

Final Symposium of the research project

SeeOff – Strategieentwicklung zum effizienten Rückbau von Offshore-Windparks

Development of efficient strategies for offshore wind farm decommissioning

March 30th 2022



SeeOff

Strategieentwicklung zum effizienten
Rückbau von Offshore-Windparks

SeeOff - Strategieentwicklung zum effizienten Rückbau von Offshore Windparks

(Development of strategies for sustainable offshore wind farm decommissioning)

Project duration:

November 2018 – April 2022

Projekt coordination:

City University of Applied Sciences Bremen
Prof. Dr.-Ing. Silke Eckardt

Website:

www.seeoff.de

Supported by:



Federal Ministry
for Economic Affairs
and Climate Action

on the basis of a decision
by the German Bundestag



- 09.00** **Welcome and introduction**
(Prof. Dr.-Ing. Silke Eckardt, City University of Applied Sciences Bremen)
- 09.20** **Dismantling of offshore wind farms at sea**
(Bernd Köhler, Deutsche Windtechnik)
- 09.40** **Comminution of offshore wind farm components and recovery of materials at land**
(Dr. Sven Rausch, Nehlsen AG)
- 10.00** **Q & A Session**
- 10.20** ***Coffee Break and Networking in Lounge-Area***
- 10.35** **Economic efficiency of offshore wind farm decommissioning**
(Janina Bösche, City University of Applied Sciences Bremen)
- 10.50** **Environmental impacts of offshore wind farm decommissioning**
(Vanessa Spielmann, City University of Applied Sciences Bremen)
- 11.10** **Occupational safety of offshore wind farm decommissioning**
(Mandy Ebojie, City University of Applied Sciences Bremen)
- 11.25** **Q & A Session**
- 11.45** ***Lunch Break and Networking in virtual Lounge-Area***
- 12.15** **Bringing economic efficiency, environmental impacts and occupational safety together: Multi criteria decision making for offshore wind farm decommissioning**
(Vanessa Spielmann, City University of Applied Sciences Bremen)
- 12.30** **Public acceptance of offshore wind farm decommissioning**
(Philipp Tremer, German Offshore Wind Energy Foundation)
- 12.45** **Q & A Session**
- 13.05** ***Goodbye and subsequent Networking in Lounge-Area***
- 13.45** **Closing of conference platform**

Final Symposium of the research project *SeeOff*, March 30th 2022

Bringing economic efficiency, environmental impacts and occupational safety together: Multi criteria decision making for OWF decommissioning

Vanessa Spielmann

City University of Applied Sciences Bremen



SeeOff

Strategieentwicklung zum effizienten
Rückbau von Offshore-Windparks

Multi criteria decision making

Multi criteria decision analysis (MCDA) is a tool that supports decision making considering multiple objectives

Procedure:

1. Determination and weighting of decision criteria
2. Assessment of decommissioning scenarios
3. Calculation and interpretation of decision scores

Multi criteria decision making

Determination of decision criteria

Sustainable decommissioning of offshore wind farms					
Category	Economy	Environment			Health and safety
Aspect	Economic efficiency	GHG-Emission	Biodiversity	Resource efficiency	Safety at work
Objective	Economic efficient	Low GHG-Emission	Minor local impact	High resource efficiency	Few hazards
Attribute	(Present) value of costs/ decommissioned MW	CO ₂ -Equivalent	Fraction of species richness maintained	Recovery rate	Hazard measure

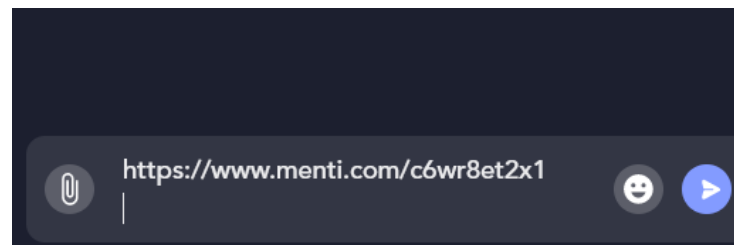
Multi criteria decision making

Weighting of decision criteria

Live Criteria Weighting

Please rate the criteria regarding their relevance for offshore wind farm decommissioning on a scale of 1 (not relevant) to 9 (extremely relevant)

