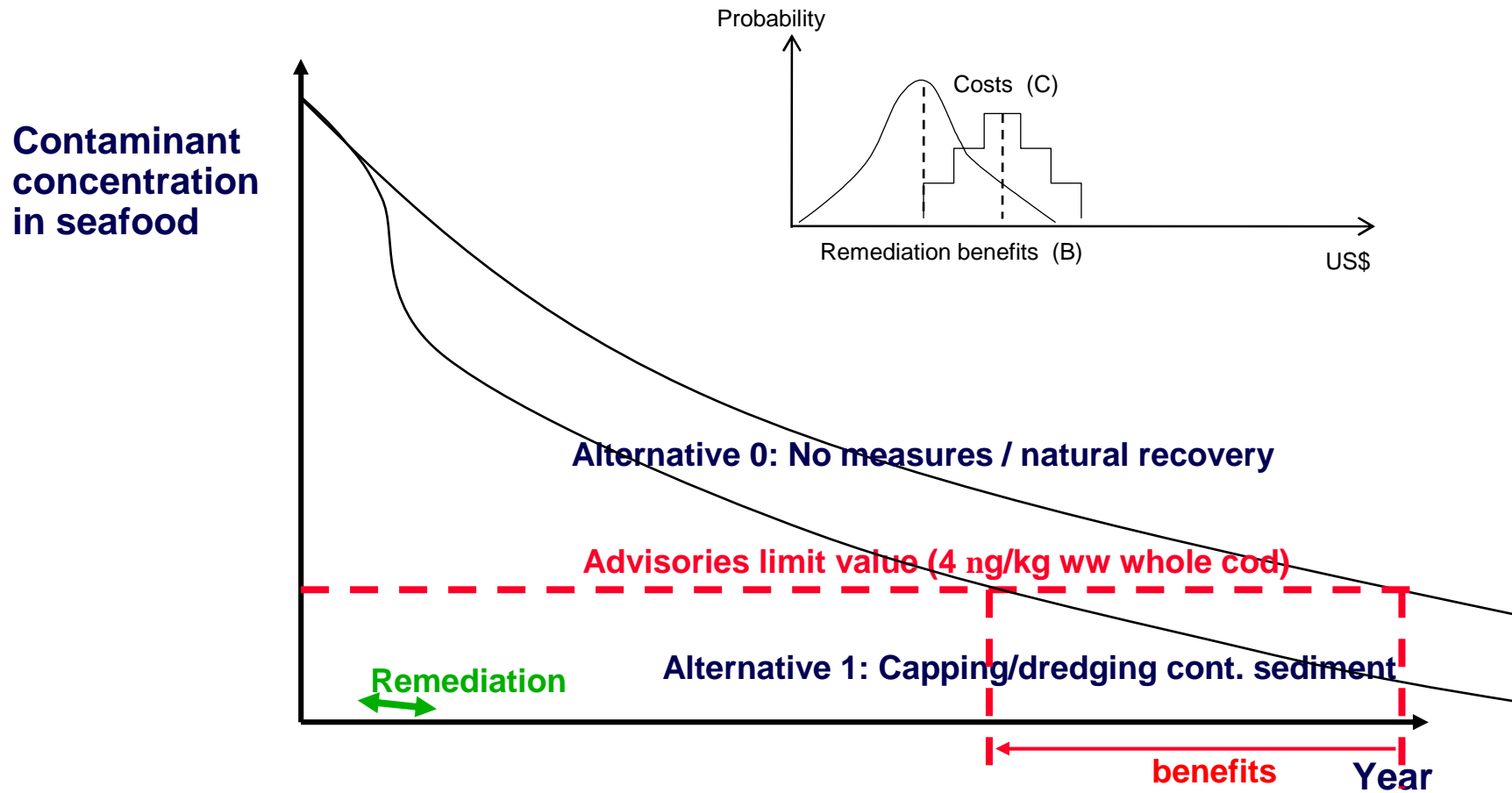


Source: SEDFLEX Project

Willingness to pay for reducing time to removal of seafood consumption advisories



Willingness to pay for reducing time to removal of seafood consumption advisories



Description of advisories (2005)

