UNDERSTANDING DEEP ATLANTIC ECOSYSTEMS

Public polarization in ecosystem service benefit valuation: A discrete choice experiment for deep sea protection in Norway and Scotland

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Introduction

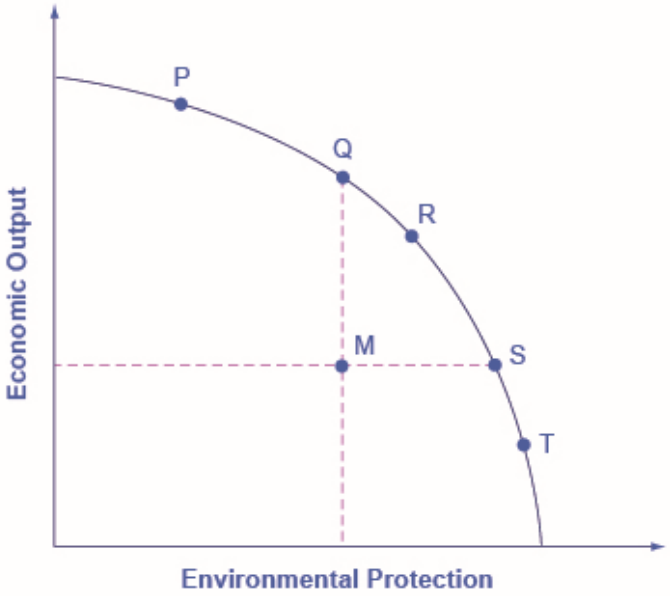
- Public ecocentrism among Norwegians and Scots is good
  - but a mere expression of willingness to support that could be void

- Given the heterogeneous economic status among nations and individuals, are there tradeoffs for ecosystem services delivery?

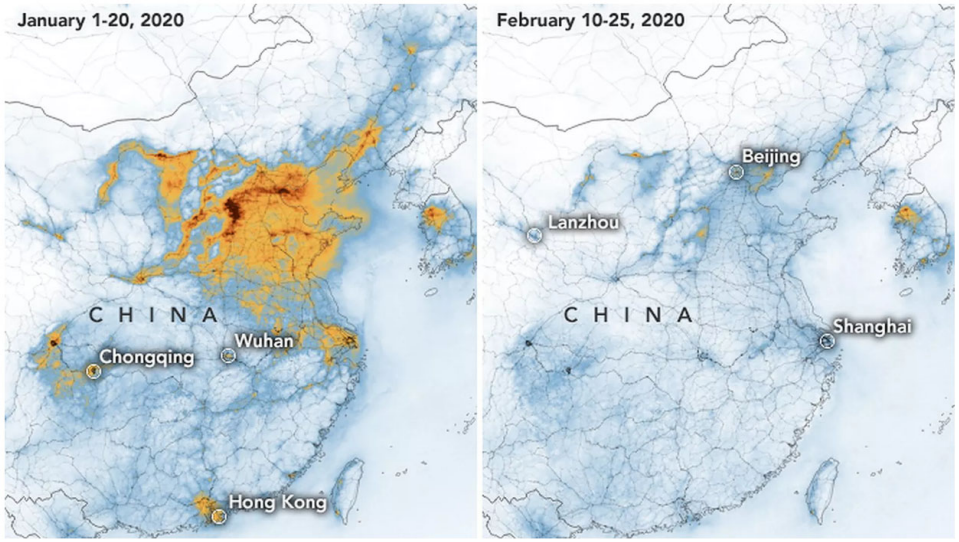
- There is growing evidence that in the long run, environmental protection may increase economic output through substitution effects.

Introduction

- In the short run, we can expect to follow the PPF:



Exogenous shock of COVID-19 on economic output and pollution reduction



Satellite images showing the mean tropospheric nitrogen dioxide density changes over China. Photo: NASA

[NASA images show China pollution clears (NO_2) as coronavirus shuts factories]

Introduction

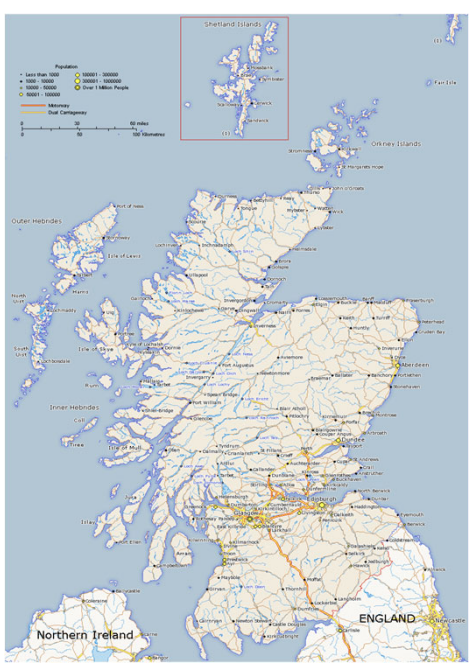
- At the microlevel, individuals will have to trade-off part of their incomes for more ecosystem services delivery – environmental regulation: **Taxes**.