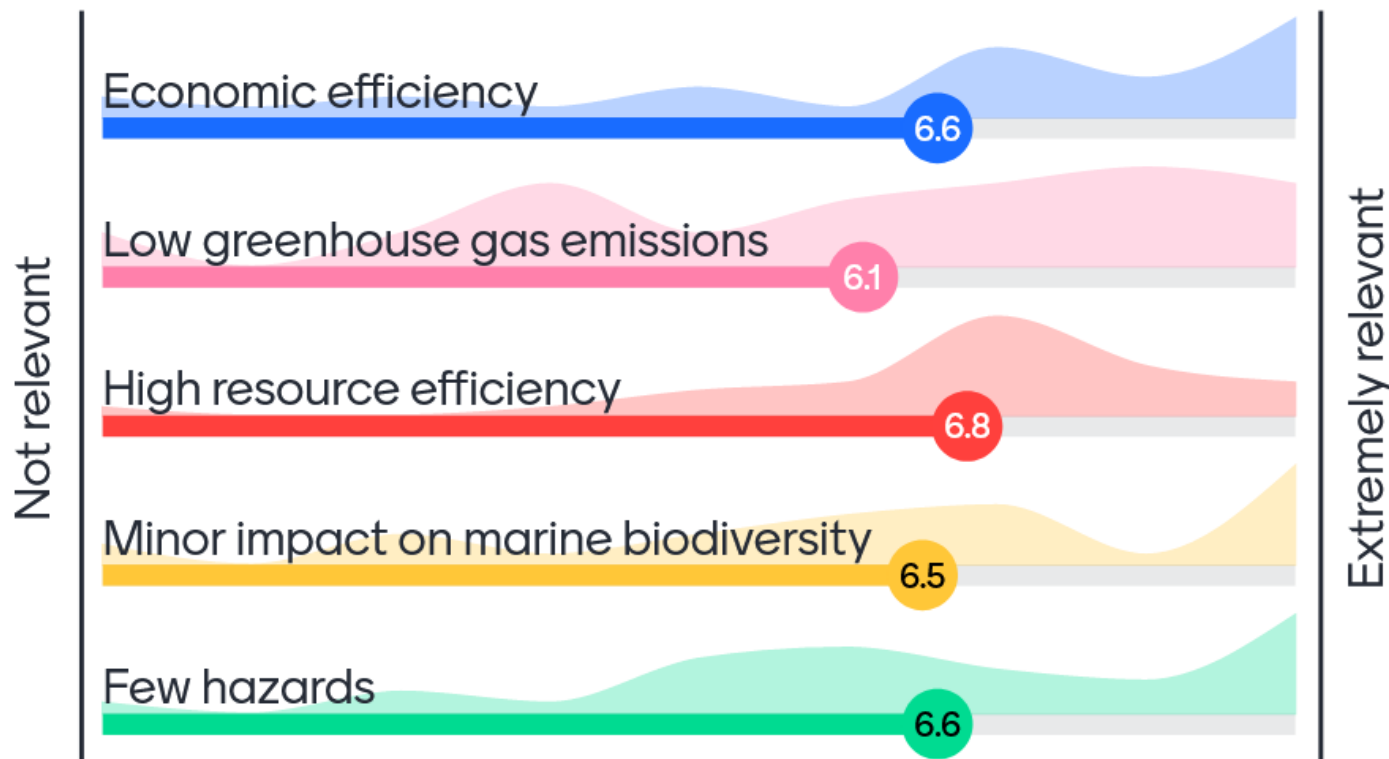
Please use Mentimeter-link in chat



Multi criteria decision making

Weighting of decision criteria

Live Criteria Weighting - Results



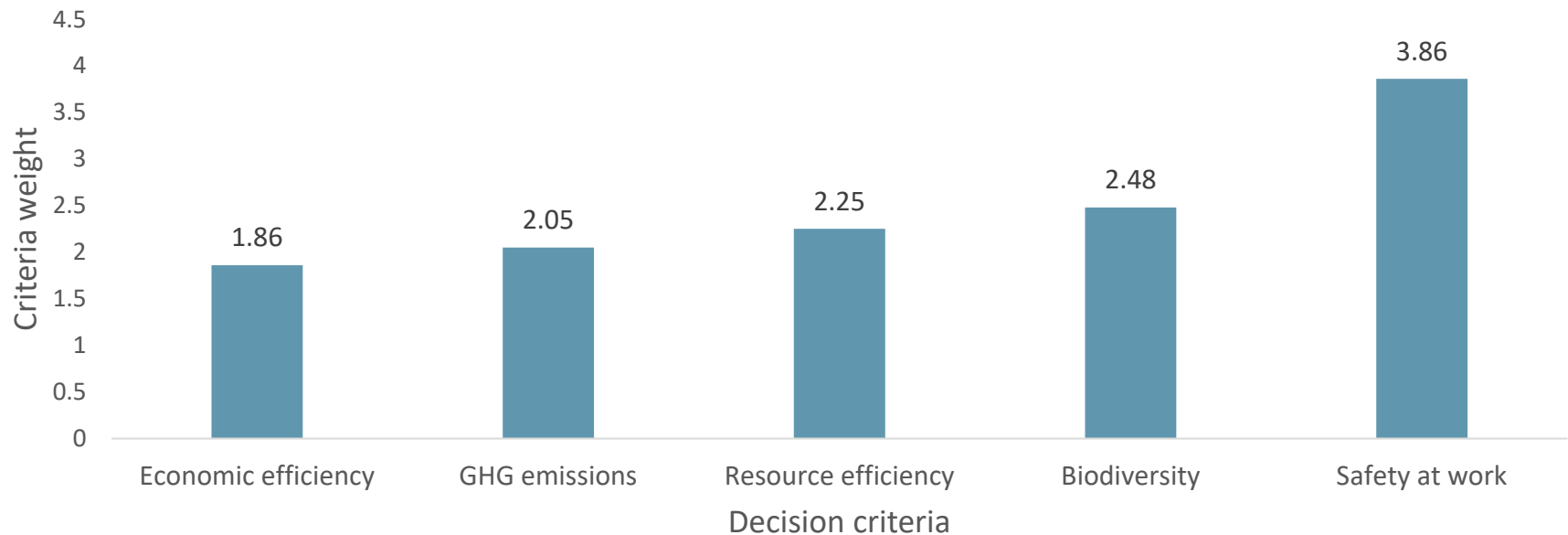
Multi criteria decision making

Weighting of decision criteria

Priority analysis

- One-week online survey
- Pairwise comparison of decision criteria

	Criterion	
	A	B
Criterion A is as important as criterion B	1	1
Criterion A is more important than criterion B	2	0
Criterion B is more important than criterion A	0	2



Multi criteria decision making

Assessment of decommissioning scenarios

Points for the fulfilment of the decision criterion

On a scale

0 = criterion not fulfilled

...

10 = criterion fulfilment is
