Most influential factors affecting CO_2 emissions in fisheries

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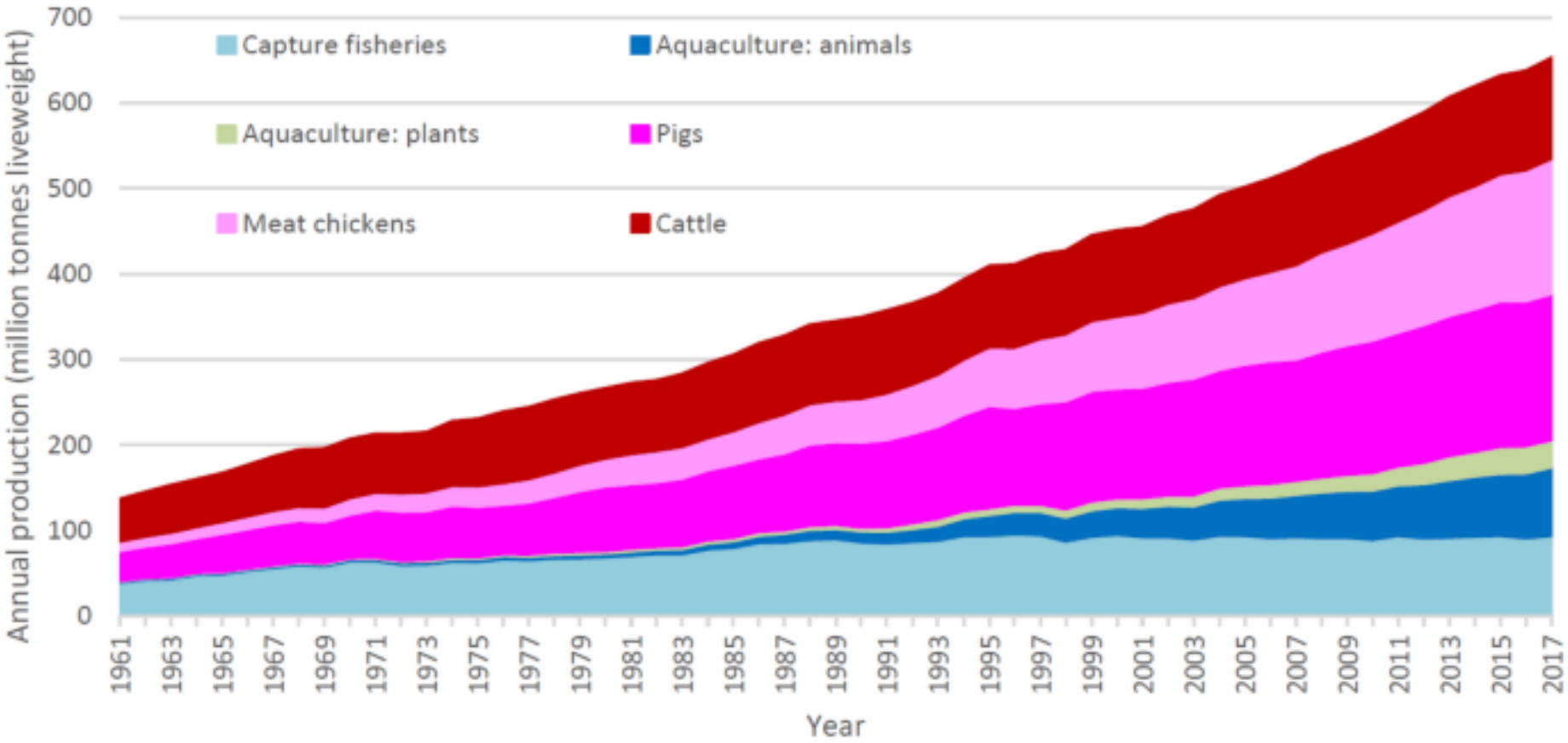
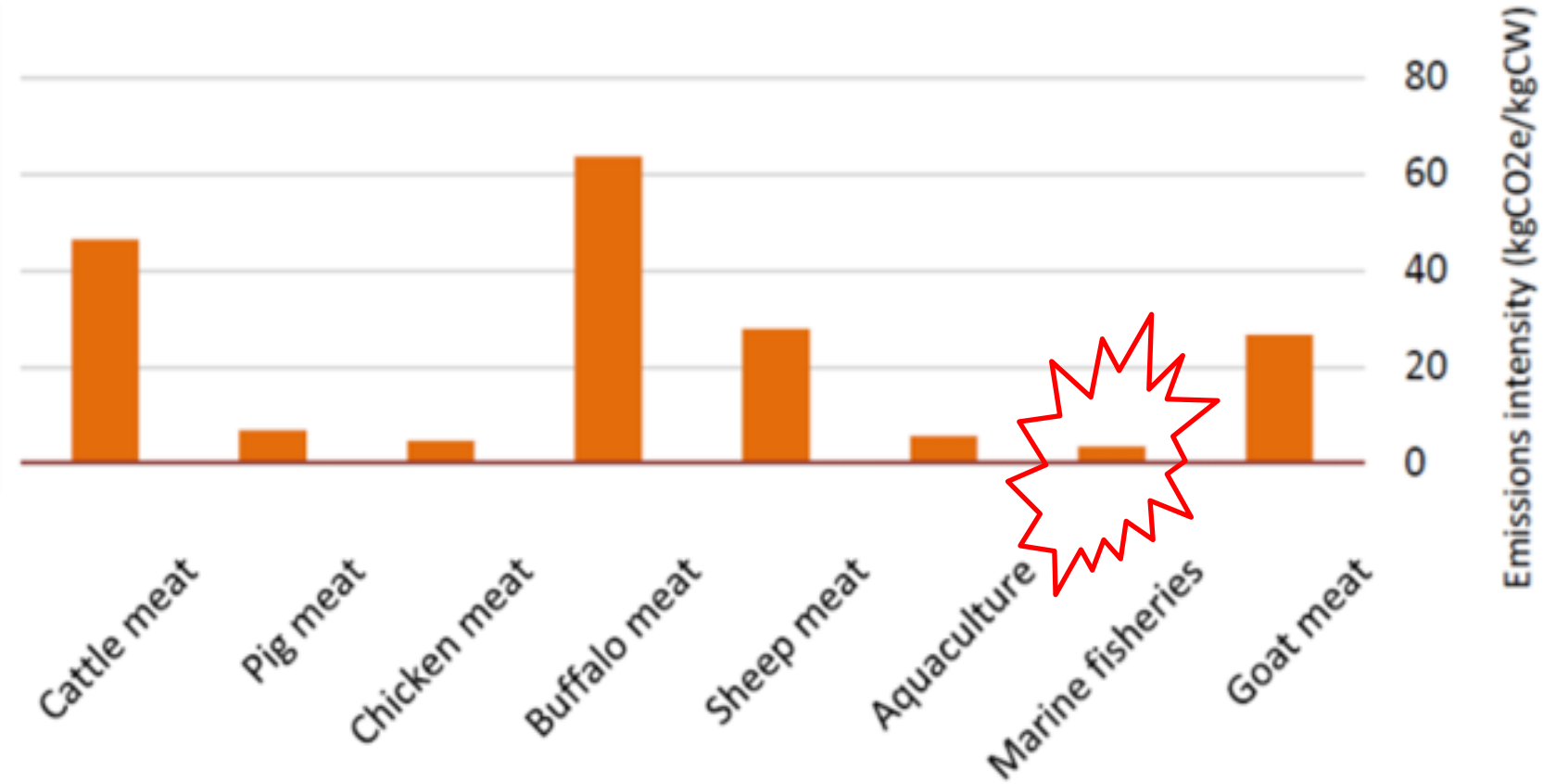
GHG emissions from animal production