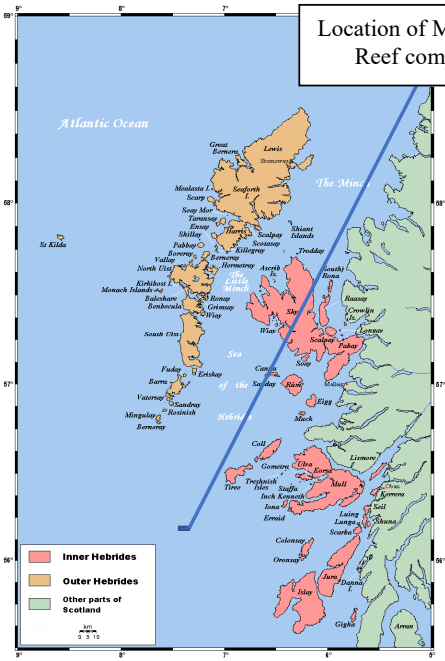
- Some strong minorities in some countries are not in favour of such regulations (-> political earthquake)
  - Yellow vest syndrome (gilets jaune) – 2018
  - Establishment of “No-to-toll-roads party” in Norway
  - On the other hand, is “Extinction Rebellion (**XR**)” in the UK

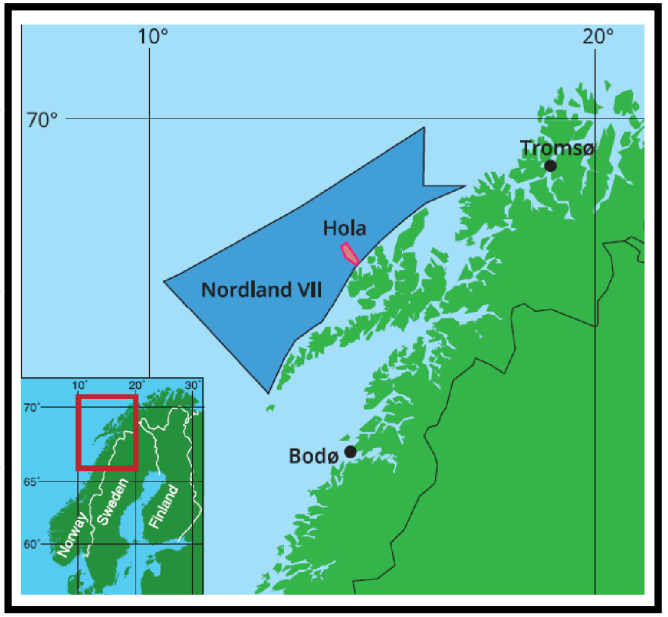
Basic Research Question

- Are there tradeoffs between ecosystem services delivery and income?
- Are the public homogenous or polarized towards such tradeoff commitments?
- What are the socio-economic determinants of such groups if any?

Study Area







- Mingulay Reef Complex (MRC)

- Lofoten Vesteralen (LoVe)

Method

- Online survey
- Sample: 1,025 (Scotland) and 1,024 (Norway)

- Survey design
  - Prior knowledge and awareness
  - Deep sea condition, management
  - Pro-environmental concerns
  - Attitudinal questions
  - Discrete Choice Experiment

DCE – Policy Selection

Health of Commercial Fish Stocks	Density of Marine Litter (items per litter)
✓ Health3: >80% ✓ Health2: 40-80% ✓ Health1: <40%	✓ Litter3: Good –> 0-1 ✓ Litter2: Moderate -> 2-4 ✓ Litter1: Poor -> 5-8
Size of Protected Area (% of Hebrides) ✓ Area4: 15% ✓ Area3: 10% ✓ Area2: 6% ✓ Area1: 1%	**Blue Economy Growth (+Jobs)** ✓ Job3: +40 ✓ Job2: +20 ✓ Job1: No Change in Jobs

