Livscyklusvurdering af danske fiskeprodukter

Usikkerhed, metoder, og dataudfordringer

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LIFE CYCLE ASSESSMENT OF DANISH FISH PRODUCTS

UNCERTAINTY, METHODS AND DATA CHALLENGES

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LCA OF FISH PRODUCTS

- Consumers demand sustainable food products
- Producers rely on LCA to evaluate and communicate the sustainability of products
- Increasingly for fish too

Credit: https://www.futureoffish.org/

LCA AS A MODEL

- LCA is a modelling exercise
- Model results are uncertain [1]:
  - → imperfect knowledge
  - → assumptions
  - → lack of precise data
- Due to uncertainty, comparing results from different LCA models is challenging

Credit: BibLus-net

UNCERTAINTY AND VARIABILITY

- Impact of mixed fisheries? (**Co-production**)
- Consequences of increasing demand? (**Constraints**)
- Impact of variable conditions? (**Time and space**)

Need to **fit the simplified LCA model** to complex reality.

MODELLING APPROACHES

- Retrospective account of impacts of a product (**Attributional**)
- Prospective look at consequences of change in demand (**Consequential**) [2]

- Most LCA studies on fish are attributional LCA [3]
- But different LCA methods used to support similar decisions

STUDY OBJECTIVES

For the specific case of fisheries, systematically address uncertainty in LCA results due to:

- Modelling choices
- Variability of vessels and fishing conditions
- Data gaps

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CLIMATE IMPACT OF 1 kg DANISH FISH

Top-down approach:

1. Disaggregation of national statistics
   - Define subgroups of fisheries
   - Divide total catch and fuel use among subgroups
2. System modelling
   - Test different models of co-production and constraints

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FISHERIES UNDER ANALYSIS

Vessel category	Subgroups
Trawlers up to 12 m	Cod and plaice, Norwegian Lobster, Sprat
Trawlers 15-18 m	Cod and plaice, Norwegian Lobster, Sprat, Industrial fish
Trawlers 18-24 m	Cod and plaice, Norwegian Lobster, Industrial fish
Trawlers over 40 m	Industrial fish, Herring, Mackerel, Horsemackerel

- Data source: Statistics Denmark, Fiskeristyrelsen
- Time series for years 2017 - 2019

DISAGGREGATION

1. Reduce number of fish categories

Fuel and catch table
(Fisheries statistics, Trawlers <12m, 2019)

Statistics Denmark data:		
A.8 Fuel, 1000 litre	fuel [1000 L]	
	442.00	
	Mass [tons]	Revenue [1000 DDK]
B.1.1 Atlantic cod, tonnes	153.00	2567
B.1.2 Haddock, tonnes	9.00	143
B.1.3 Saithe, tonnes	6.00	68
B.1.4 European hake, tonnes	5.00	93
B.1.5 Other codfishes, tonnes	9.00	156
B.1.6 European plaice, tonnes	274.00	4280
B.1.7 European flounder, tonnes	53.00	244
B.1.8 Witch Flounder, tonnes	3.00	66
B.1.9 Lemon Sole, tonnes	5.00	127
B.1.10 Common Sole, tonnes	8.00	811
B.1.11 Turbot, tonnes	7.00	324
B.1.12 Other flatfishes, tonnes	35.00	423
B.1.13 Atlantic Herring, tonnes	0.00	0
B.1.14 Atlantic Mackerel, tonnes	0.00	1
B.1.15 Sprat, tonnes	218.00	355
B.1.16 Atlantic Horsemackerel, tonnes	0.00	0
B.1.17 Monk, tonnes	3.00	97
B.1.18 European eel, tonnes	0.00	0
B.1.19 Other fish for human consumptio	7.00	713
B.2.1 Norway lobster, tonnes	81.00	5118
B.2.2 Northern prawn, tonnes	0.00	0
B.2.3 Common Shrimp, tonnes	0.00	0
B.2.4 Blue mussels, tonnes	0.00	0
B.2.5 Other cockles and mussels, tonnes	0.00	0
B.2.6 Other crustaceans and molluscs, to	1.00	35
B.3 Industrial fish, tonnes	63.00	99
Total	940.00	15621