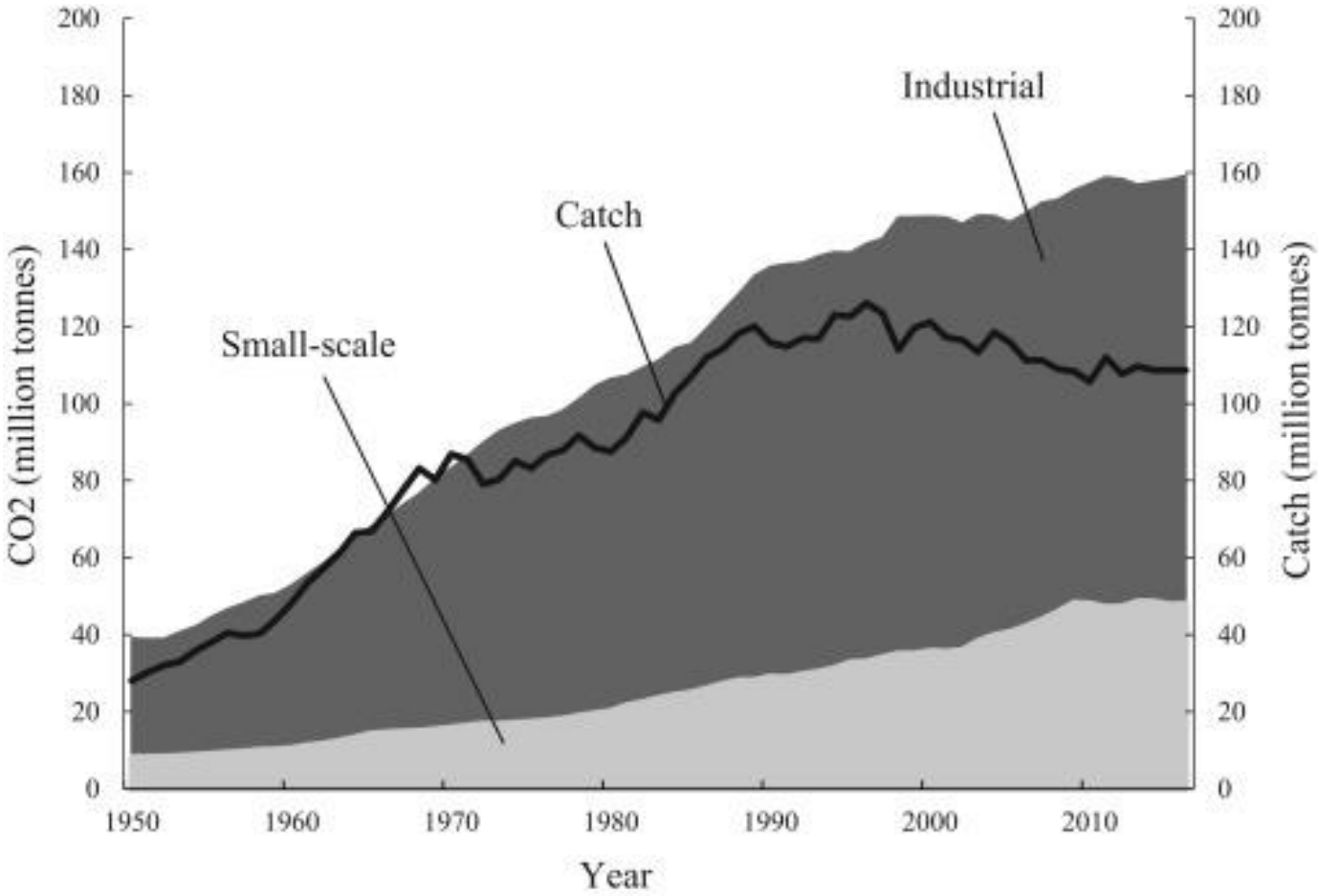
Source: MacLeod et al 2020

Carbon intensity



Source: MacLeod et al 2020

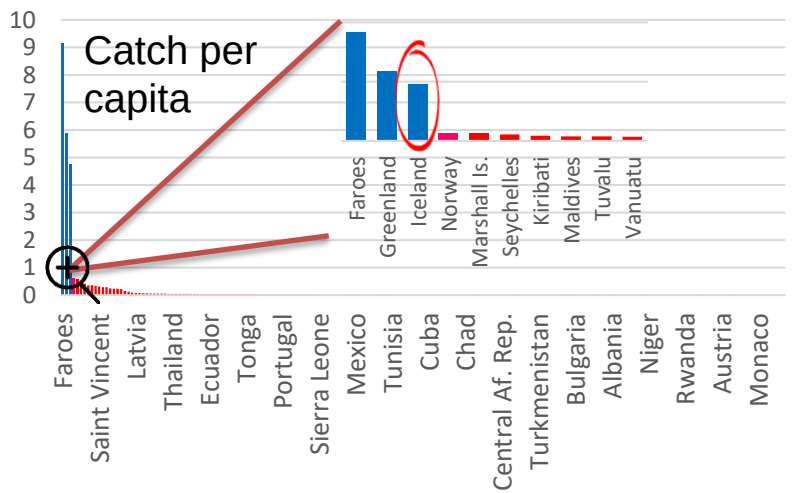