Cost (€/):	
0	5
	10
	20
	30
	40
	60

DCE – Management Scenarios

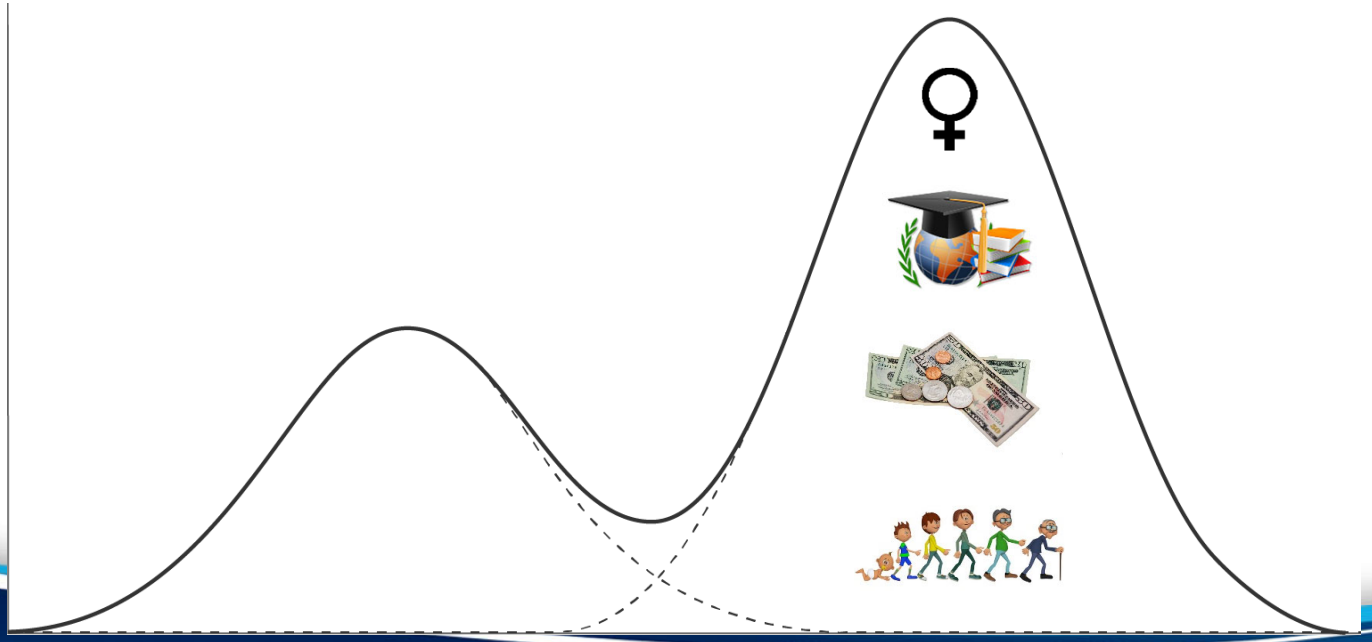
Figure: Sample Task

SCENARIO 1	Option A	Option B	Option C (current management)
The health of commercial fish stocks	**High:** 80% of commercial stocks at healthy stock levels	**Moderate:** 50% of commercial stocks at healthy stock levels	**Low:** 40% of commercial stocks s at healthy stock levels
Density of Marine litter	**Moderate** (2 to 3 items of litter per km²)	**Good** (0 to 1 item of litter per km²)	**Poor** (4 to 6 items of litter per km²)
Size of protected area	**3% of the area of Nordland VII**	**7.5% of the area of Nordland VII**	**0.5% of the area of Nordland VII**
Marine economy jobs created from sea based commercial activities in the area	**+ 40 jobs**	**+ 20 jobs**	**No employment change**
Additional costs (per person per year) **NOK**	**NOK 450**	**NOK 600**	**NOK 0**
Your choice for scenario 1 *(please tick A, B or C)*	☐	☐	☐