COMMERCIALISATION BAN



SEAFOOD DIETARY
ADVISORY



COD



SEA TROUT



POLLACK



MACKEREL



HERRING



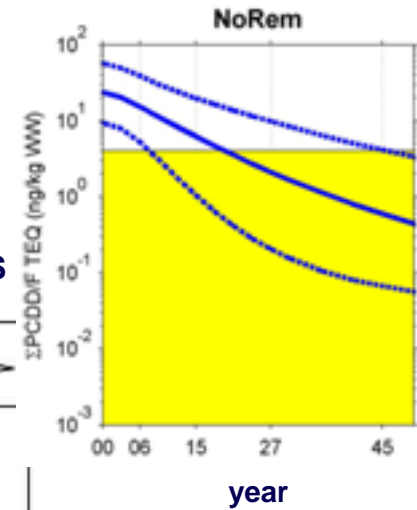
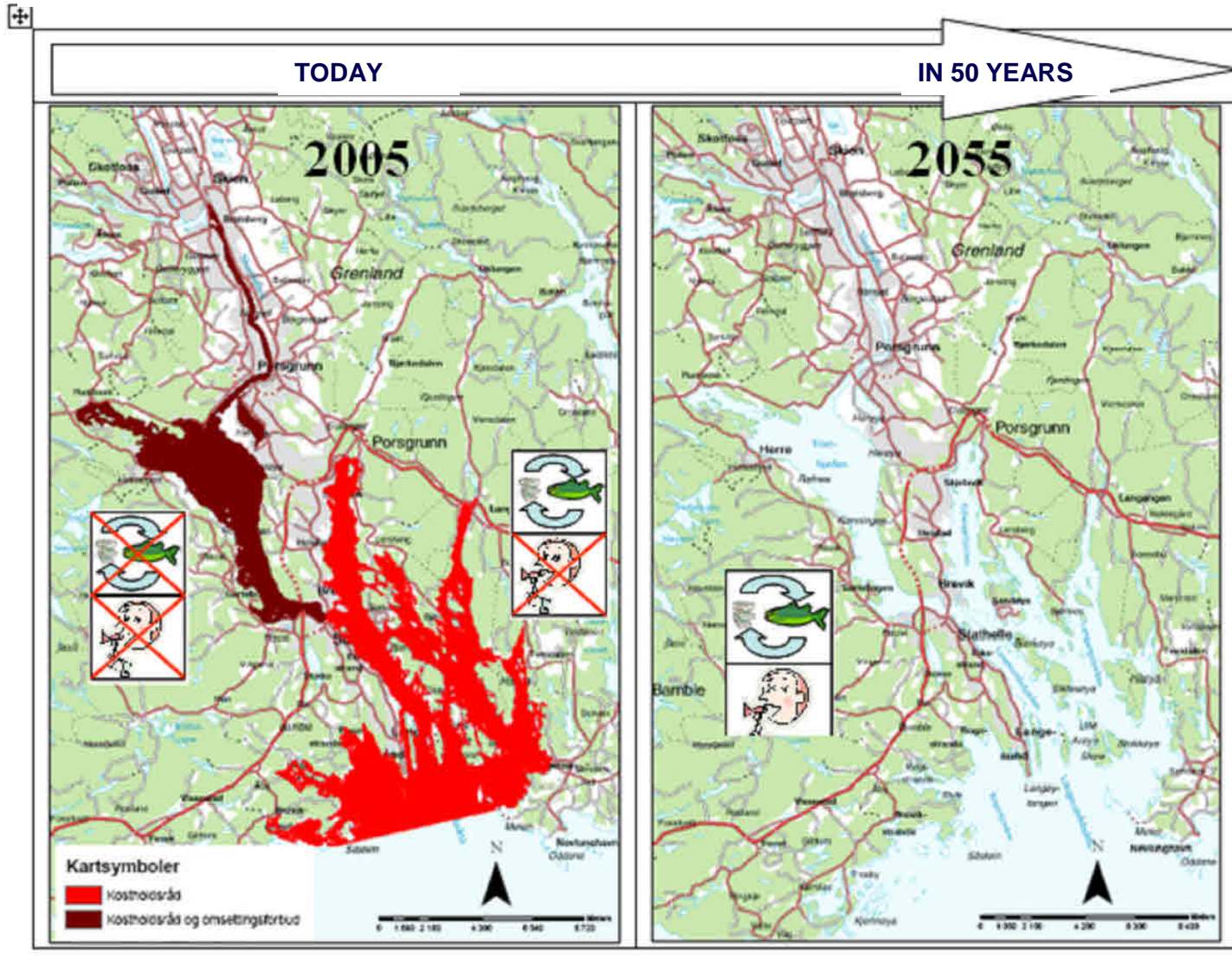
EEL