Development of catch and emissions



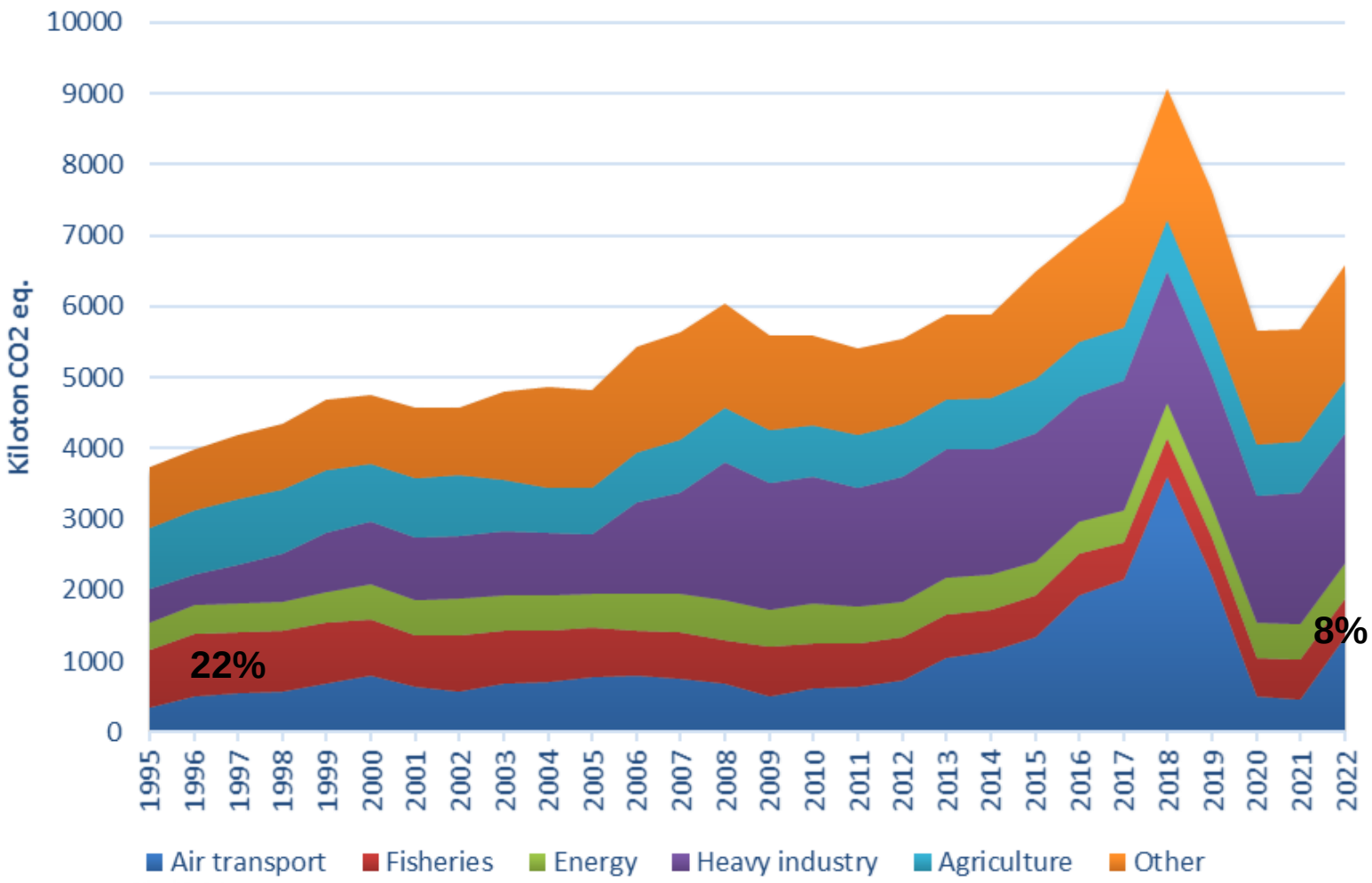
Source: Greer et al 2020

Icelandic fisheries

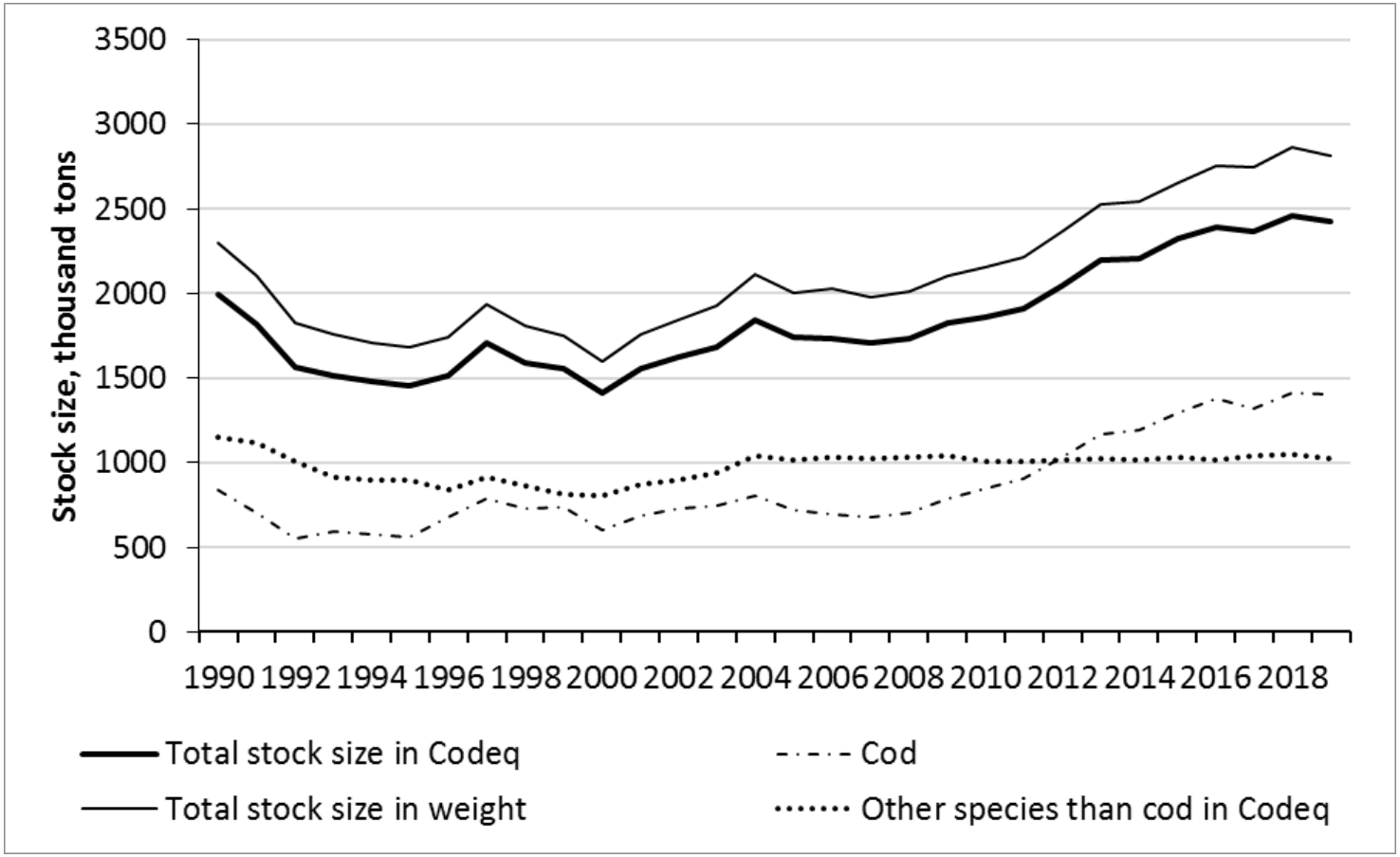
- Among top 20 fishing nations in the world by quantity
- Multi species fishery
- Quota regulated since 1984
- Mostly industrial and very consolidated
- TAC regulated by harvest rule
- Very profitable