excellent

The other points were
distributed proportionally

Points	Criteria fulfilment	t CO ₂ -Equivalents	
0	not fulfilled	>	52,903
1	just sufficient	52,902	51,530
2	sufficient	51,529	50,158
3	sufficient - satisfactory	50,157	48,786
4	satisfactory	48,785	47,414
5	satisfactory - good	47,413	46,043
6	good	46,042	44,671
7	good - very good	44,670	43,299
8	very good	43,298	41,927
9	very good - excellent	41,926	40,555
10	excellent	<	40,556

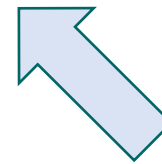
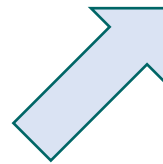
Multi criteria decision making

Calculation of decision scores

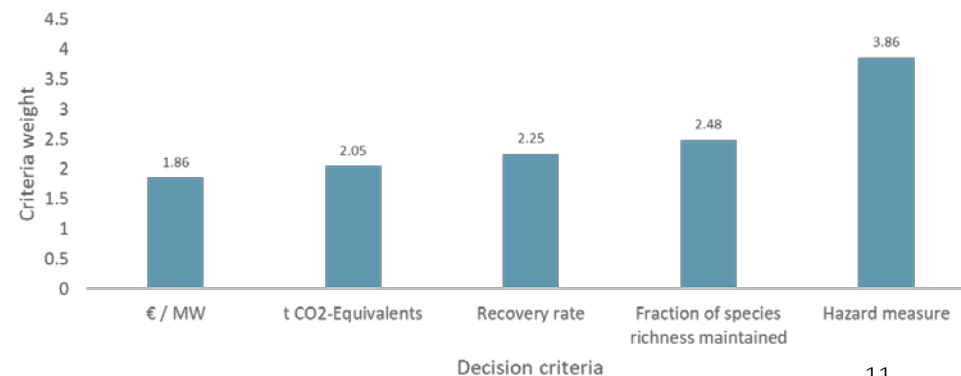
Calculate decision scores (DS_i)

Weighted sum model

$$DS_i = \sum_{j=1}^m CF_{ij} * CW_j$$



Criteria weights (CW_j)



