What role can Scottish-caught pelagic fish play in delivering a climate smart future?

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Climate change

Concentrations of greenhouse gasses (GHGs) are at the highest level in the last 20 million years.

This overall warming of 1.25° C since 1880 has been projected to have devastating worldwide effects and there are already world wide consequences ranging from increased incidence of droughts through to rising sea level.

Consequently, there is an urgent need to limit the global warming to below 1.5° C - 2° C to avoid wide scale biodiversity loss and ensure we remain able to produce enough food to feed the growing human population.

The goal of net zero global carbon emissions by 2050 has been set by the UN Framework Convention on Climate Change, with Scotland now committed to net zero by 2045.

Food and climate change

One of the largest contributors to GHG emissions is the global food production sector, which is estimated to produce 21-37% of the total human created GHG emissions worldwide

9- 14% of this is attributed to crop and livestock agricultural activities, and 4% from seafood production.

It is estimated that the increase in demand for food could cause GHG impacts to rise by as much as 40% by 2050.

In order to avoid the potentially catastrophic effects of climate change we need to identify 'climate smart' food sources:

- Food sources that have a low or neutral carbon footprint
- Are robust against climate change
- Can be sustainably increased to meet demand

My PhD: What role can Scottish caught pelagic fish play in delivering a climate smart future?

Fisheries for small pelagic fish play an important part in Scottish economy

- 285 thousand tonnes of pelagic fish worth £202 million were landed by Scottish vessels in 2018

Small pelagic fisheries have been seen to have a relatively low carbon footprint and low environmental impact in other fisheries around the globe.

Therefore high potential as a climate smart food source to help address the need to achieve net zero

The aims of this PhD thesis are two-fold:

- to estimate the full climate smart environmental impacts of Scottish-caught pelagic fish;
- to determine how Scottish-caught pelagic fish can contribute towards climate smart food production

Life Cycle Assessment

I assessed the climate related impacts of Scottish caught pelagic fish

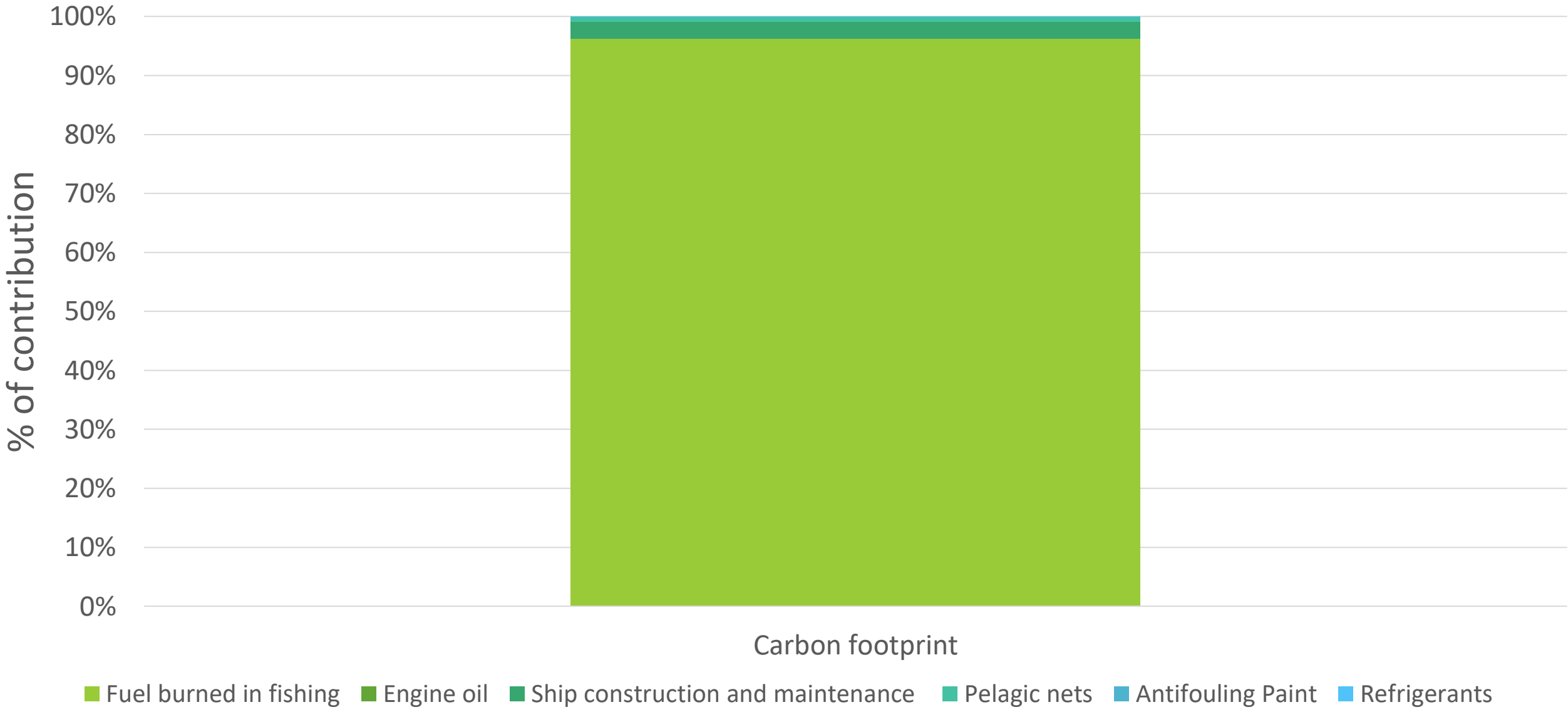
To do this I looked at:

- All of the raw materials and energy used to build the ship, nets etc and associated GHG emissions etc
- All of the activities that cause GHGs/negative impact on the environment
  - Use of consumables
  - Fuel burning
  - Refrigerants
- Total catch

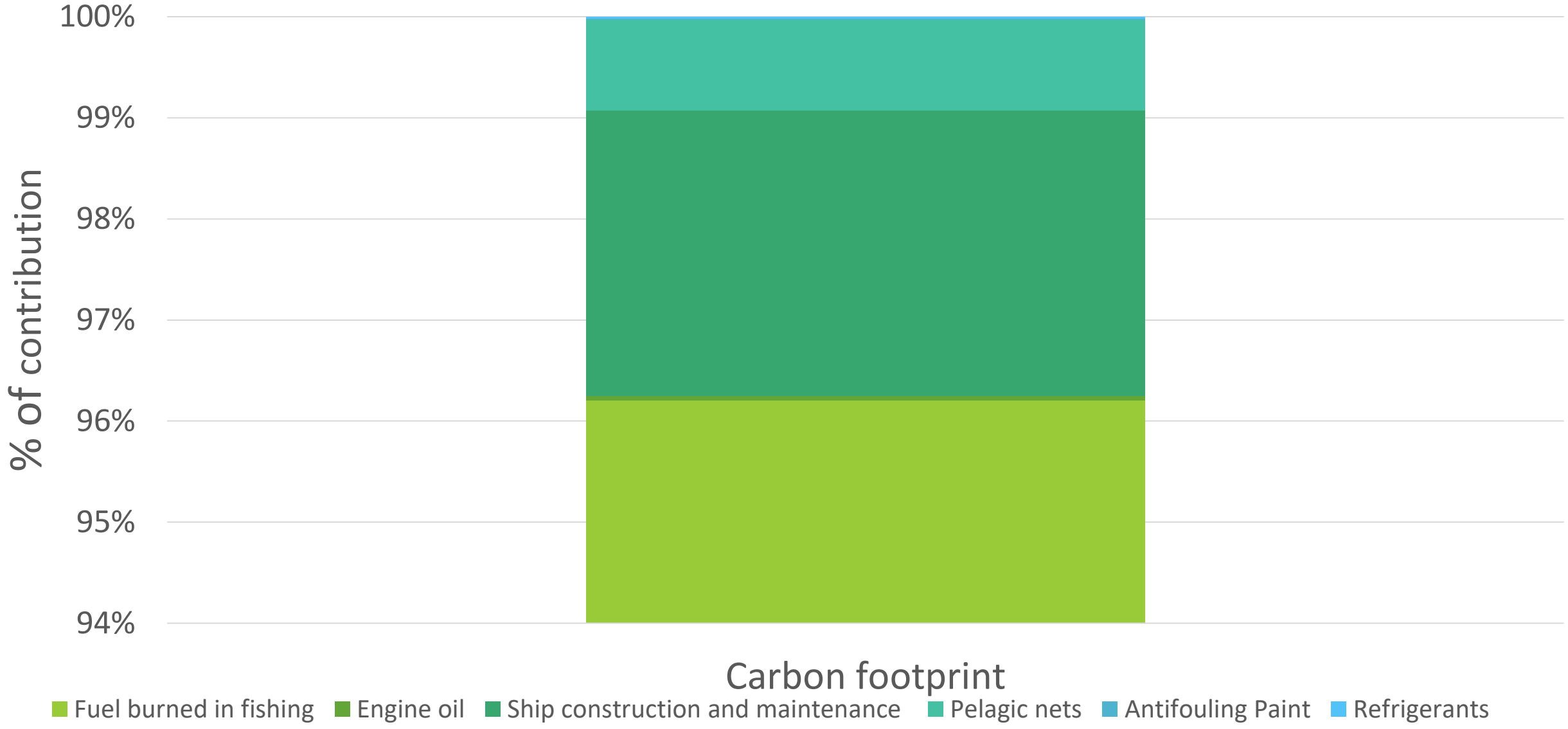
Full Impact indicators explored in PhD

