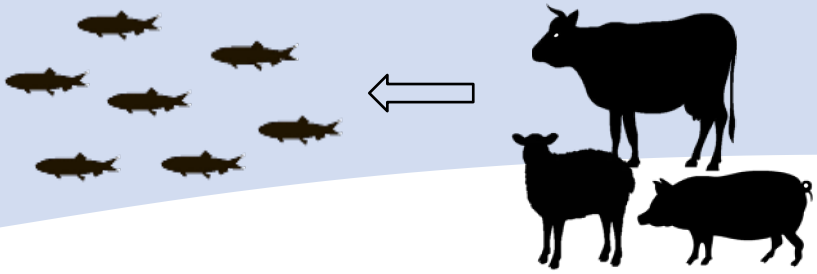
Potential health benefits of replacing red meat with forage fish



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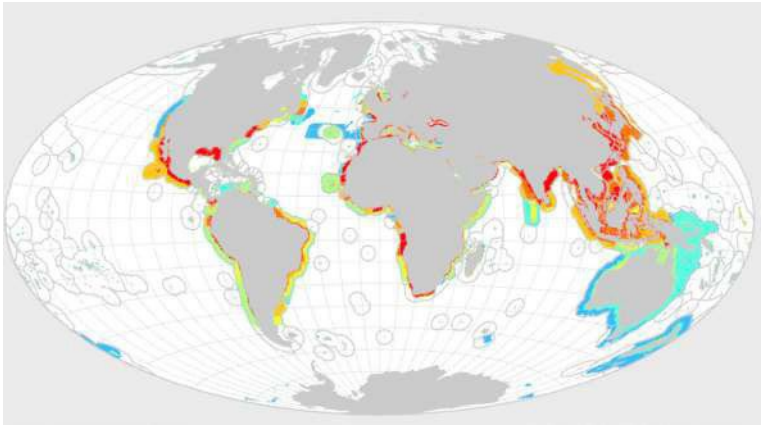
The 29th AIM International Workshop

National Institute for Environmental Studies

Forage fish

https://news.stonybrook.edu/newsroom/pressrelease/general/foragefish/



Sea Around Us data

Forage fish (e.g., sardines, anchovies, and mackerels) form the basis of a healthy marine food web—they provide food for larger species (e.g., tuna and whales). Pauly et al. (1998)