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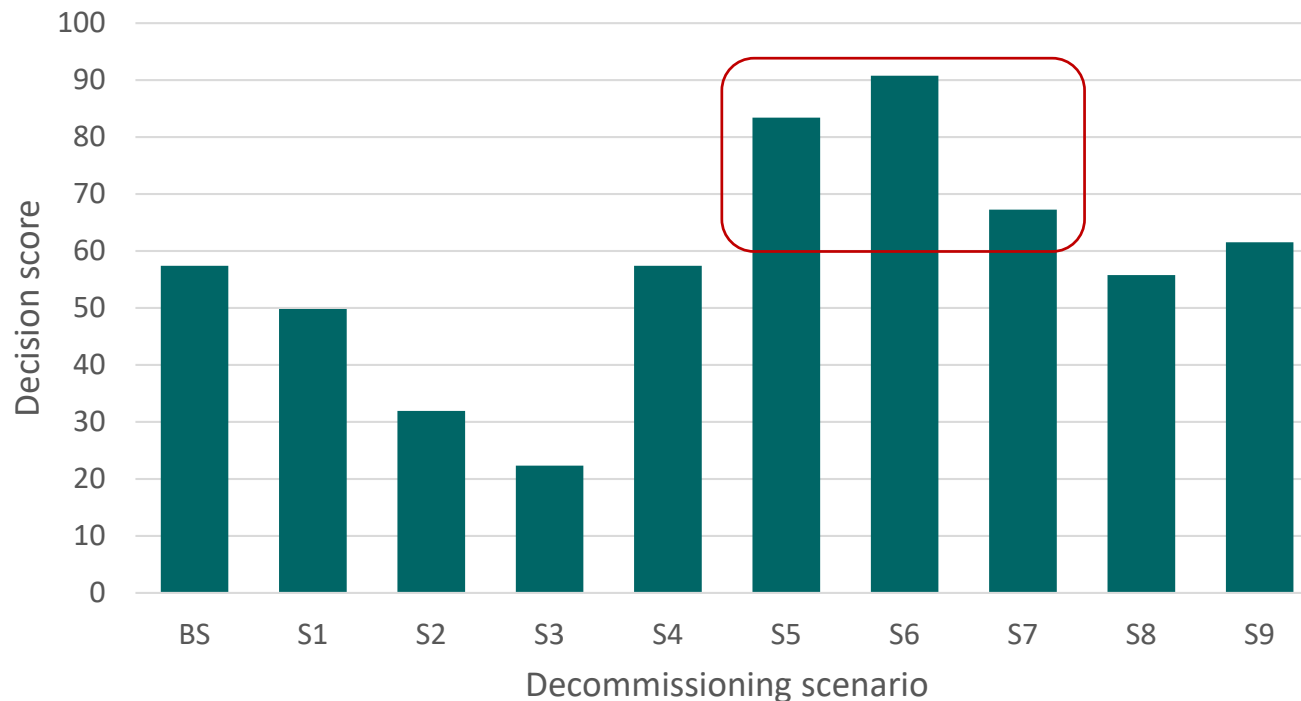
Points for the fulfilment of the decision criterion (CF_{ij})

Multi criteria decision making Interpretation of decision scores

Decommissioning scenarios

- BS Baseline scenario
- S1 Feeder concept WTG
- S2 Feeder concept WTG-FOU
- S3 Feeder concept WTG and WTG-FOU
- S4 Load-off OSS with SPMT
- S5 SPL left in situ
- S6 Sea cables left in situ
- S7 WTG-FOU: cut above seabed
- S8 WTG-FOU: complete removal
- S9 FOU: cut with diamond wire machine

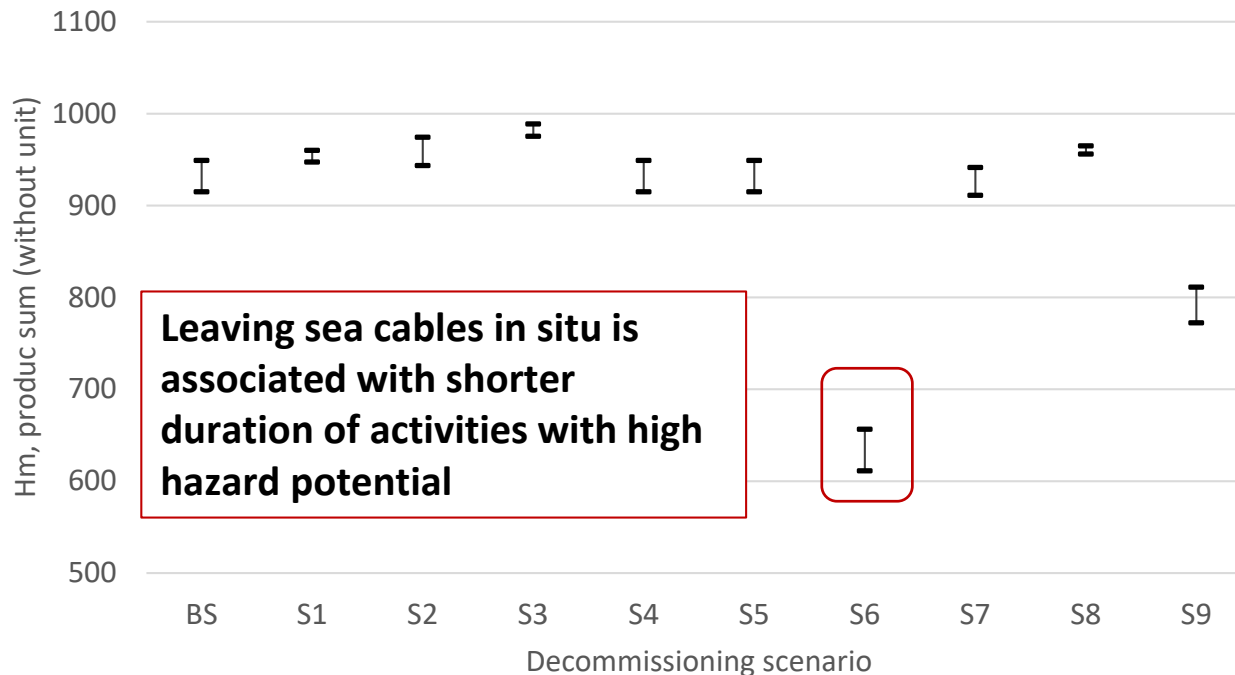
High scores for partial decommissioning scenarios