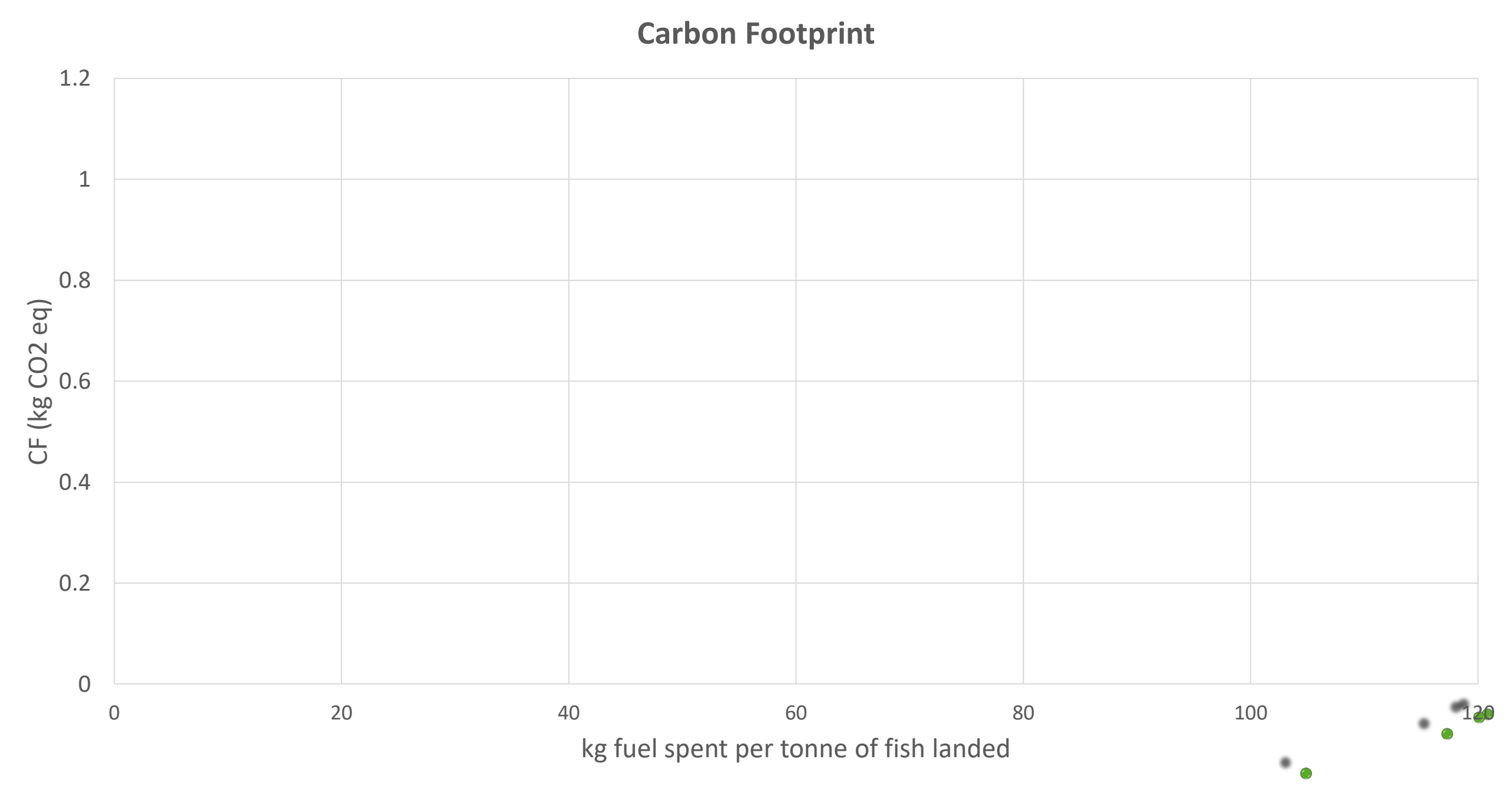
- Abiotic depletion ADP
- Abiotic depletion (fossil fuels) ADPFF
- **Carbon Footprint**
- Ozone layer depletion ODP
- Human toxicity HTP
- Fresh water aquatic ecotoxicity FETP
- Marine aquatic ecotoxicity METP.
- Terrestrial ecotoxicity TETP
- Photochemical oxidation formation POMF
- Acidification AP
- Eutrophication EP