Model: *Latent Class Logit*

$$y = f(\theta, X) + \varepsilon$$

Expectation of polarization :
Bi-Modal Distribution



Results – Survey Summary Statistics

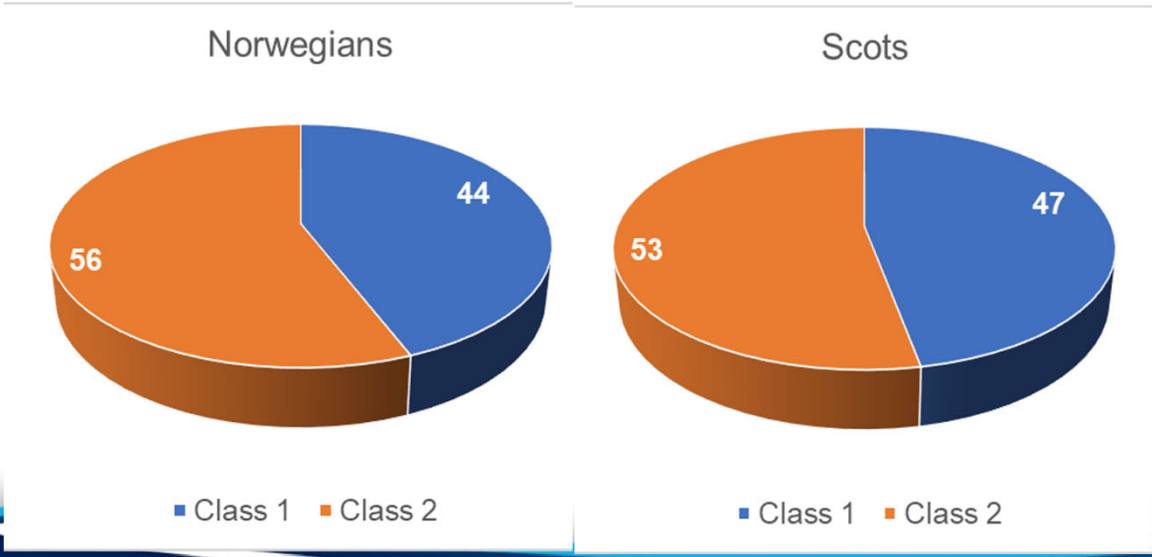
Variable	Mingulay		LoVe	
	Mean	Std. Dev.	Mean	Std. Dev.
Age group1 (18-35)	0.101	0.302	0.168	0.374
Age group2 (36-55)	0.493	0.500	0.394	0.489
Age group3 (>55)	0.406	0.491	0.438	0.496
Male	0.440	0.497	0.572	0.495
Tertiary Education	0.518	0.500	0.864	0.343
Full time employed	0.380	0.486	0.592	0.492
Part time employed	0.133	0.339	0.092	0.289
Student	0.064	0.246	0.052	0.222
Unemployed	0.044	0.205	0.021	0.145
Resident of Highlands and Islands	0.063	0.244	-	-
Marine Sports	0.384	0.487	0.466	0.499
Member of environmental organization	-	-	0.108	0.311

0.471	0.529	0.439	0.561

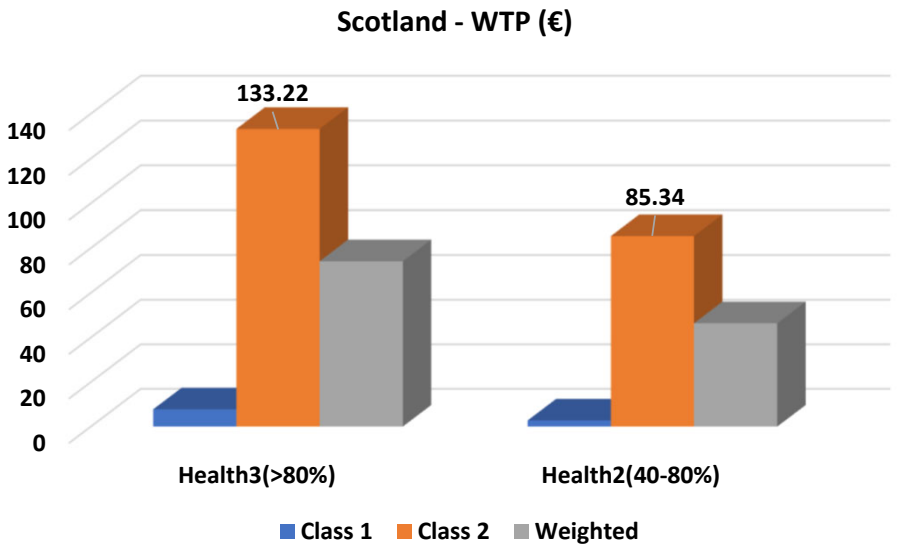
Results:

- Preferences and willingness to pay of the public form **2** clusters -> Polarization.
  - Those who are willing to pay or tradeoff with a fraction of their income (**Class 2**).
  - Those who are not or just WTP meagre amounts (**Class 1**)

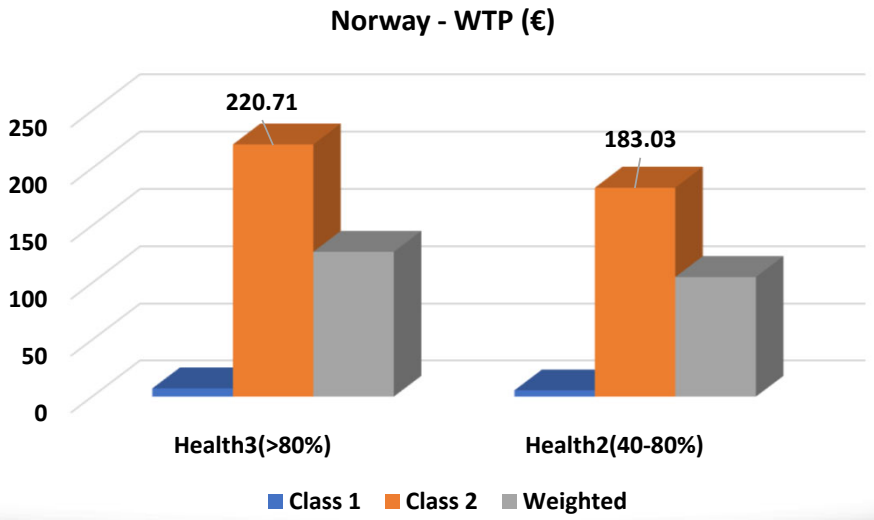
The 2 groups are almost equally distributed (%)