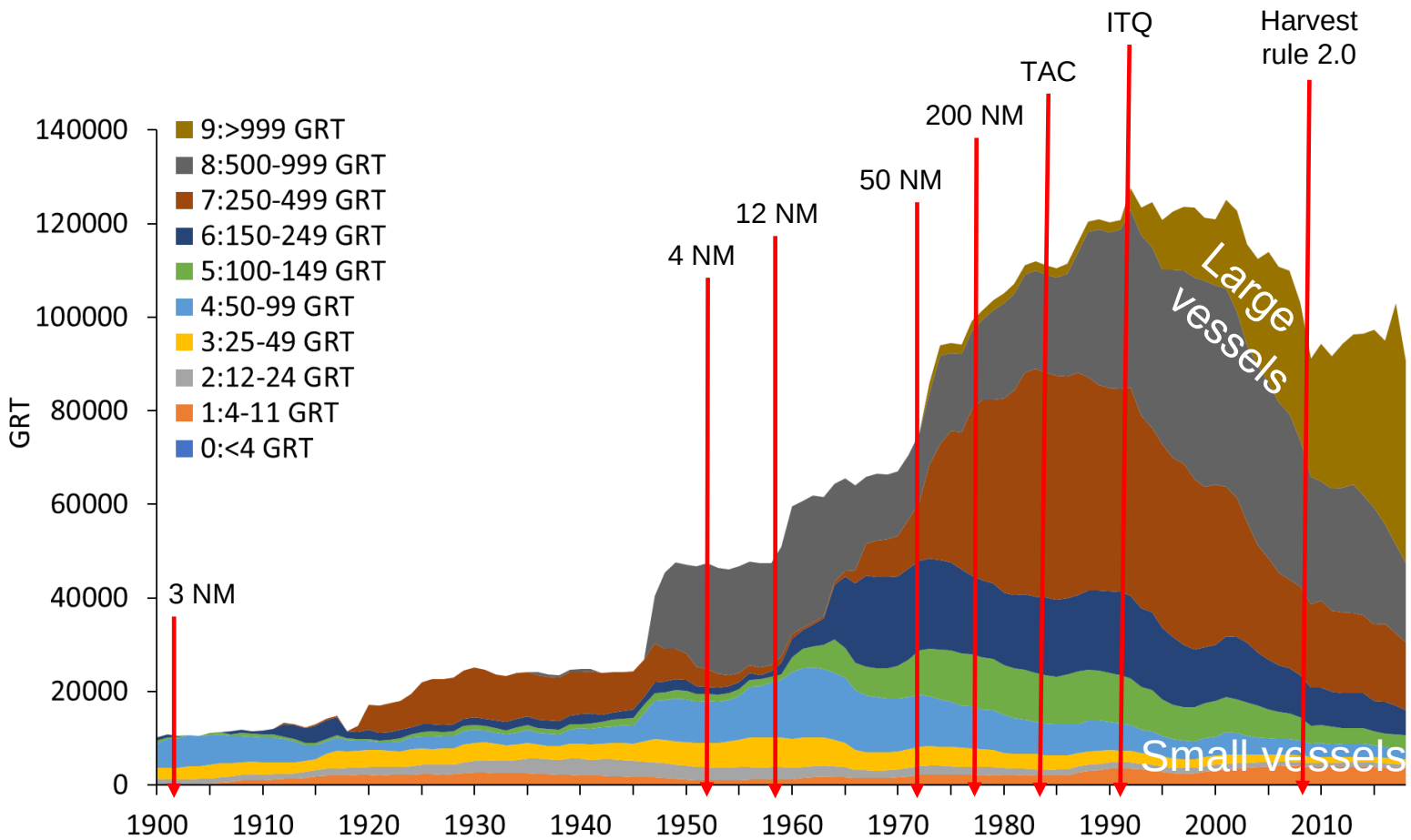
Iceland´s story



Stock size development



Icelandic fishing fleet- GRT



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Source: Hreiðar Þór Valtýsson
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Factors that might affect carbon intensity in fishing

- Management system
- Gear
- Vessel type