Multi criteria decision making Interpretation of decision scores

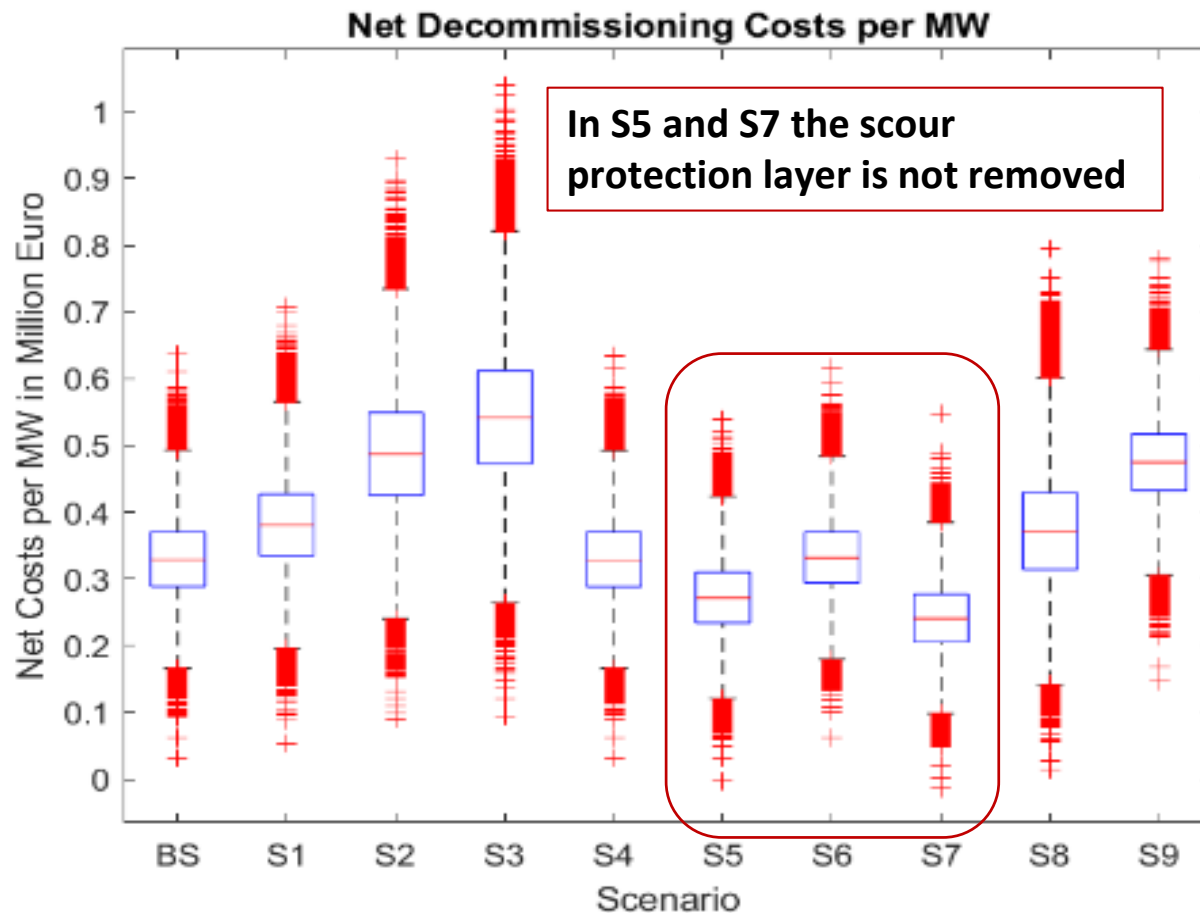
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Multi criteria decision making