Component contribution to the carbon footprint of Scottish caught pelagic fish



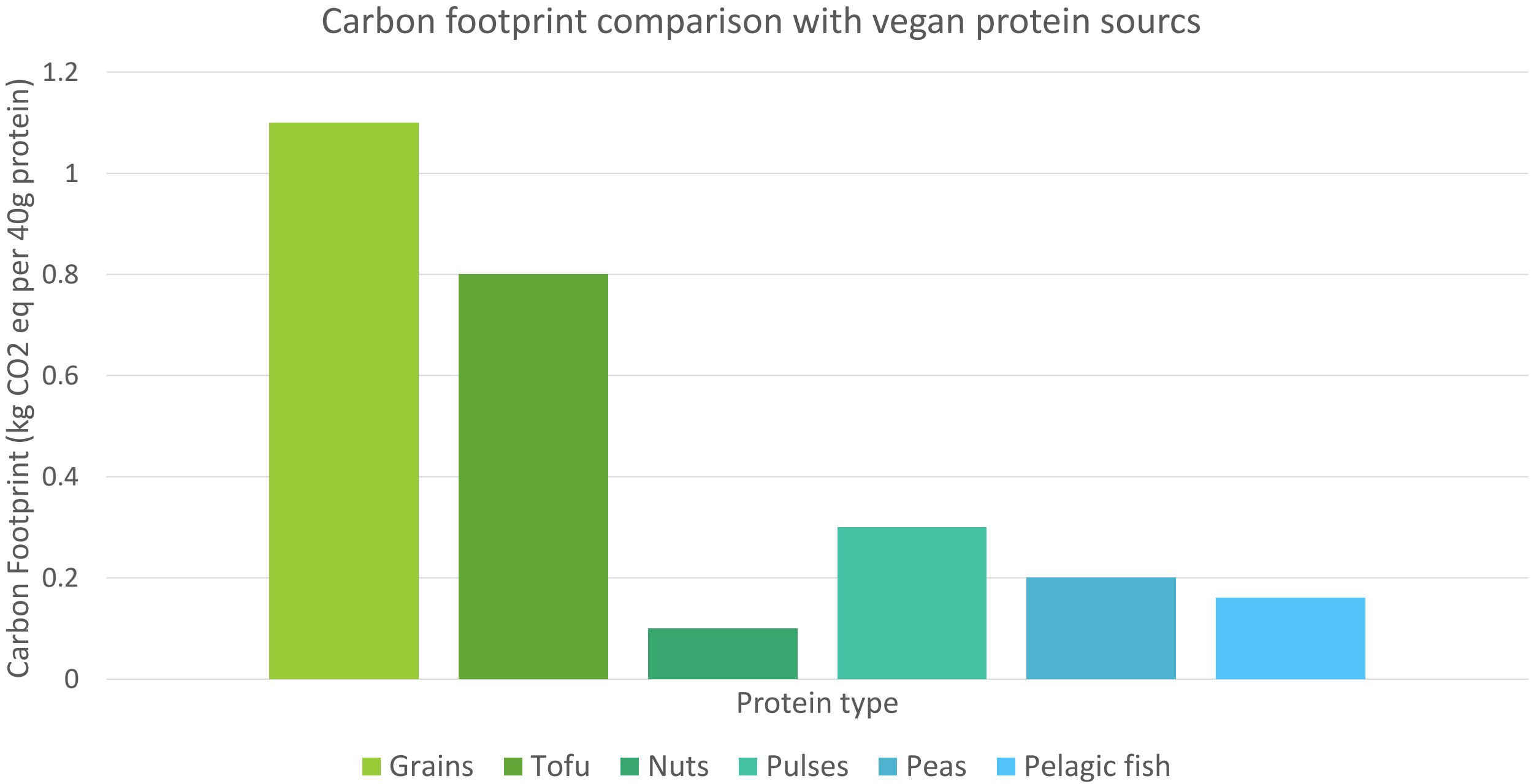
Component contribution to the carbon footprint of Scottish caught pelagic fish