- Technology
- Carbon pricing
- Stock size

How much does each factor contribute?

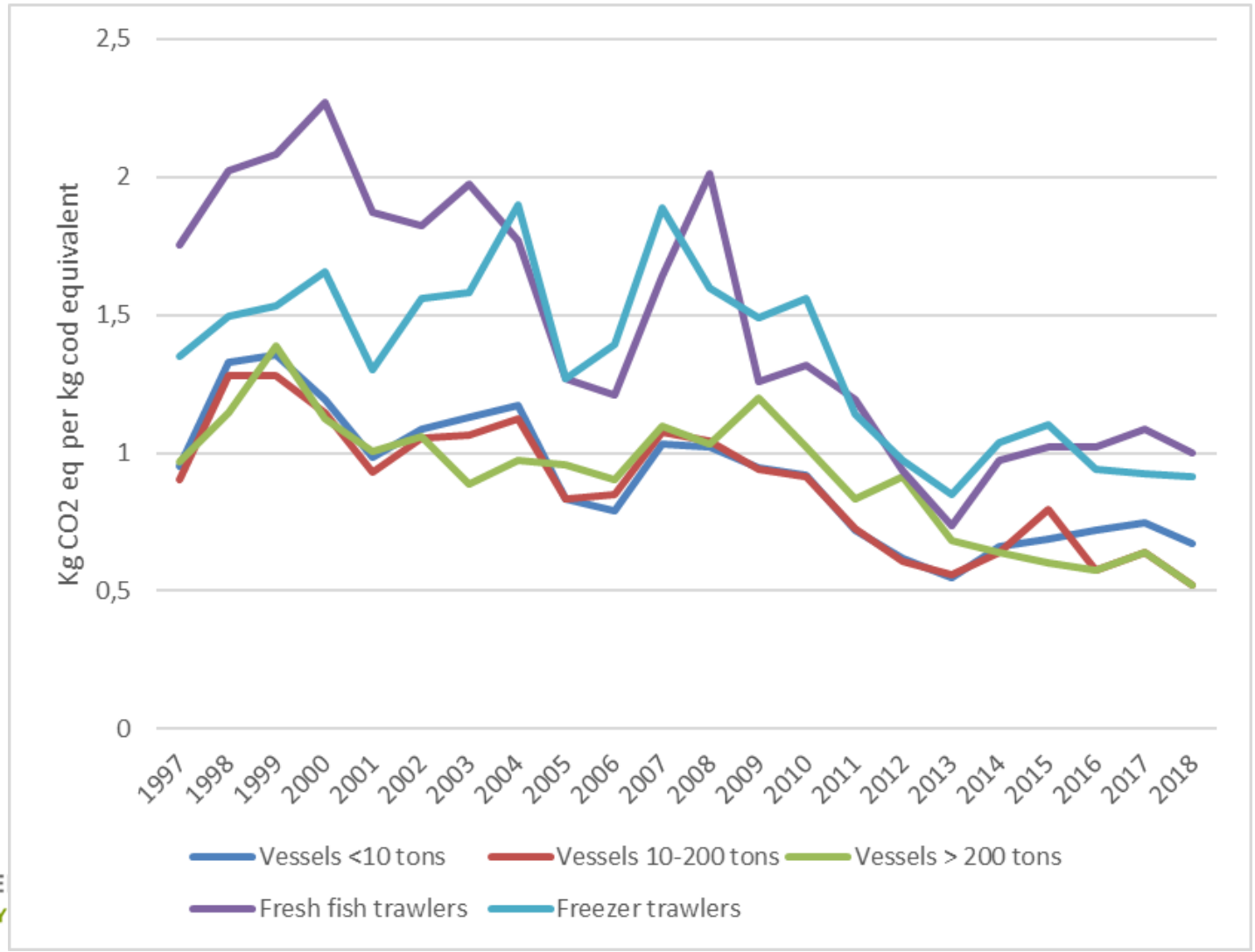
Study focus

- Focus on the Icelandic demersal fishing by fleet segment
- Study period 1997 to 2018
- Quantity aggregation based on cod equivalents
- Carbon intensity based on kg CO2 eq. per kg catch in cod equivalent