Catch table, reduced

Mass and revenuel of fish groups

fishery groups	mass (tons)	revenue (1000
Codfish	182.00	3027.00
Flatfish	385.00	6275.00
Industrial fish	63.00	99.00
Norway lobster	81.00	5118.00
Sprat	218.00	355.00
tot	929.00	14874.00

DISAGGREGATION

1. Reduce number of fish categories

2. Disaggregate in different fisheries

Catch table, reduced

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Disaggregation factors table (Thrane, 2004)[4]

	Cod/plaice fishery	Lobster fishery	Sprat fishery	Scaling factor
codfish	0.56	0.37	0.00	0.93
flatfish	0.32	0.22	0.00	0.54
industrial fish	0.12	0.20	0.52	0.83
n lobster	0.00	0.22	0.00	0.22
Sprat	0.00	0.00	0.48	0.48
tot	1.00	1.00	1.00	

Mass/fuel disaggregation

	Cod/plaice	Lobster	Sprat
codfish	110.02	71.98	0.00
flatfish	228.52	156.48	0.00
industrial fish	8.98	14.75	39.27
n lobster	0.00	81.00	0.00
Sprat	0.00	0.00	218.00

Disaggregated fisheries inventories

DISAGGREGATION

1. Reduce number of fish categories

2. Disaggregate in different fisheries

3. Disaggregate fuel

Fuel and catch table
(Fisheries statistics, Trawlers <12m, 2019)

Statistics Denmark data:		
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	Mass [tons]	Revenue [1000 DDK]
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B.1.3 Saithe, tonnes	6.00	68

Emission factors table

Emission factors from literature review	
fishery group	Fuel consumption factors (L/kg)
cod and flatfish	0.45
industrial fish	0.06
norway lob	2.44
sprat	0.58

Mass/fuel disaggregation

	Cod/plaice	Lobster	Sprat
codfish	110.02	71.98	0.00
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Sprat	0.00	0.00	218.00

fuel results (1000 L)

cod	Norw lobster	Sprat	tot fuel
49.95	197.64	125.57	476.90

plaice
103.75

cod/plaice
153.69

Disaggregated fisheries inventories with fuel

SYSTEM MODELLING

Approach	Method	Question answered
Attributional	Partitioning by mass: mass allocation	Retrospective: how can impacts of various activities be attributed to this product?
Attributional	Partitioning by revenue: economic allocation	Retrospective: how can impacts of various activities be attributed to this product?
Consequential	Substitution, Constrained activity	Prospective: what are the consequences of increasing the demand for this product, when its production can not be increased due to constraints?
Consequential	Substitution, Unconstrained activity, no alternative production routes	Prospective: what are the consequences of increasing the demand for this product, when it can't be produced in any other way?
Consequential	Substitution, Unconstrained activity, alternative production routes	Prospective: what are the consequences of increasing the demand for this product, when there are alternatives in the market?