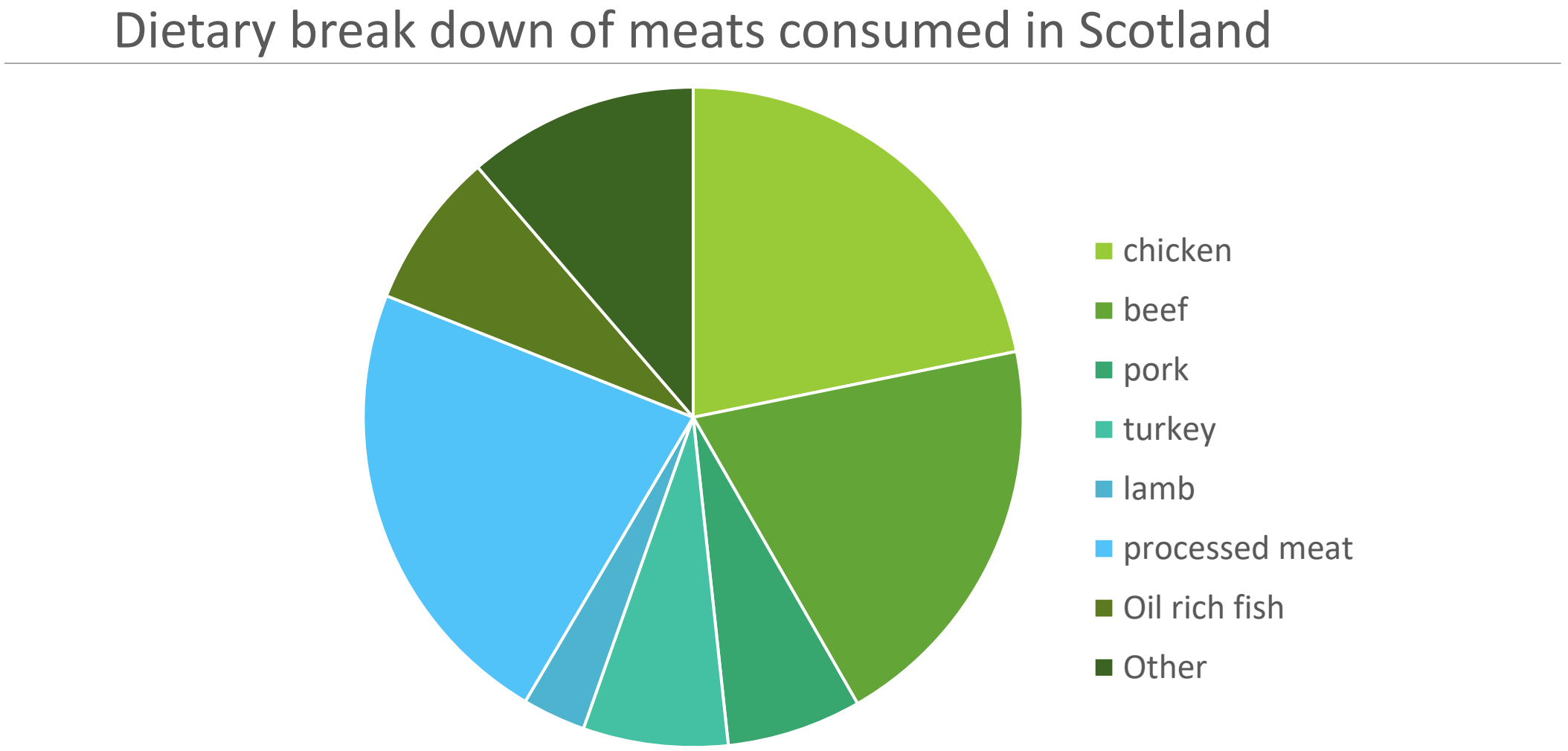

Carbon Footprint
1.2
1
0.8
0.6
0.4
0.2
0
CF (kg CO2 eq)
0
20
40
60
80
100
120
kg fuel spent per tonne of fish landed