CRAB

Baseline scenario

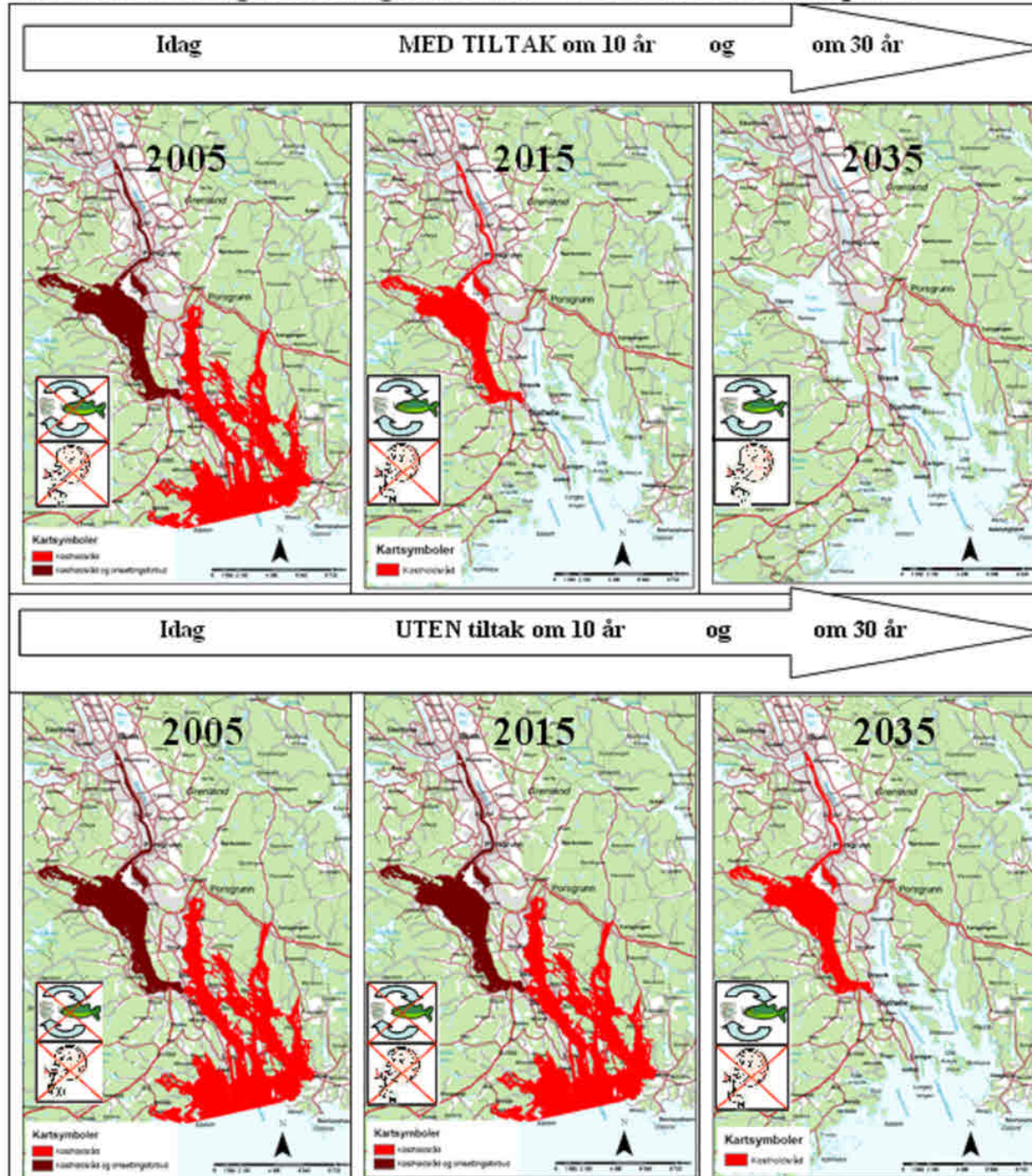
Seafood dietary advisory and commercialisation ban today and in 50 years NO MEASURES