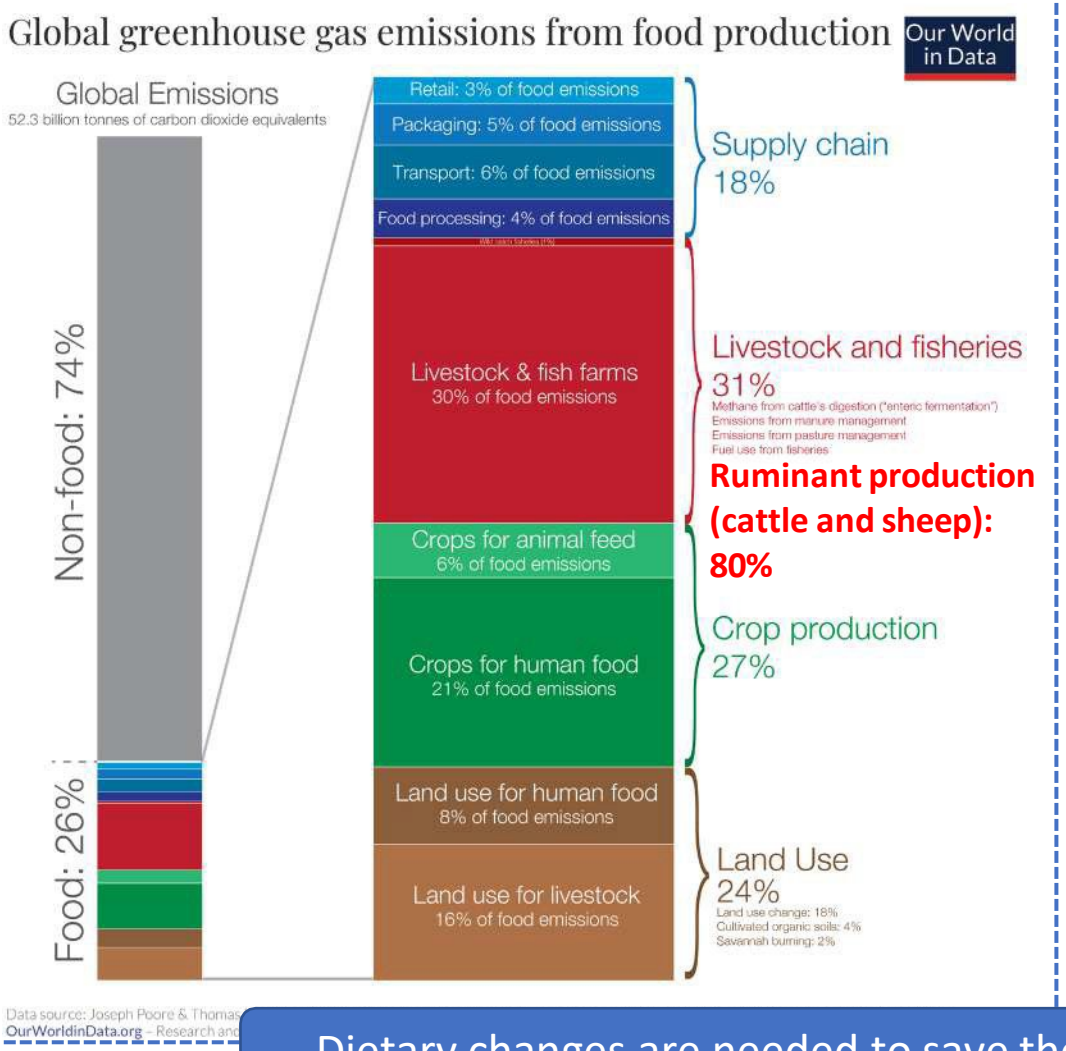
Approximately 30% of the world's total marine capture fisheries landings (by live weight).

Pauly (2019)

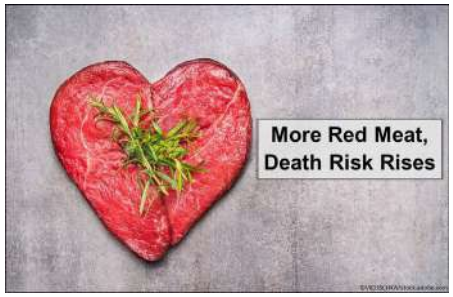
Approximately 74% of forage fish are currently processed into animal feed products called fishmeal and fish oil, rather than for human consumption.

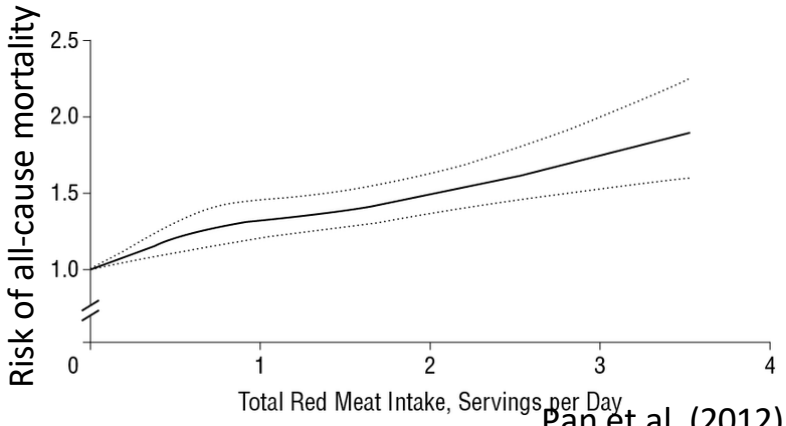
Why replace red meat?