Data

- Emission data from the Icelandic Environmental Agency
- Input, output and price data from Statistics Iceland
- Stock size data from Icelandic Marine Research Institute

Development of carbon intensity



Change over the period

	1997 to 2000	2015 to 2018	Change
Weighted average of all demersal fisheries	1.47	0.89	-39.5%
Boats <10 GRT	1.21	0.71	-41.4%
Boats 10 to 200 GRT	1.15	0.63	-45.1%
Boats >200 GRT	1.16	0.58	-49.5%
Fresh fish trawlers	2.03	1.03	-49.2%
Freezer trawlers	1.51	0.97	-35.7%

Model

- We estimate the relationship between emissions and fishing using an implicit production function derived from:

$$\max_{y,x}\{p'y - w'x\}$$

$$\text{S.t.}$$

$$g(y, x, z, e, \bar{y}) \leq 0$$

$$z = z_0$$

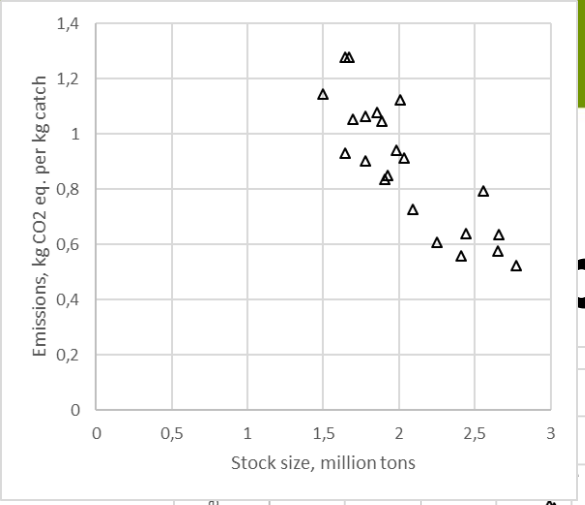
$$y \leq \bar{y}$$

y is output (regulated by a quota $\bar{y}$), x is input, z are environmental factors and e are emissions and p and w are prices

Statistical results

Gear type	Stock size	Trend	Total quota	Fuel price	Fish price
Passive	-0,97	0,0009	0,96	-0,44	0,50
	(-3,45)	(0,07)	(-57,81)	(-8,03)	(-4,27)
Active	-0,95	-0,0216	0,87	-0,13	0,44
	(-2,20)	(-1,21)	(-20,56)	(-1,53)	(-2,44)

t-values in parenthesis



bon intensity and stock size

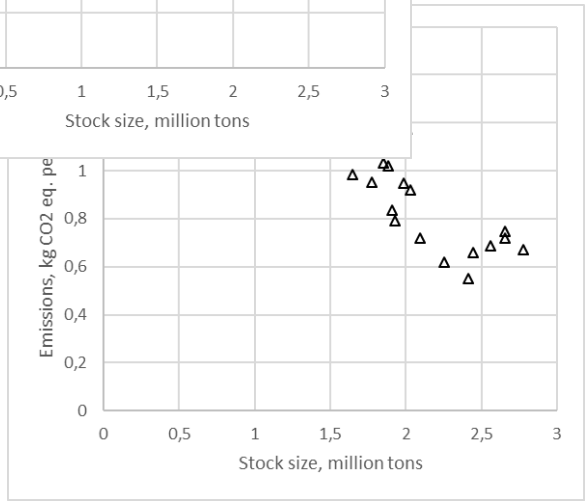


Figure 2a. Coastal vessels <10 GRT.