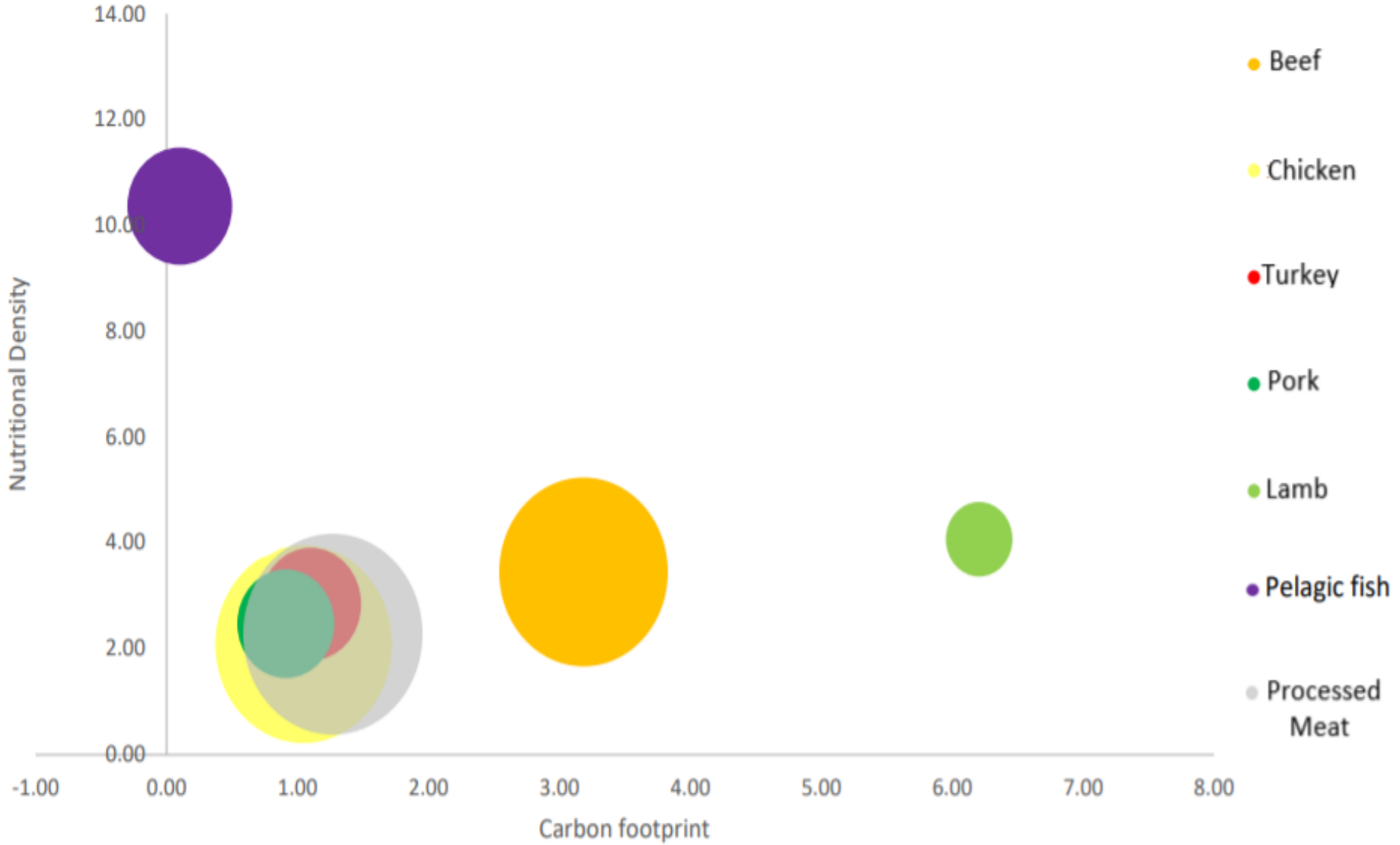
How does pelagic fish compare to other meat sources?

Fish type	Place of study	Fishing method	Carbon Footprint (kg CO_2eq per kg of meat)
Atlantic Mackerel	Basque Country	Purse seine	Typically, > 0.200
Small pelagic	Scotland	Pelagic trawl	0.452
Atlantic Mackerel	Galicia	Purse seine	0.61
Horse Mackerel	Galicia	Purse seine	0.797
Atlantic Mackerel	Galicia	Pelagic trawl	0.88
Cod	Norway	Mixed	1.6
Haddock	Norway	Mixed	1.75
Horse Mackerel	Galicia	Bottom trawl	2.28
Farmed Salmon	UK	Farmed	3.27
Pork	Netherlands	Farmed	4.59
Chicken	Netherlands	Farmed	5.99
Turkey	Global	Farmed	6.04
Beef	Global	Farmed	26.61
Lamb	England and Wales	Farmed	27.91
Shrimp	Senegal	Trawl	~29


Carbon footprint comparison with vegan protein sourcs
Carbon Footprint (kg CO2 eq per 40g protein)
1.2
1
0.8
0.6
0.4
0.2
0
Protein type
Grains
Tofu
Nuts
Pulses
Peas
Pelagic fish