**SEDFLEX
BIOTIC-
ABIOTIC
MODEL
PREDICTION
(CRAB)**

KORT 2

Kostholdsråd og omsetningsforbud MED OG UTEN tiltakspakke



Scenarios

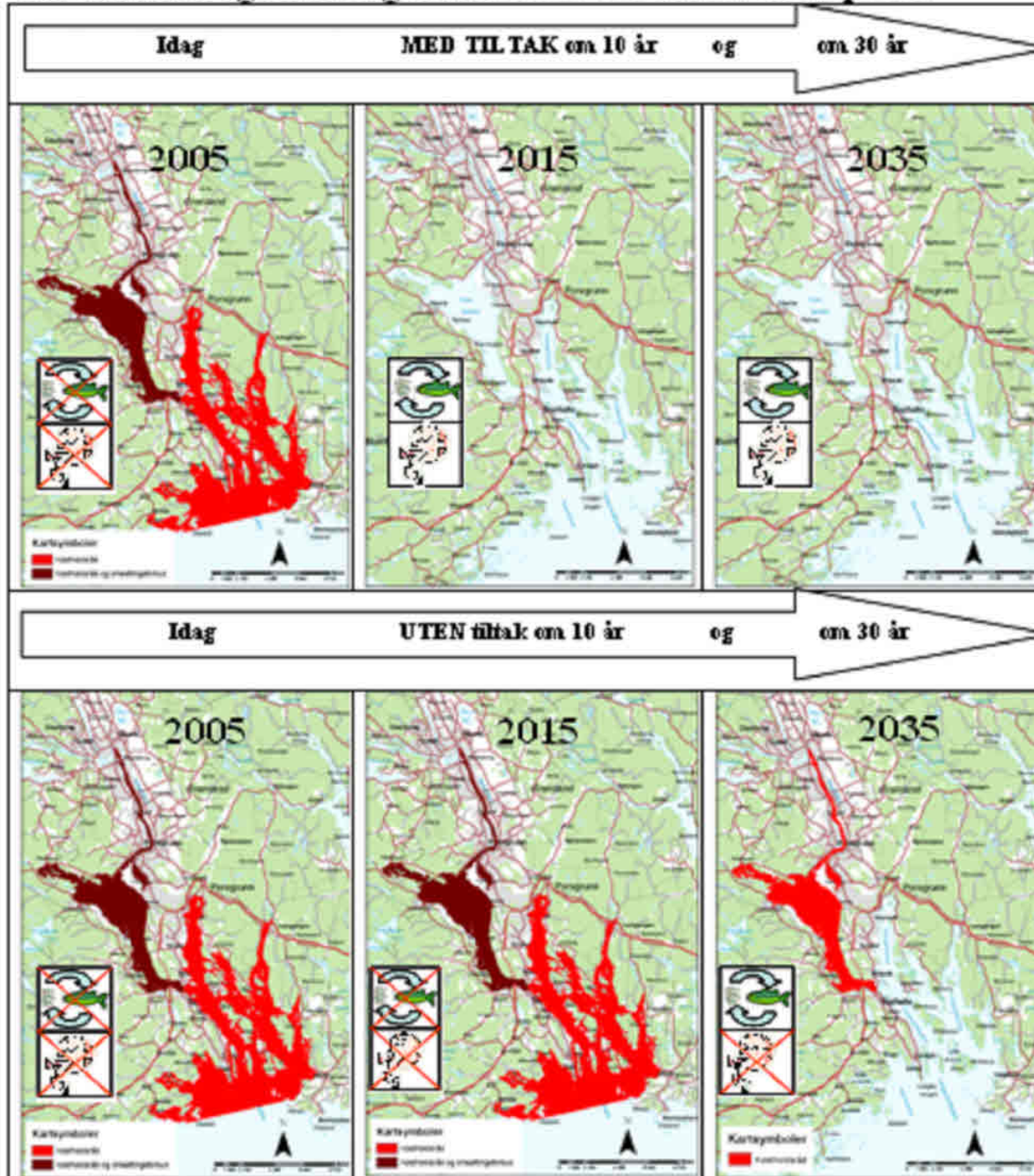
**”small”
remediation
package**

versus

**without
remediation
(2035)**

KORT 1

Kostholdsråd og omsetningsforbud MED OG UTEN tiltakspakke

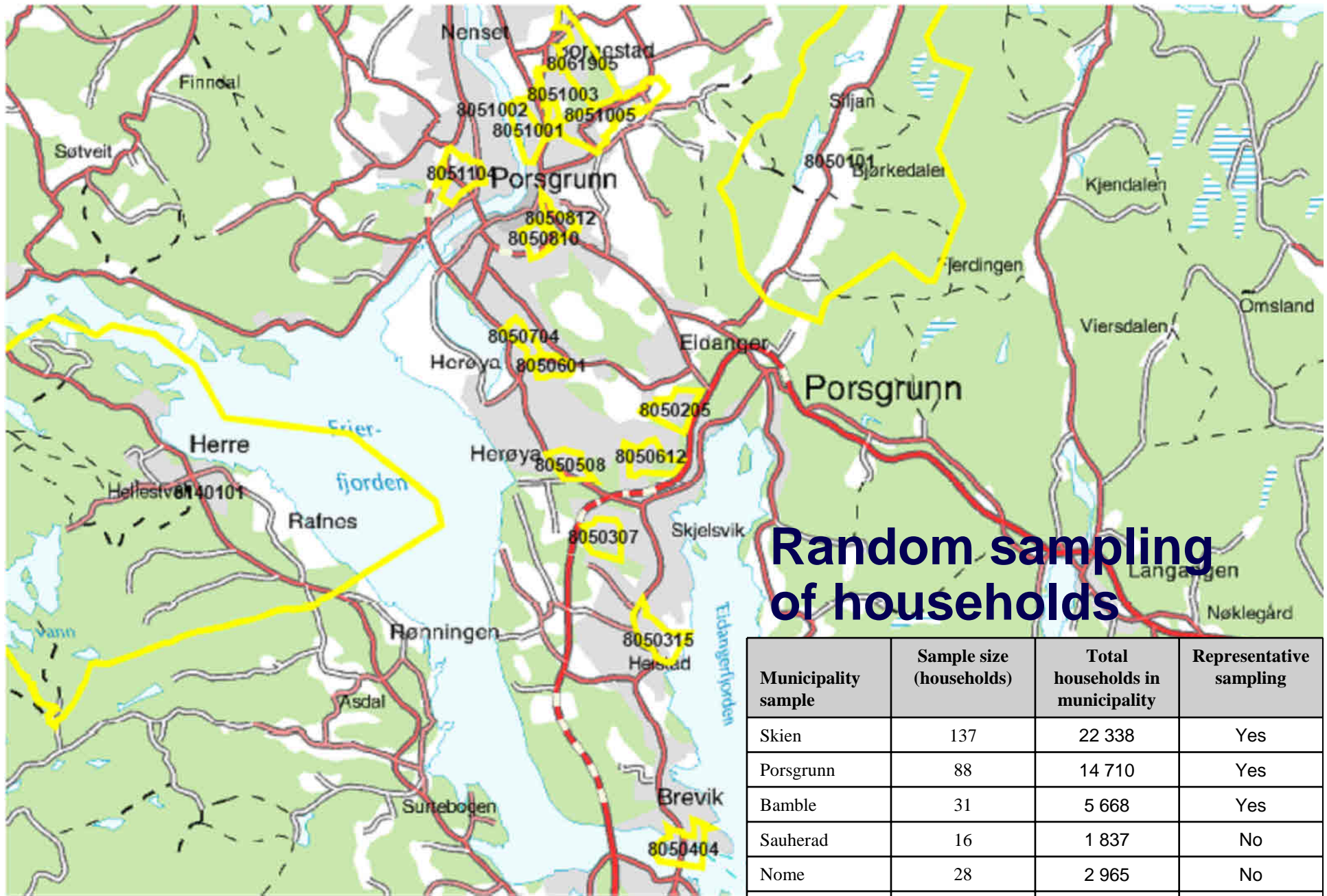


Scenarios

**”large”
remediation
package**

versus

**without
remediation
(2035)**



Random sampling of households

Municipality sample	Sample size (households)	Total households in municipality	Representative sampling
Skien	137	22 338	Yes
Porsgrunn	88	14 710	Yes
Bamble	31	5 668	Yes
Sauherad	16	1 837	No
Nome	28	2 965	No
Larvik	64	17 672	No
<i>Total</i>	<i>364</i>		

Sampling: "grunnkretser"

Willingness to pay question

- "What is the most your household would be willing to pay during the next 10 years in the form of a county tax / municipal fee, in order to implement the remediation measures and obtain the effects described on the cards shown previously?"