Interpretation of decision scores

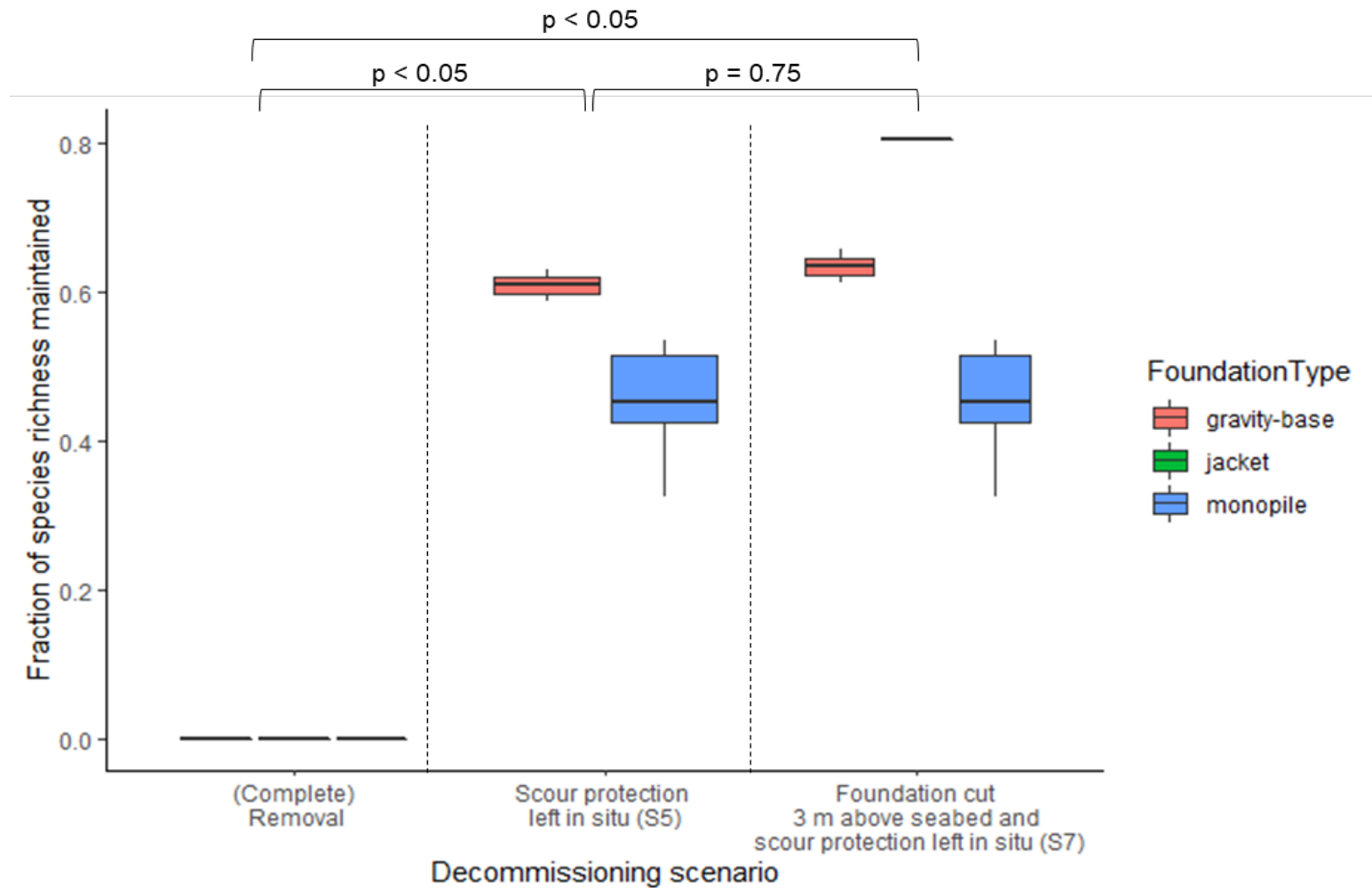


Decommissioning scenarios

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Environmental impacts