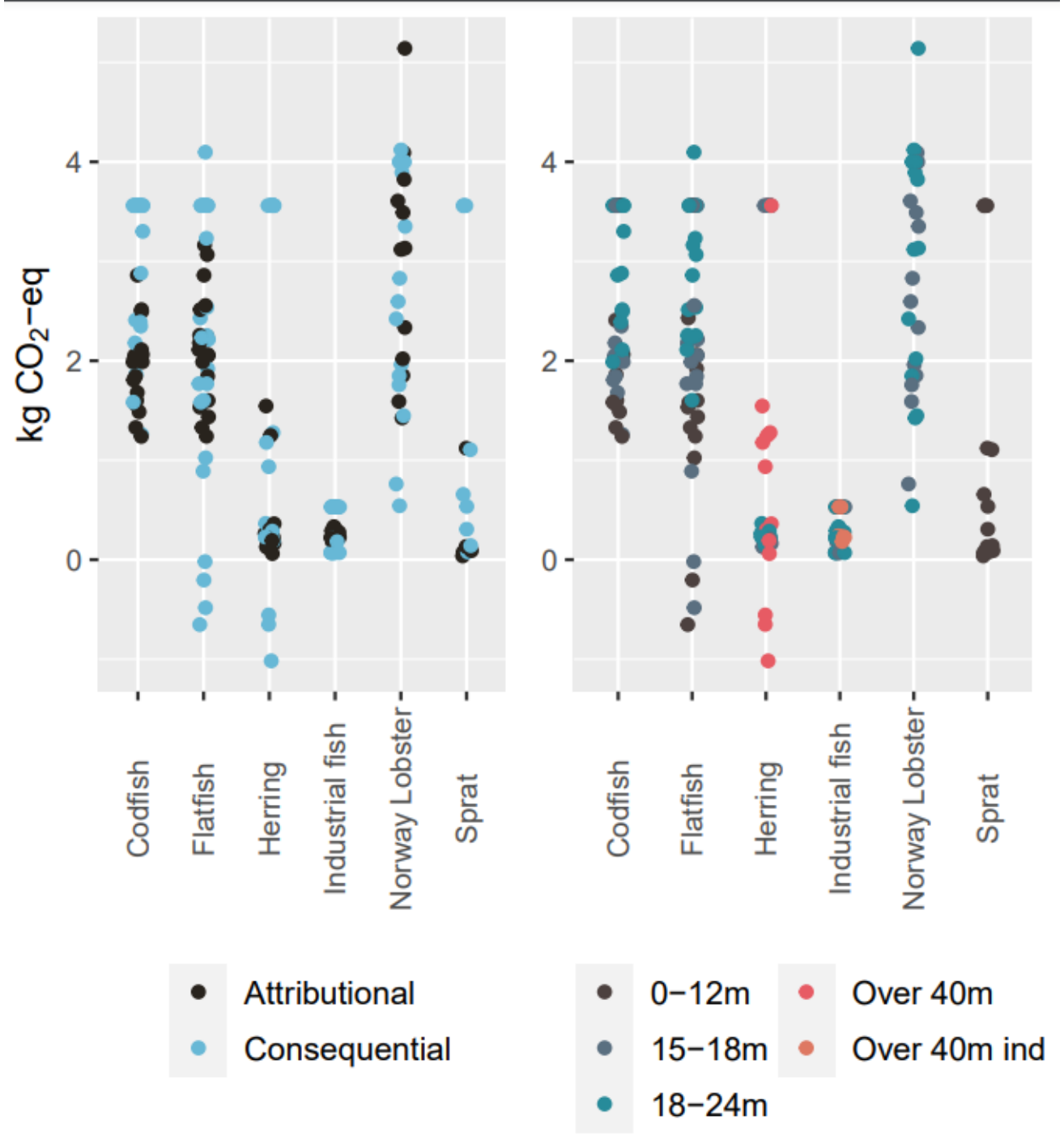
RESULTS

- Uncertainty of attributional vs consequential (left)

Compared with

- uncertainty of different segments and fishing practices (right)