Ellicitation using Payment Card:

Annual amount	Monthly amount	Would your household pay this amount? Yes / No
0	0	
kr. 300	25	
kr. 600	50	
kr. 900	75	
kr. 1200	100	
kr. 1500	125	
kr. 2000	167	
kr. 3000	250	
kr. 4000	333	
kr. 5000	417	
kr. 6000	500	
kr. 7000	583	
kr. 8000	667	
kr. 9 000	750	
kr. 10 000	833	
kr. 11 000	917	
kr. 12 000	1000	
mer enn kr. 12000		

1 USD = 6,4 NOK (2005)

KORT 3.1 MULIGE DEPONIER FOR FORURENET MUDDER



Follow-up questions on remediation methodologies scenarios

KORT 3.2 DEPONI FOR FORURENET MUDDER PÅ LANGØYA



Willingness to pay for sediment remediation

Sub-sample municipalities	Mean (kr./yr.) over 10 years	5%	95%	N
Porsgrunn	1592	1282	1941	66
Skien	1520	1294	1819	106
Bamble	1134	822	1553	20
<i>Neighbouring municipalities</i>	<i>1507</i>	<i>1320</i>	<i>1703</i>	<i>192</i>
<i>Upstream (Nome & Sauherad)</i>	<i>1078</i>	<i>805</i>	<i>1519</i>	<i>33</i>
<i>Next fjord (Larvik)</i>	<i>977</i>	<i>764</i>	<i>1220</i>	<i>42</i>