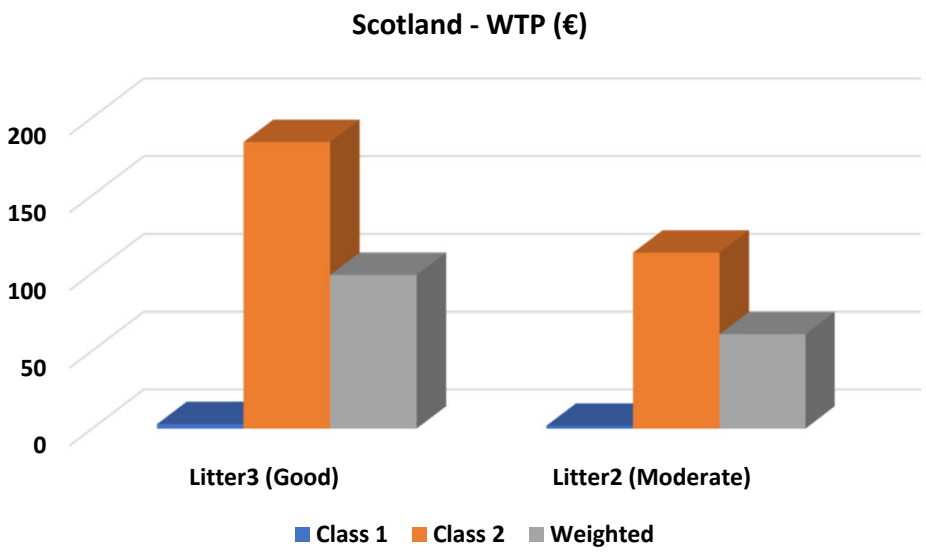
Results: Health of Fish Stock



- ❑ **Preference for the highest Attribute Level**
- ❑ **WTP for Class 2 > Class 1**
- ❑ **Weighted WTP > 0**



Results: Density of Marine Litter



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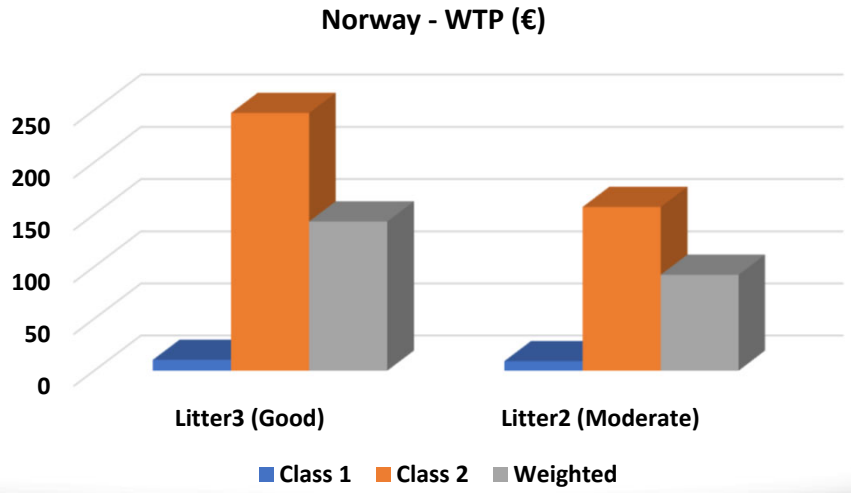
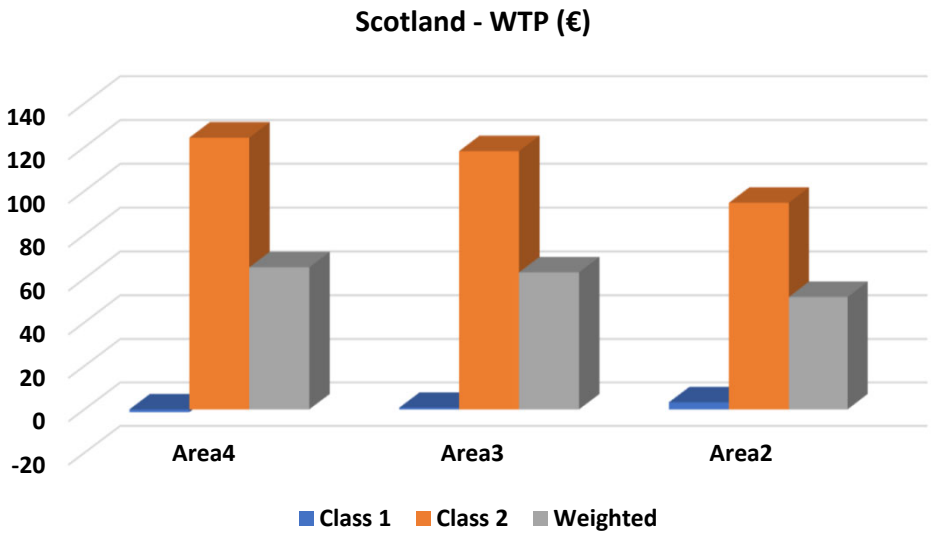