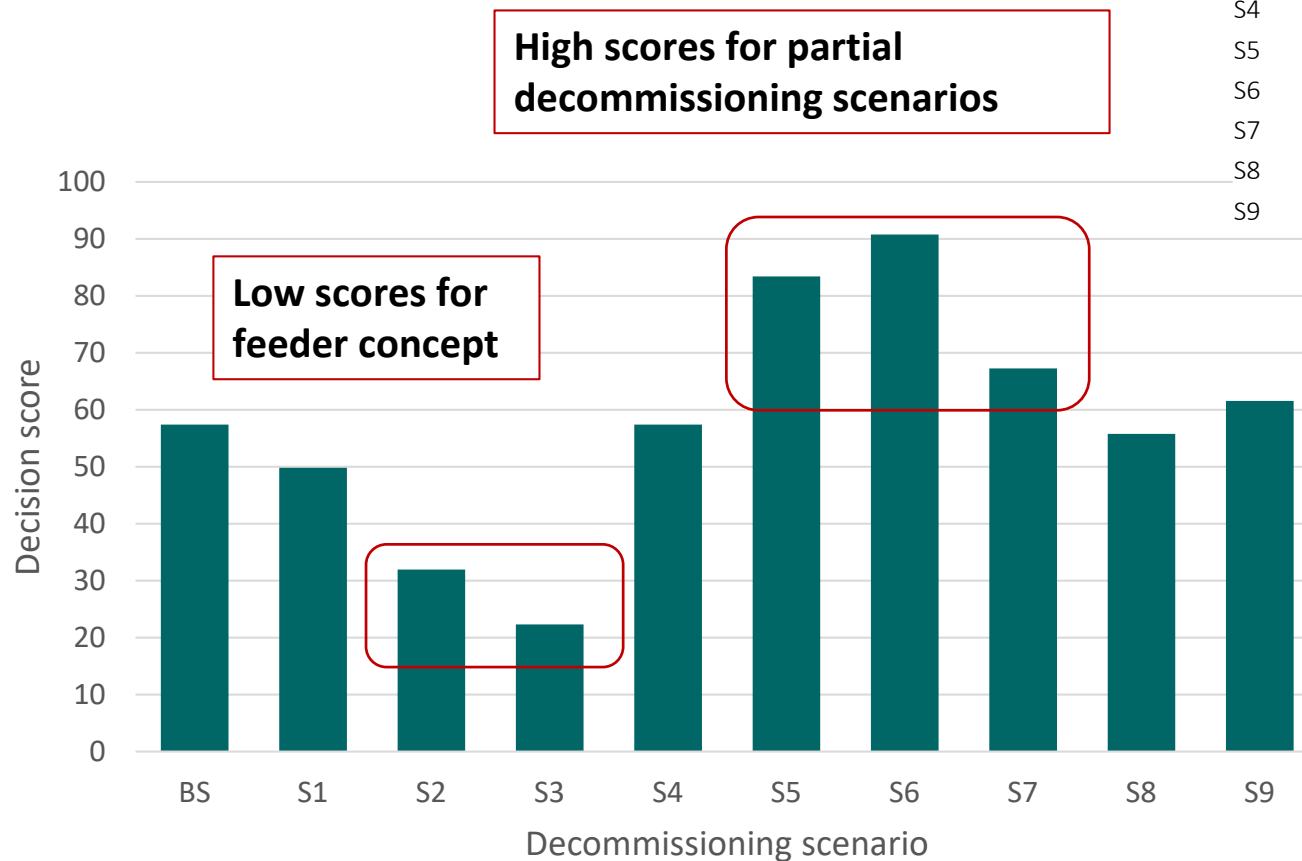
Biodiversity



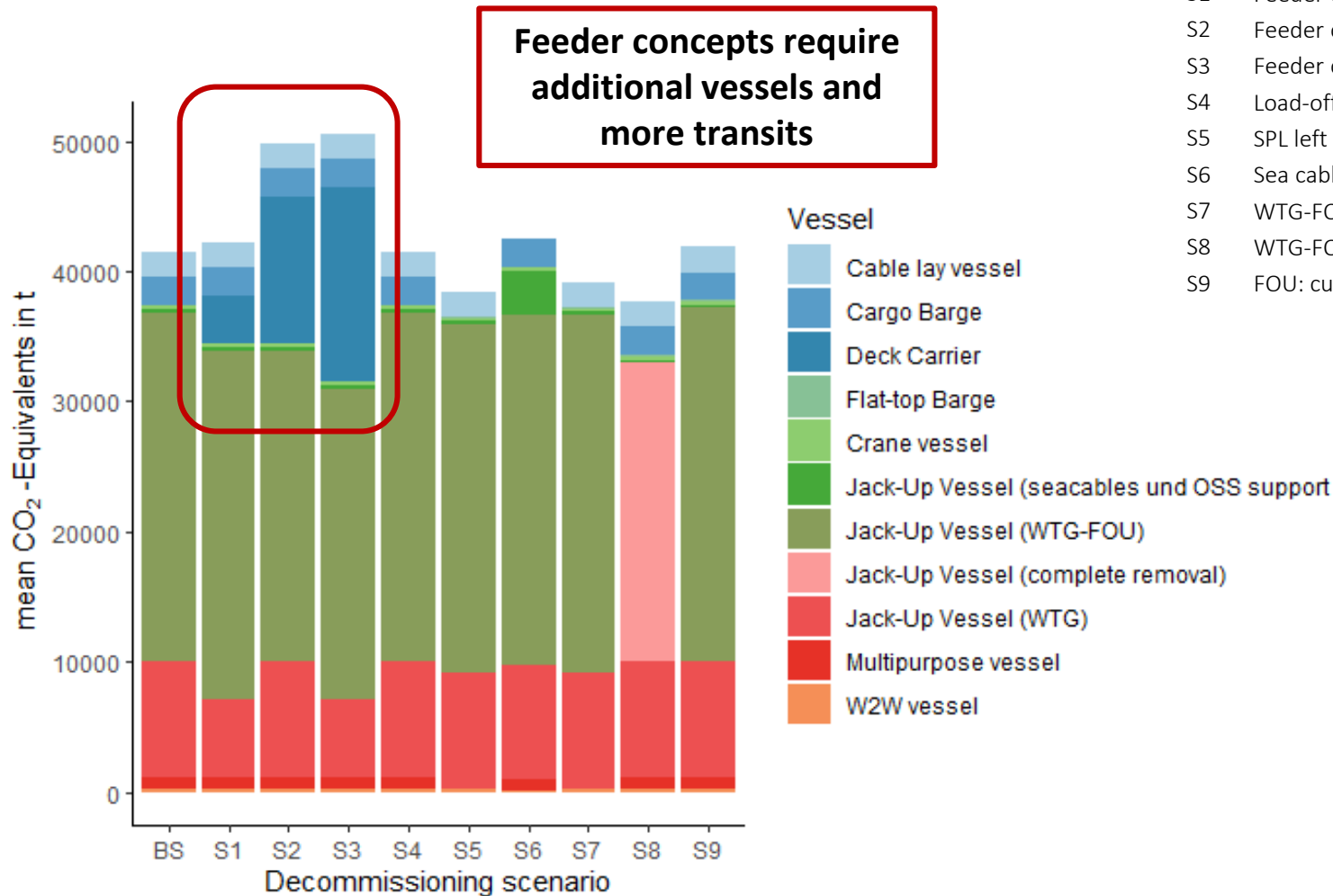
Multi criteria decision making Interpretation of decision scores