The Scottish diet

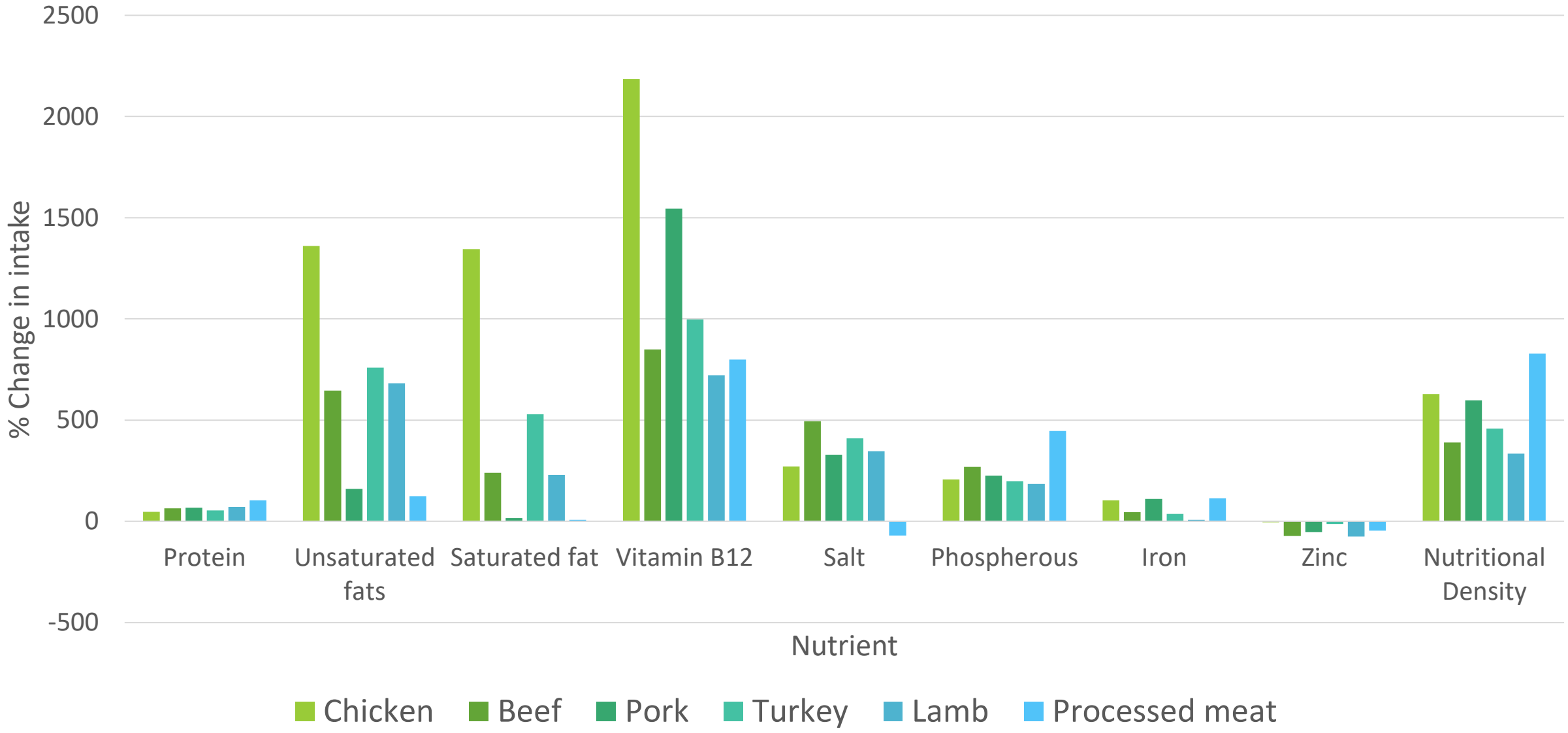



14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Nutritional Density
-1.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
Carbon footprint
Beef
Chicken
Turkey
Pork
Lamb
Pelagic fish
Processed Meat

So what happens if we start eating more pelagic fish?