Results: Size of Protected Area



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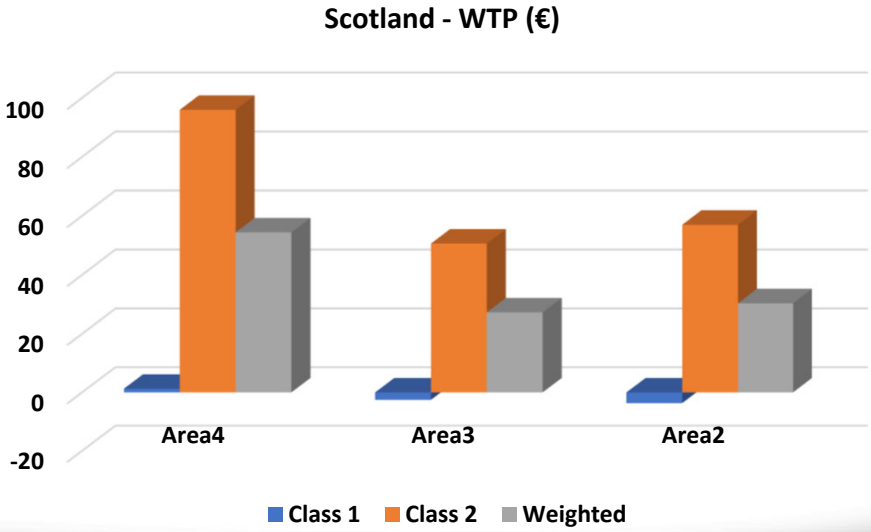
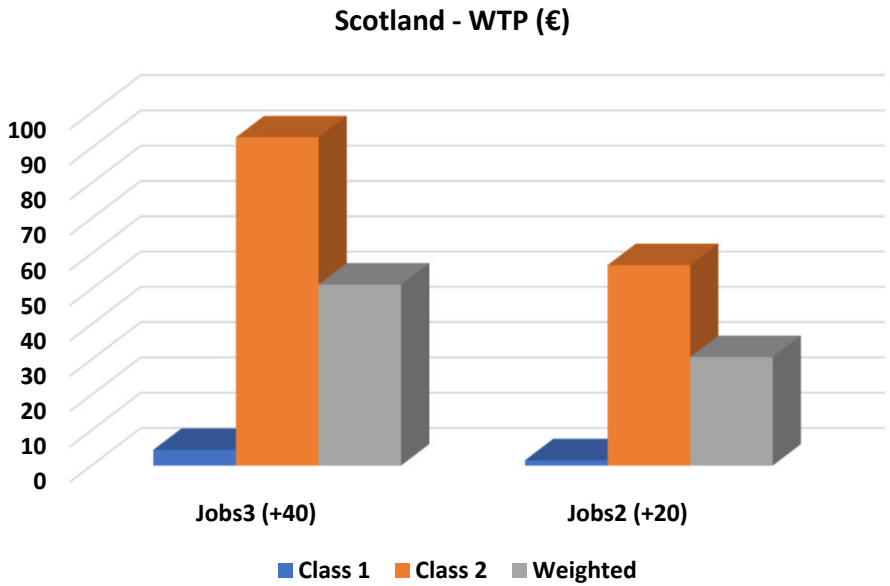
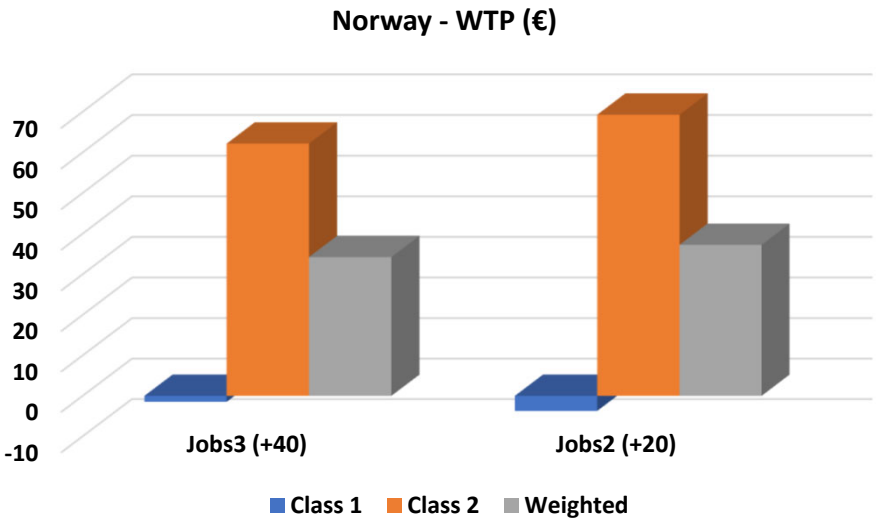