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Environmental impacts GHG Emissions



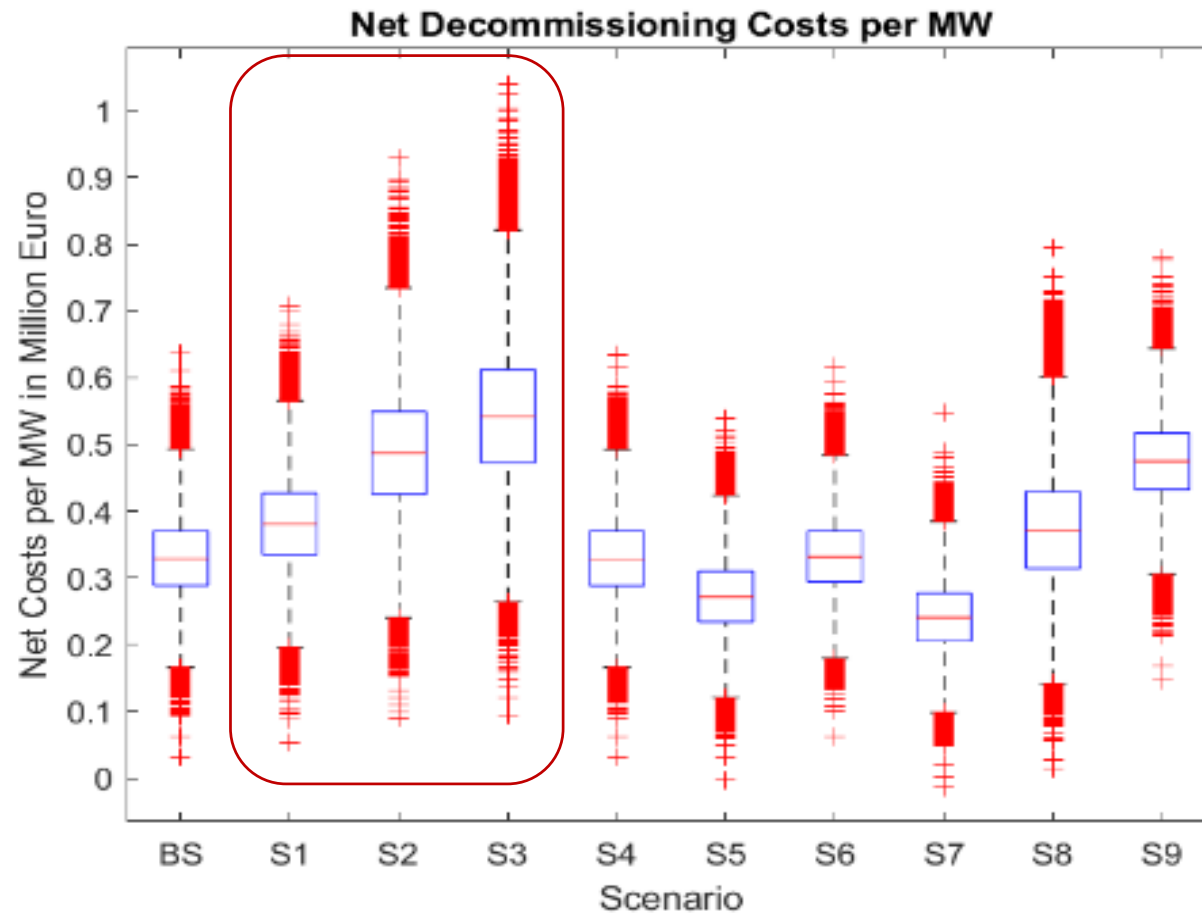
Decommissioning scenarios

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Multi criteria decision making

Interpretation of decision scores

Feeder concepts require
additional vessels



Multi criteria decision making

Conclusion

High decision scores for decommissioning scenarios with partial decommissioning

Low decision scores for decommissioning scenarios with feeder concepts

- Partial decommissioning scenarios, particularly leaving scour protection in situ should be taken into consideration
- Innovative dismantling and logistic concepts that forego or reduce the utilisation of expensive vessels with high GHG emissions should be investigated

Thank you for your attention!

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