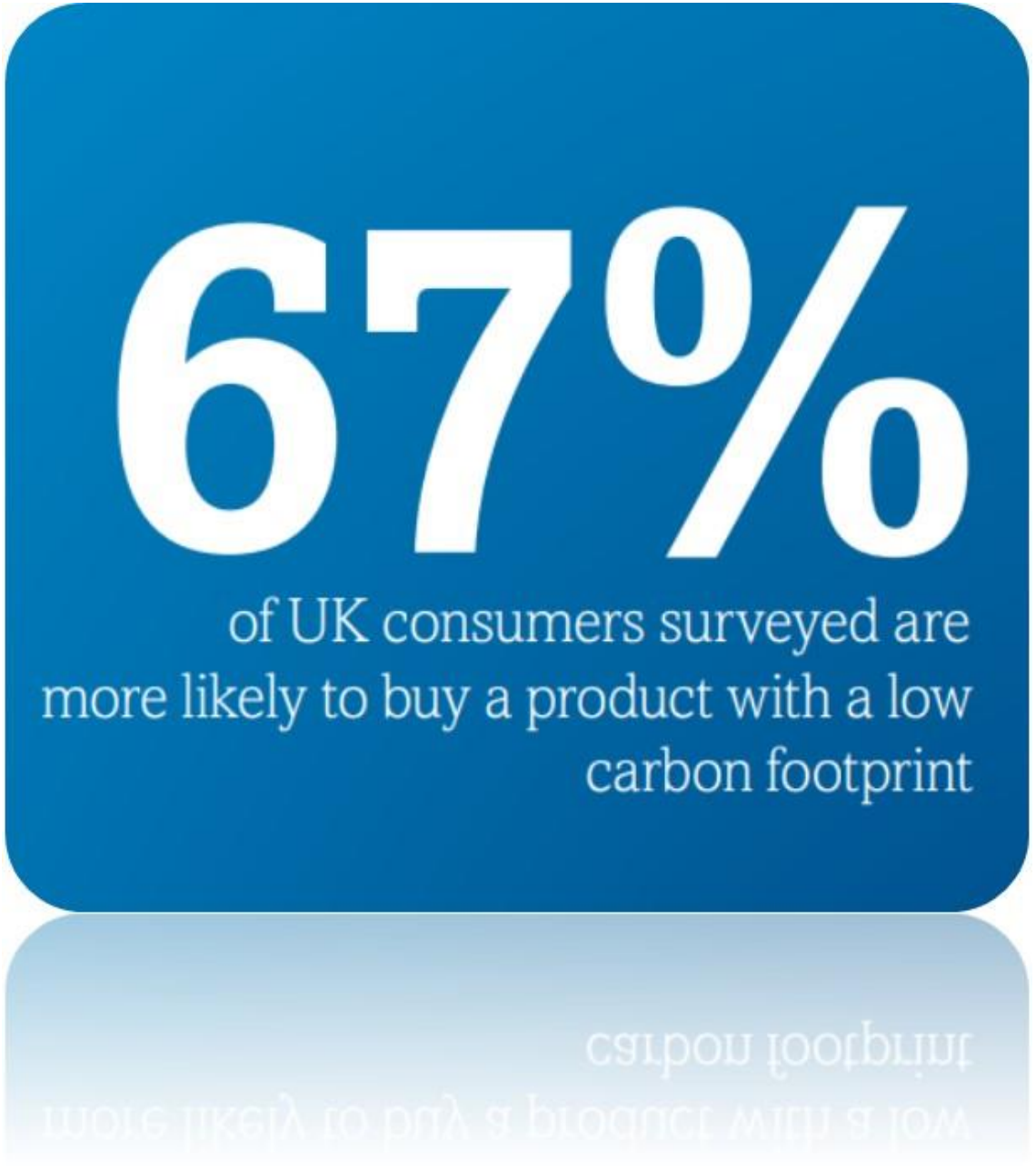
Meat consumption level	Substitute for 1 weekly meal of beef	Substitute for 1 weekly meal of chicken	Substitute for 1 weekly meal of processed meats	Substitute for 1 weekly meal of turkey	Substitute for 1 weekly meal of lamb	Substitute for 1 weekly meal of pork
Medium meat consumption	CF reduced by 30%	CF reduced by 9%	CF reduced by 7%	CF reduced by 3%	CF reduced by 10%	CF reduced by 1%

% Change in nutrient intake caused by subtitling one meal per week of meat for mackerel



How easy is it for the general consumer to identify climate smart seafood?

- Consumers typically use ecolabels to identify sustainable and ethical produce
- Often consumers do not know the full details of what an ecolabel covers, but trust in its general message
- Many ecolabels self identify as being representative of sustainable produce.
- But is climate change included in their definition of sustainability?



Source: Carbon Trust (2019)

Fully included | Partially included | Non-essential inclusion only | Related criteria included | Promotes the use of renewable energy | Not included

0%	3%	7%	7%	31%	52%
	FARMED RESPONSIBLY asc CERTIFIED	FRIEND OF THE SEA QUALITY TROUT UK	KRAV ORGANIC pasifika CERTIFIED	SOIL ASSOCIATION ORGANIC STANDARD Maatlat Duurzame Aquacultuur Australian Certified Organic GAP GLOBALG.A.P. VietGAP Naturland AsureQuality	BIOSUISSE RESPONSIBLE FISHING SCHEME demeter Aboriginal Principles for Sustainable Aquaculture CERTIFIED MSC www.msc.org ALASKA SEAFOOD FISHERIES AEL CERTIFIED bio gro ORGANIC Fair Trade USA FOOD ALLIANCE CERTIFIED Good Aquaculture Practices GAP FOR FISH FARMING Marine Eco-Label Japan BEST AQUACULTURE PRACTICES CERTIFIED

Conclusion

Are Scottish caught pelagic fish climate smart?

- They have comparably low CF to both other fisheries and to terrestrial meats and this suggests they have good potential to be considered climate smart

Can they play a part in improving the Scottish diet?

- Yes! Increasing consumption of pelagic fish over other more commonly consumed meat products can substantially increase nutrient intake and have a marked reduction on associated CF as well!

But seafood ecolabels need to catch up to help the general public support good practice in terms of low climate impact.

- Failure to do so might result in masking bad practices, and reputational damage if the public were to assume that their definitions of sustainability included climate change

And thank you for listening!