Results: Blue Economy Growth -> Jobs

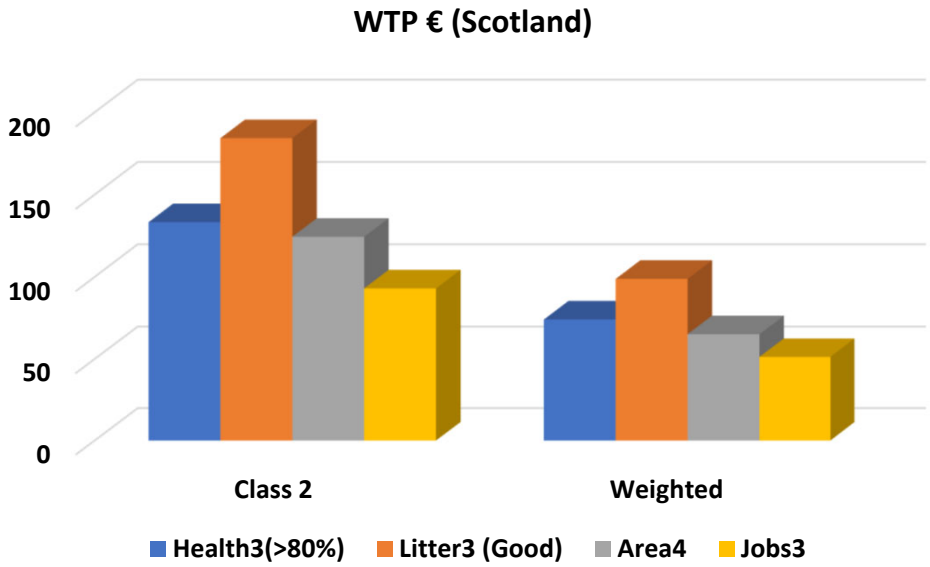


- ❑ Scots have preference for the highest attribute Level
- ❑ WTP for Class 2 > Class 1
- ❑ Weighted WTP > 0