Environmental impacts



Health impacts



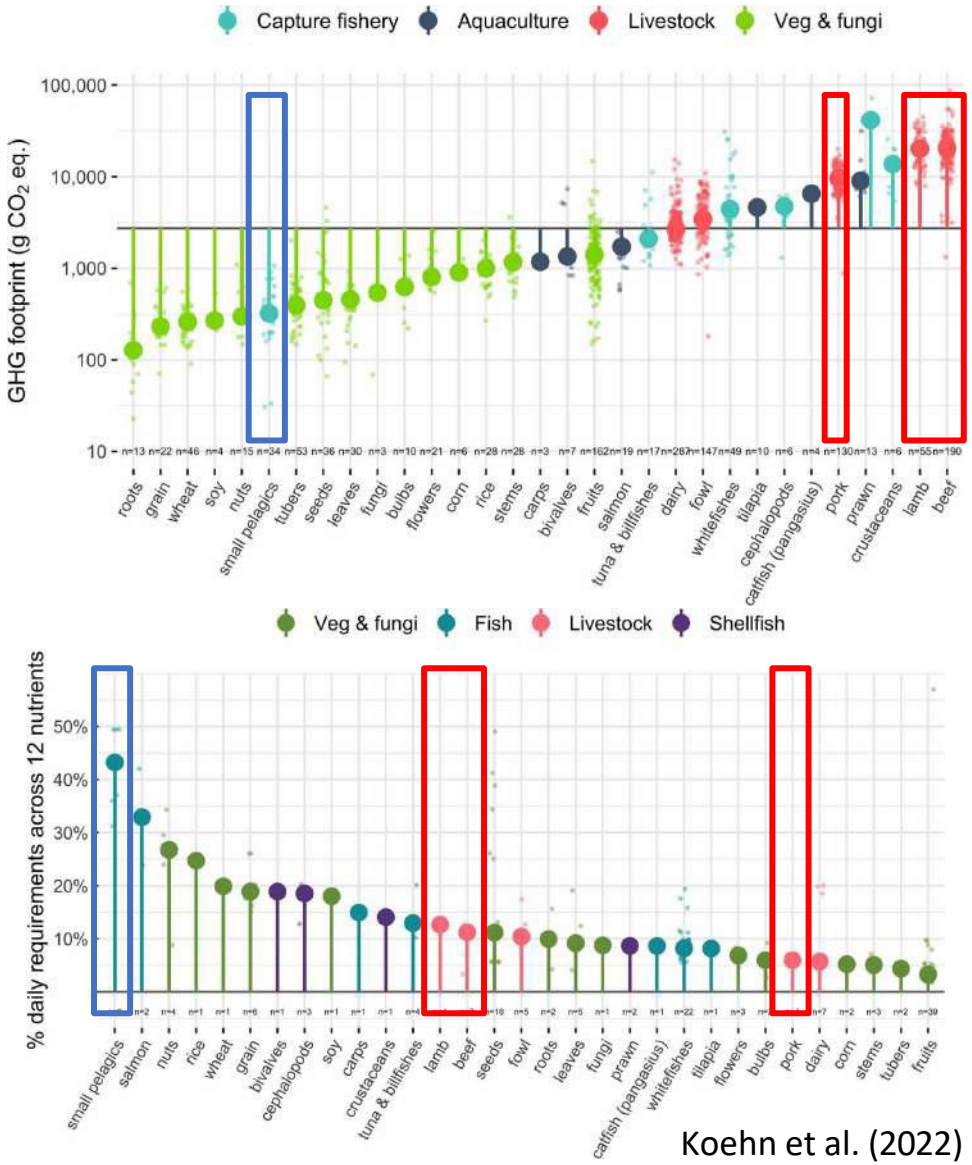


Pan et al. (2012)

Eating red meat (beef, lamb, pork) will increase the risk of heart disease and certain types of cancer

Dietary changes are needed to save the planet and stay healthy

Why forage fish may be an alternative?