1 USD = 6,4 NOK (2005)

Source: Navrud and Barton (2006)

Comparison with other willingness to pay studies

	Willingness to pay (2005 kr.)		
Bergland and Magnussen (1996)	767 943	+/-270 +/-277	Depending on sample and type of question
This study (2005)	1507	+/-186	Mean of "small" and "large" remediation scenario

Issues in valuing benefits of sediment remediation

Issue 1: Aggregating benefits

- Population affected, use and non-use values

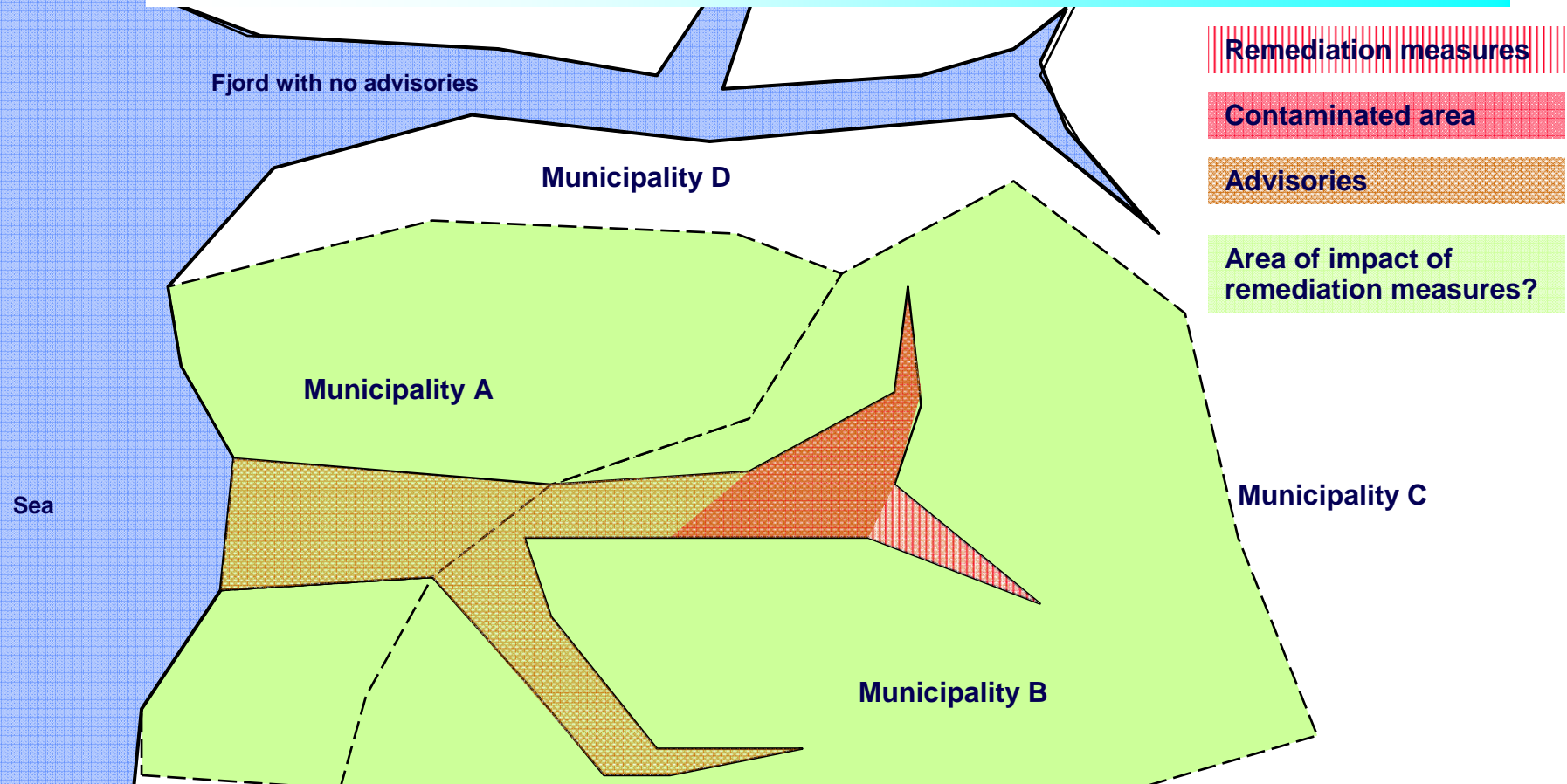
Issue 2: WTP: Economic preferences or attitudes?