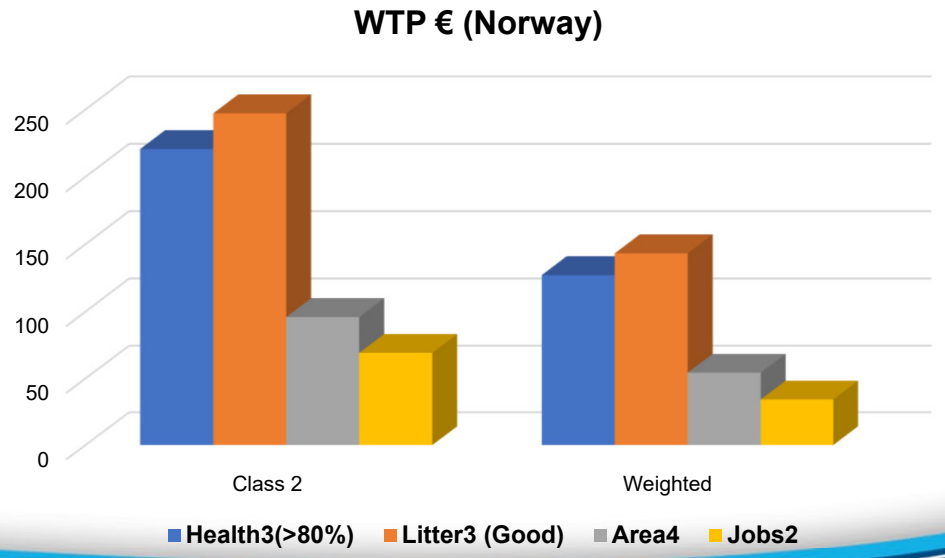


- ❑ Norwegians have preference for the lower increment of jobs

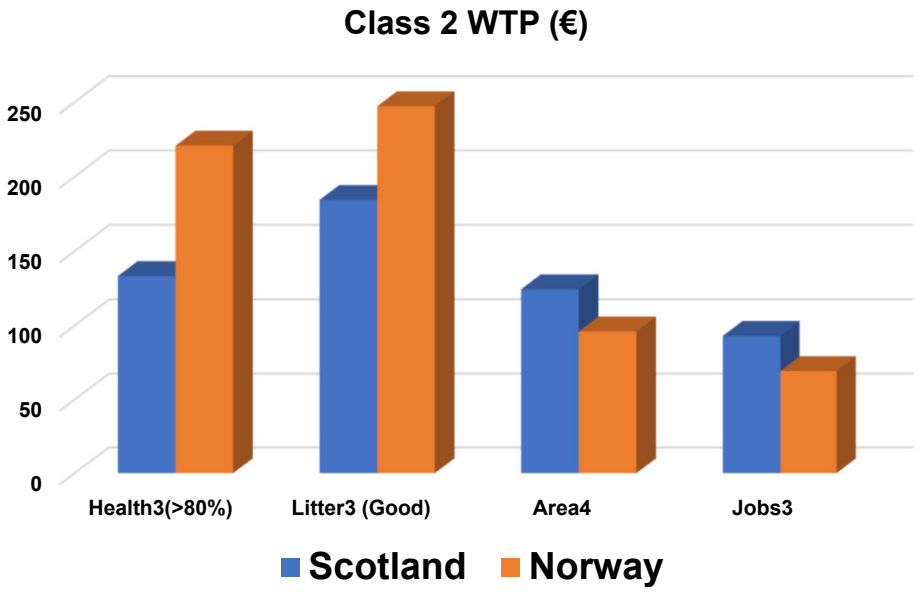
Ranking Most preferred Attribute Values



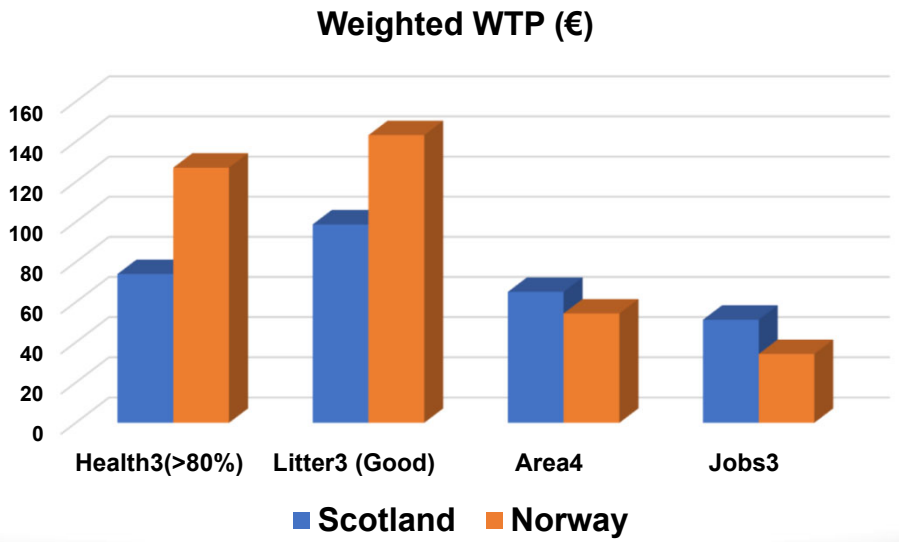
1. **Marine Litter**
2. **Health of Fish Stock**
3. **Size of MPA**
4. **Jobs**



Comparing Attributes Levels by Country



- For Health and Litter:
  Norway > Scotland
- For Area and Jobs:
  Scotland > Norway



Who are the Class 2 Group?

Higher likelihood of being:

Common Across Countries

- Females
- Tertiary Education
- Lives in Large City
- Age (36-55)

Unique for Norway

- Age (56+)
- Marine Sport
- >Median Income
- Member of Env. Org.

Unique for Scotland

- Lives in the North
- Lives in Urban with Rural areas

Conclusion

- Strong evidence of polarization in income tradeoff for improved deep sea ecosystem services delivery
  - ✓Share of about half the public
  - ✓Leading to significant marginal willingness to pay variation for policy attribute changes
- Weighted sum of WTP values show both public are willing to pay for proposed policy changes that improve deep sea ecosystem services delivery

- Despite the observed high WTP among certain factions of the society,
  - ✓Policies on environmental regulation should weight in the polarized preference structures in the population to avoid potential “yellow vest syndrome”
- U(Marine Litter)>(Health of Fish Stock)> U(MPA Size)> (Jobs).
  - ✓Policies should reflect on the relative strengths of these outcomes given that the public have low level of trust in the management of the deep sea.

Thank You!

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Image credit: BGS

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