- Sum of uncertainties creates high total variability



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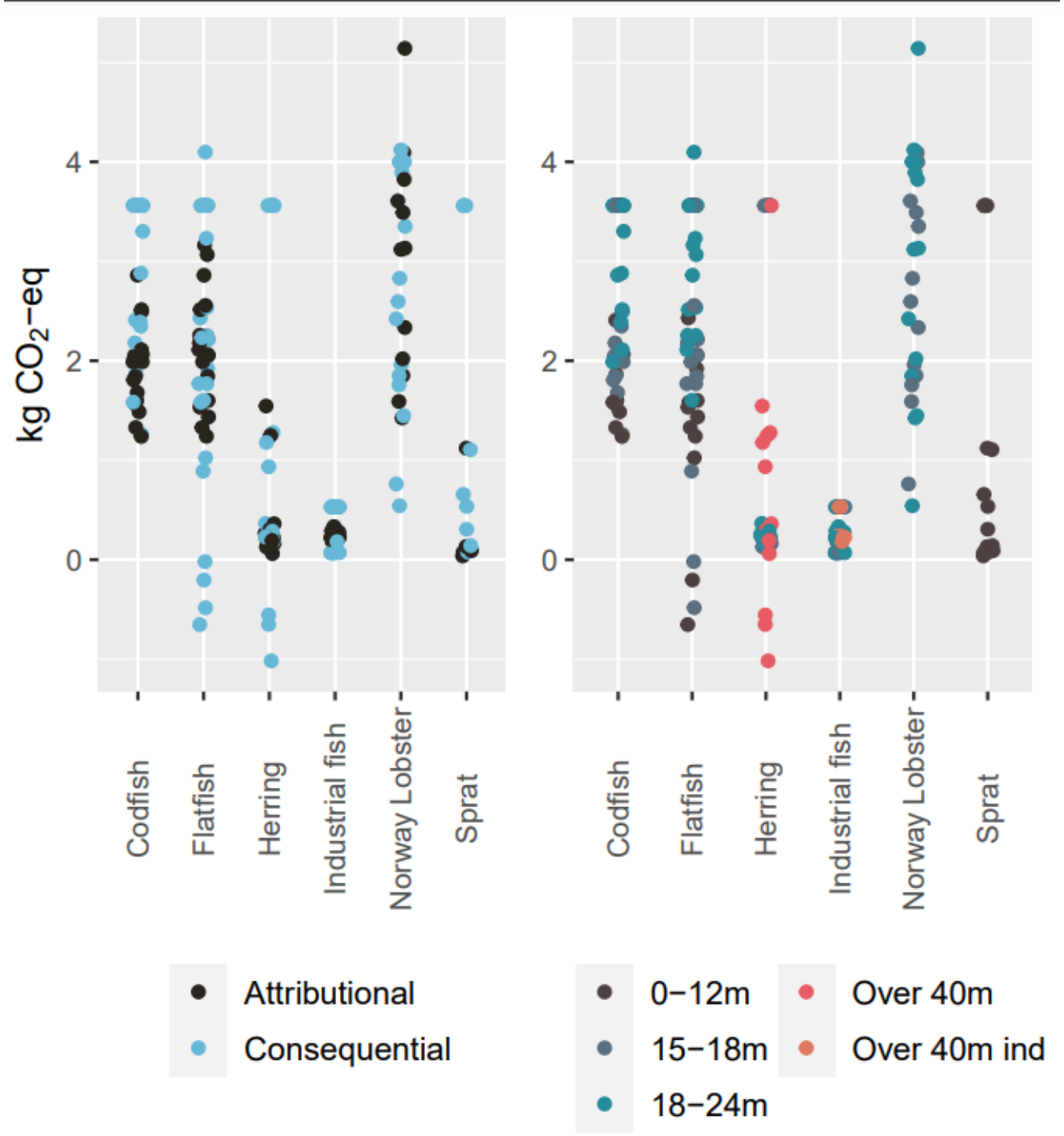