Issue 1: Aggregating benefits

Area	Mean willingness to pay (kr/hh yr)	Total households in municipality	Annual benefits (2005-kr)
Neighbouring municipalities (Skien, Porsgrunn, Bamble)	1507	42.610	64.213.270
Inland municipalities (Øvrig Telemark)	1078	30.186	34.540.508
Larvik	977	17.672	17.265.544
<i>Total</i>			114.019.322

Exclude?: 25,8% protest responses

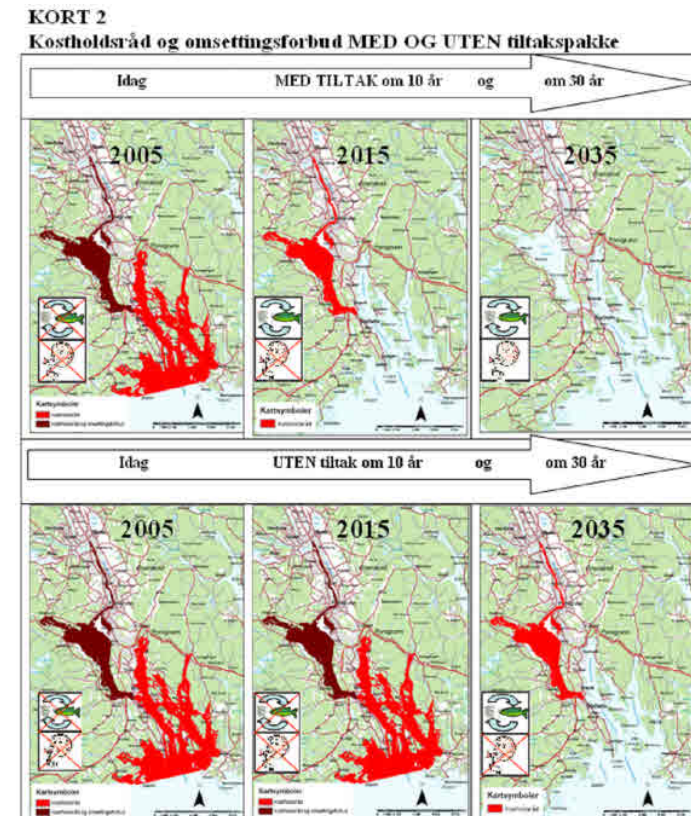
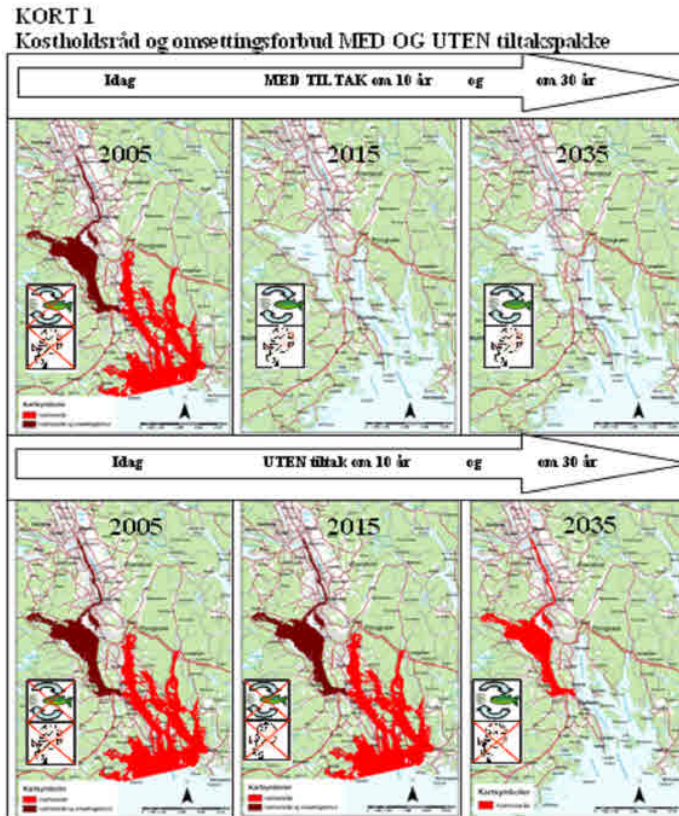
Issue 1: Aggregating benefits



	Fjord municipalities		Other municipalities	
	Yes	No	Yes	No
Household negatively affected by advisories	18 %	81 %	2 %	97 %
Will use fjord more after removal of advisories	34 %	66 %	11 %	89 %
Uses Grenland fjords currently for recreation	80 %	20 %		
Fishes in Grenland fjords	30 %	70 %		