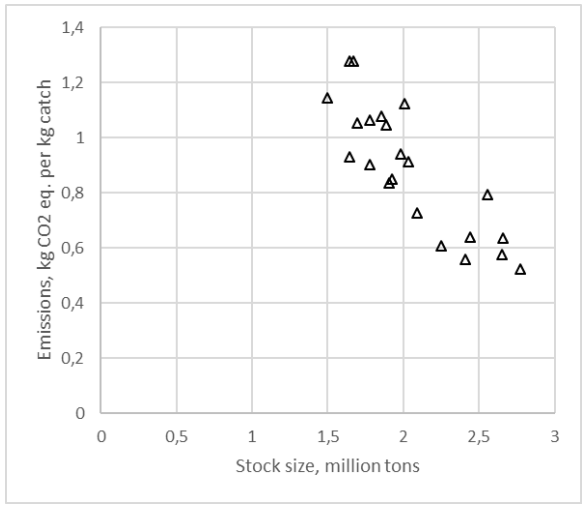


Figure 2b. Vessels 10<200 GRT

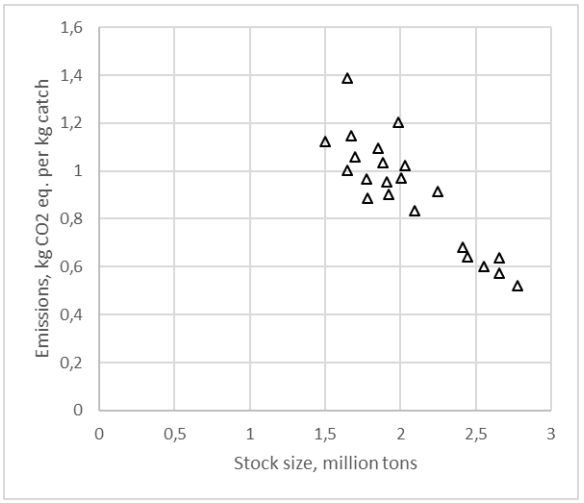


Figure 2c. Vessels >200 GRT

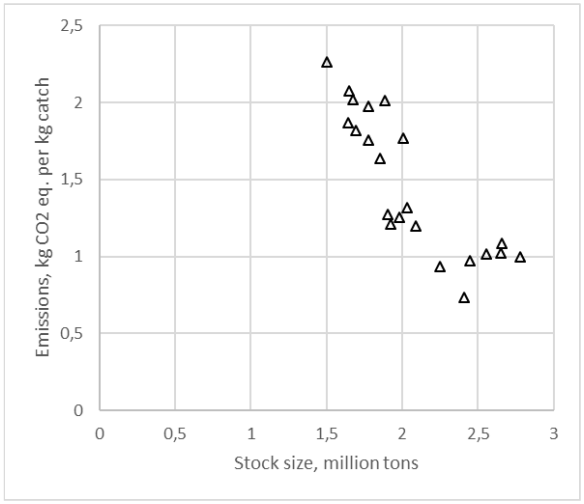


Figure 2d. Fresh fish trawlers

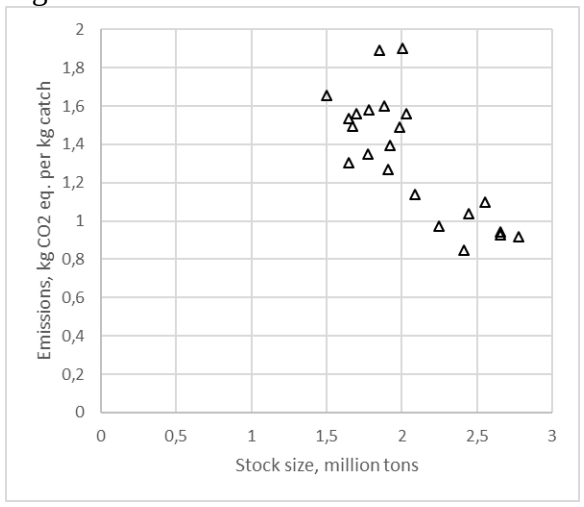


Figure 2e. Freezer trawlers

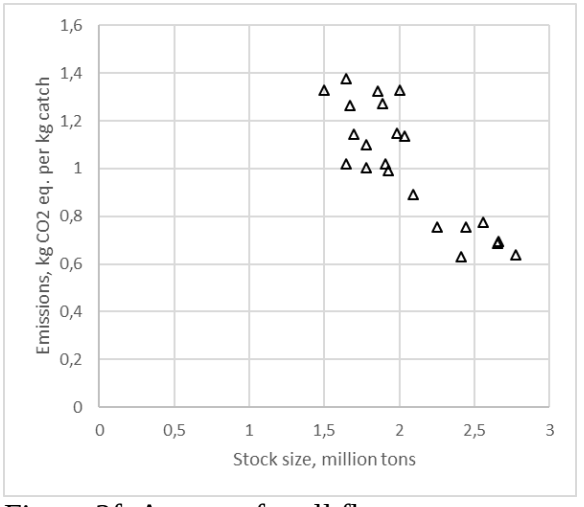


Figure 2f. Average for all fleet segments

Conclusion

- There has been a dramatic reduction in carbon intensity in the demersal fishery in Iceland
- It is most clearly related to stock size and scale
- Carbon pricing has also affected emissions
- Technology has played a minor role (why?)
- Nations can reduce emissions, increase output and improve profitability by improving fisheries management