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RESULTS

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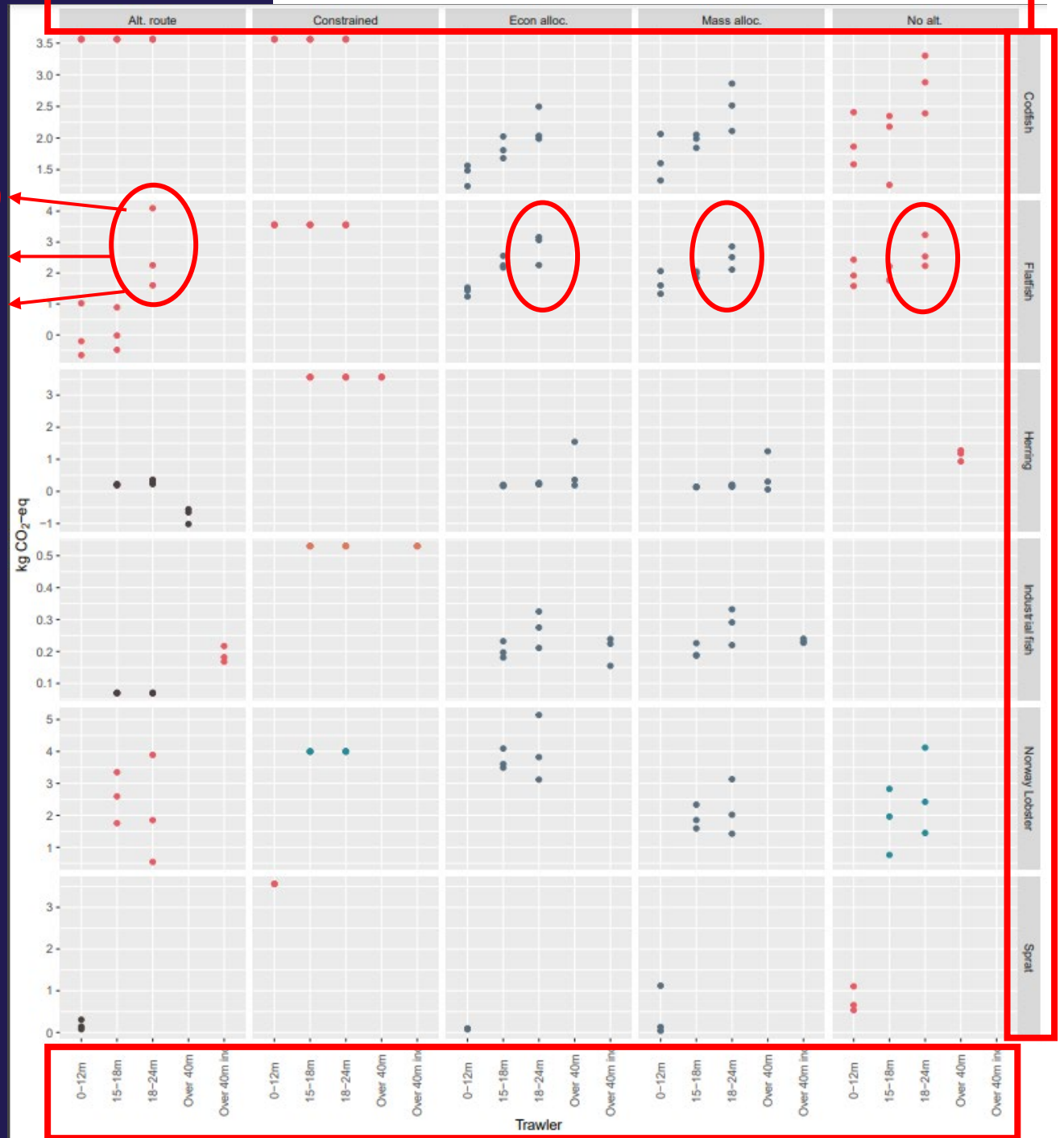
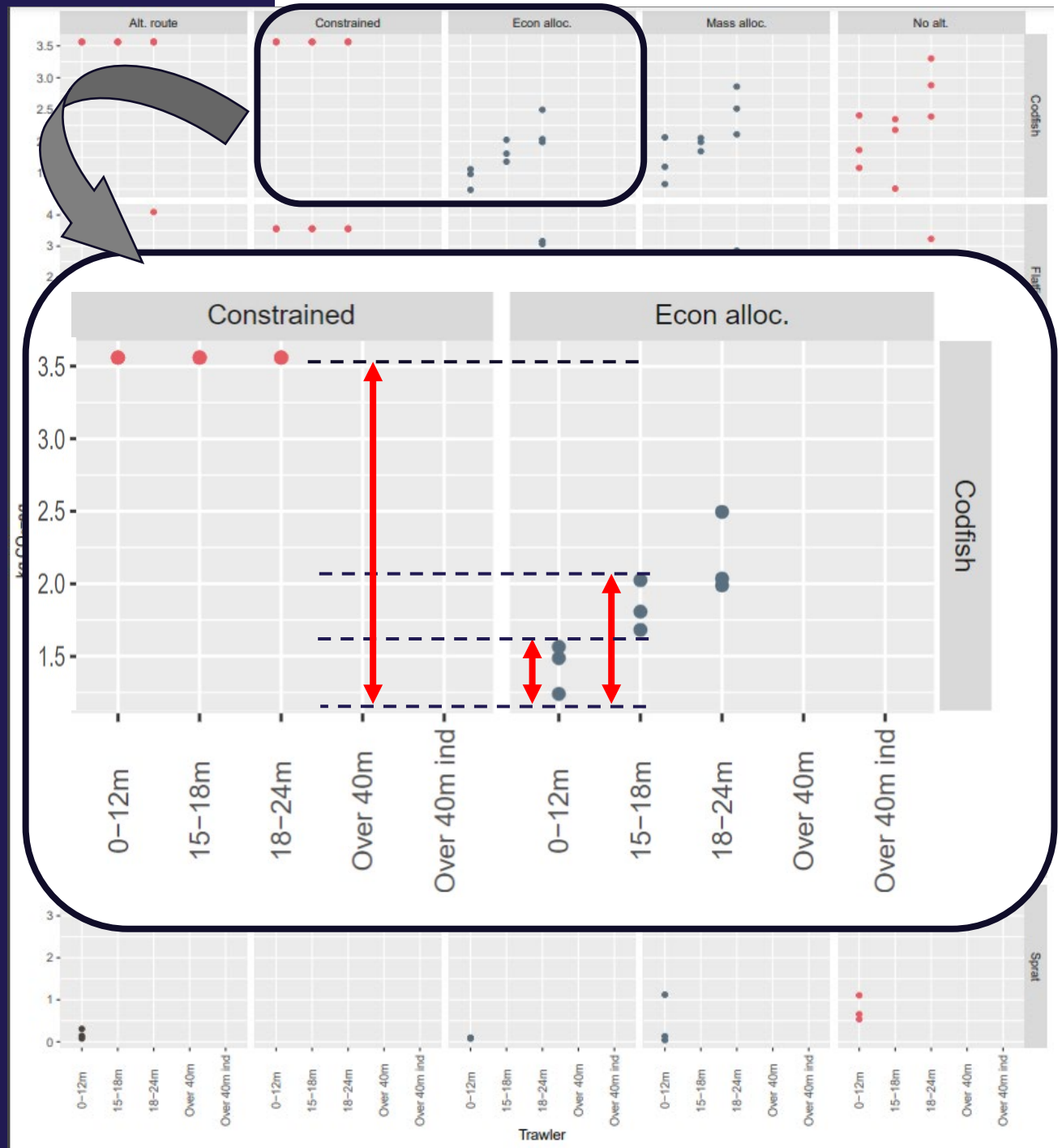
RESULTS

- Minor yearly variability



RESULTS

- Minor yearly variability
- Uncertainty due to model is higher than due to temporal variability and fishing conditions



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RESULTS

- Minor yearly variability
- Uncertainty due to model is higher than due to temporal variability and fishing conditions
- Clean fisheries results less spread due to lower influence of co-catch

CONCLUSIONS

- LCA results highly model-dependent
- Pay attention to LCA approach and assumption behind result
- Keep in mind uncertainty behind models and numbers
- Overconfidence in results: risk of greenwashing
- Focus on model transparency

Credit: Krisztian Tabori on Unsplash

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THANK YOU

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