Issue 2: Lacking sensitivity to scope of improvements

Subsample Municipalities	Large programme of measures Removal of advisories by 2015				Small programme of measures Removal of advisories by 2035			
	Mean (kr/hh yr)	5%	95%	N	Mean (kr/hh yr)	5%	95%	N
Porsgrunn, Skien, Bamble	1414	1212	1668	94	1593	1331	1915	98
Whole sample	1330	1163	1542	134	1424	1209	1677	133



Source: Navrud and Barton (2006)

Issue 2: Attitudes towards remediation measures

- Capping is greatly preferred

Prefered remediation measures	Freq.	Percent
Dredging & shoreline disposal Gunnekleivfjord	42	11.54
Dredging & deep water disposal in Frierfjord	11	3.02
Dredging & transportation to Langøya facility	49	13.46
Capping	155	42.58
Combination of measures	15	4.12
Natural recovery	34	9.34
Others	7	1.92
Don't know	51	14.01
Total		100.00

Issue 2: Willingness to pay as an attitude ; ranking

WTP follow-up question:

Subsample location	Prefers sediment capping				Prefer to let sediments recover naturally			
	Mean (kr/ hh yr)	5%	95%	N	Mean (kr/ hh yr)	5%	95%	N
Fjord Municipalities: Porsgrunn, Skien, Bamble	1777	1490	2097	84	361	115	713	13

Economist:

⇒ **WTP for non-personal / public benefit of remediation (altruism)**

Cognitive psychologist:

⇒ **dollar measures are a special case of attitude measures**

⇒ **WTP expresses a positive attitude towards the removal of advisories; "natural recovery" when seen as a "measure" may elicit WTP>0**

Issue 2: Self-reported WTP motivations

How much did you think of these reasons when stating your WTP?	Sign and WTP correlation
Information about contamination status	+++
Approximately what I pay for other good causes	---
Desire to protect environment in general	0
What we can afford	0
Comparison with what we currently pay in taxes/fees	--
Our household current use of the Grenland fjords	0
Conservation of Grenland fjords for future generations	0
Possibility of own future use of Grenland fjords	0
Fair distribution of payment	-
Increase in value of property when advisories are removed	+++
Grenland's environmental reputation	0

Issue 2: Observed predictors of willingness to pay

Explanatory variable	Sign and significance	Variable Type
Good knowledge of toxin problems in Grenlandfjords	positive	Knowledge
Considered remediation method when answering WTP	positive	Knowledge
Less public money to roads and bridges	positive	Attitude
Utility for current and future generations of remediation	positive	Attitude
Prefers capping	positive	Attitude
Prefers natural remediation	negative	Attitude
Environmentally concerned	positive	Attitude
Grenland fjords attractive for recreation	positive	Attitude
Good alternative sites to Grenland fjords	negative	Attitude
Use Grenlandsfjords more if advisories removed	positive	Attitude
Practiced water sports last 12 months	positive	Use
Used cabin near Grenland fjords last 12 months	positive	Use
Number of fishing days total last 12 months	positive	Use
Share of fresh fish eaten last 12 months	positive	Use
Household income	positive	Characteristic

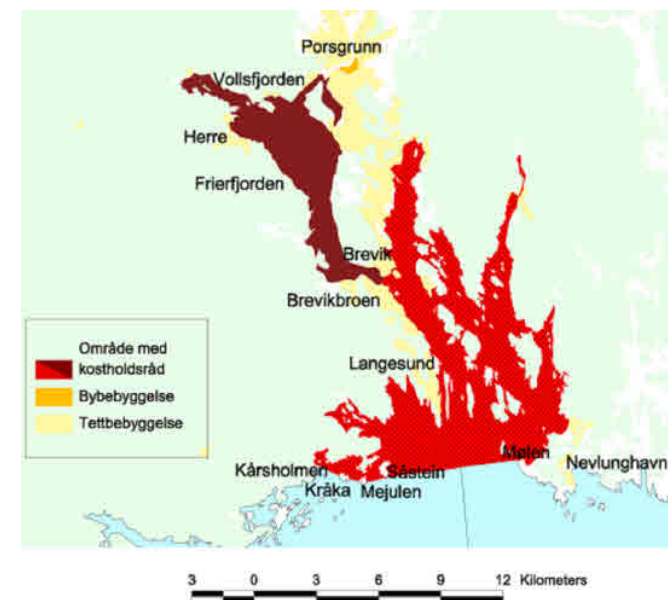
Less
stable

More
stable

variables with 5% significance for WTP shown ; 1% significance in bold

Mixed conclusions

- Uncertainty in aggregation greater than in valuation
- WTP not sensitive to scope
- WTP (somewhat) sensitive to distance
- WTP correlated with
 - attitudes
 - economic motives
 - information on environmental quality
- Current and potential use levels sensitive to distance



THANK YOU

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