Koehn et al. (2022)

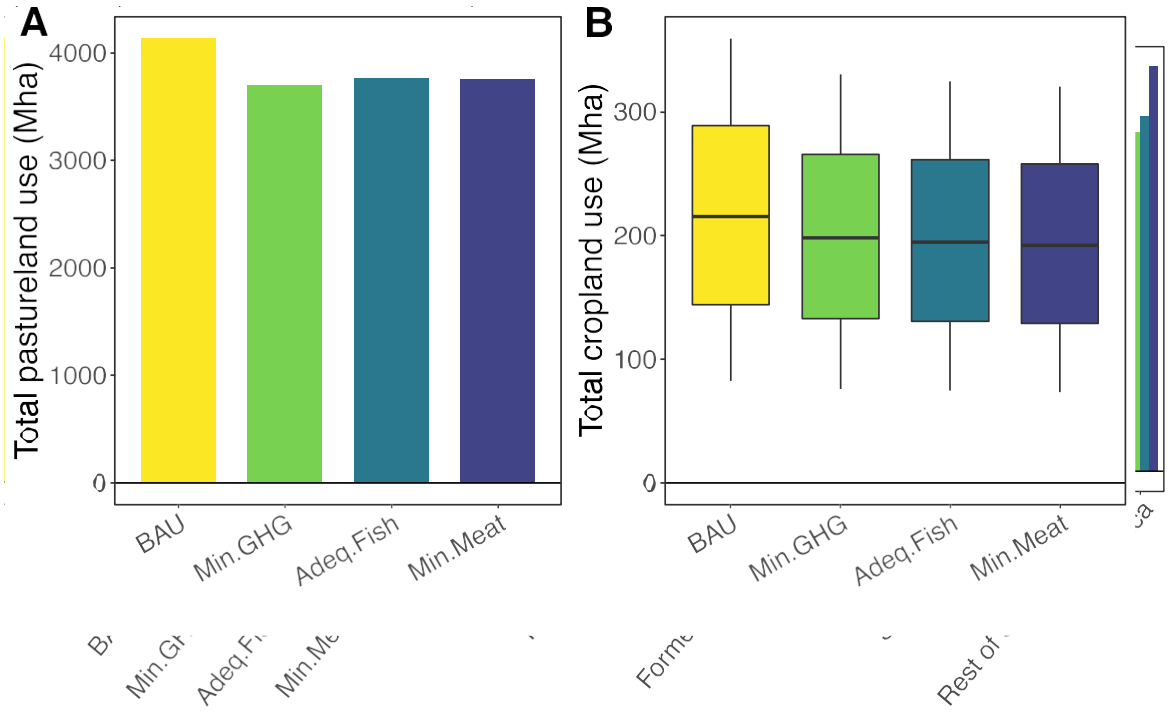
The GHG footprint of forage fish is only one percent of that of ruminants.

Forage fish are the most nutritious animal-source food and are rich in omega-3 fatty acids (DHA and EPA), calcium, and vitamin B12.

The use of forage fish to date: human consumption (26%) and feed aquaculture (74%)

Global emissions

Regional emissions



Xia et al. (2023) *Sustainable Production and Consumption*

- Forage fish supply could replace **10%** of global ruminant meat consumption.
- Such substitution could reduce ruminant-related GHG emissions by up to **15%** globally.

Question: How much may forage fish contribute to human health (nutrition and non-communicable diseases) if they are used for direct human consumption?

Red meat and forage fish Supply

FAO's projection:
Calorie supply for red meat by country in 2050 under business-as-usual scenario (BAU scenario)

Forage fish catch data (last 40 years):
Potential supply of forage fish in 2050 (FAO Fishstat J)

Nutrient concentration:
Red meat: USDA FoodData Central
Forage fish: FishBase

Substitution scenarios

Domestic supply prioritised:
Forage fish were caught for domestic consumption or red meat substitution

Minimised meat intake:
Prioritise substitution in countries with ruminant meat consumption exceeds the recommended value (environment health win-win situation)

Adequate fish intake:
Prioritise substitution in countries with fish consumption below the recommended value

Equal percentage replaced:
Same percentage of red meat was replaced in each country

Analyses

Nutrient intake:

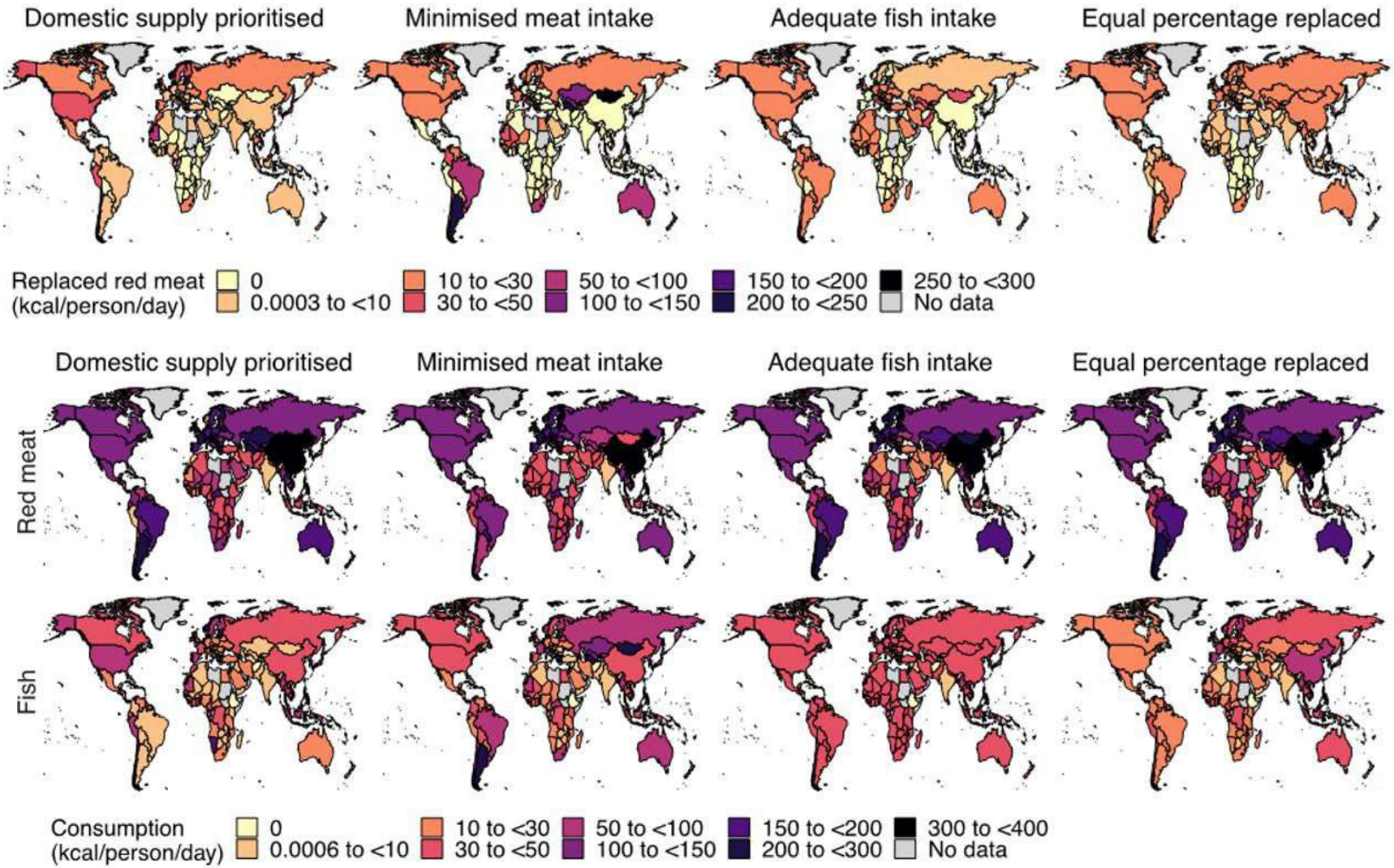
Changes in DHA+EPA, vitamin B12, vitamin A, calcium, iron, selenium, zinc, and protein intake

Non-communicable diseases:

Avoided deaths from ischaemic heart disease (IHD), stroke, diabetes, and colorectal cancer

Method: comparative risk assessment framework

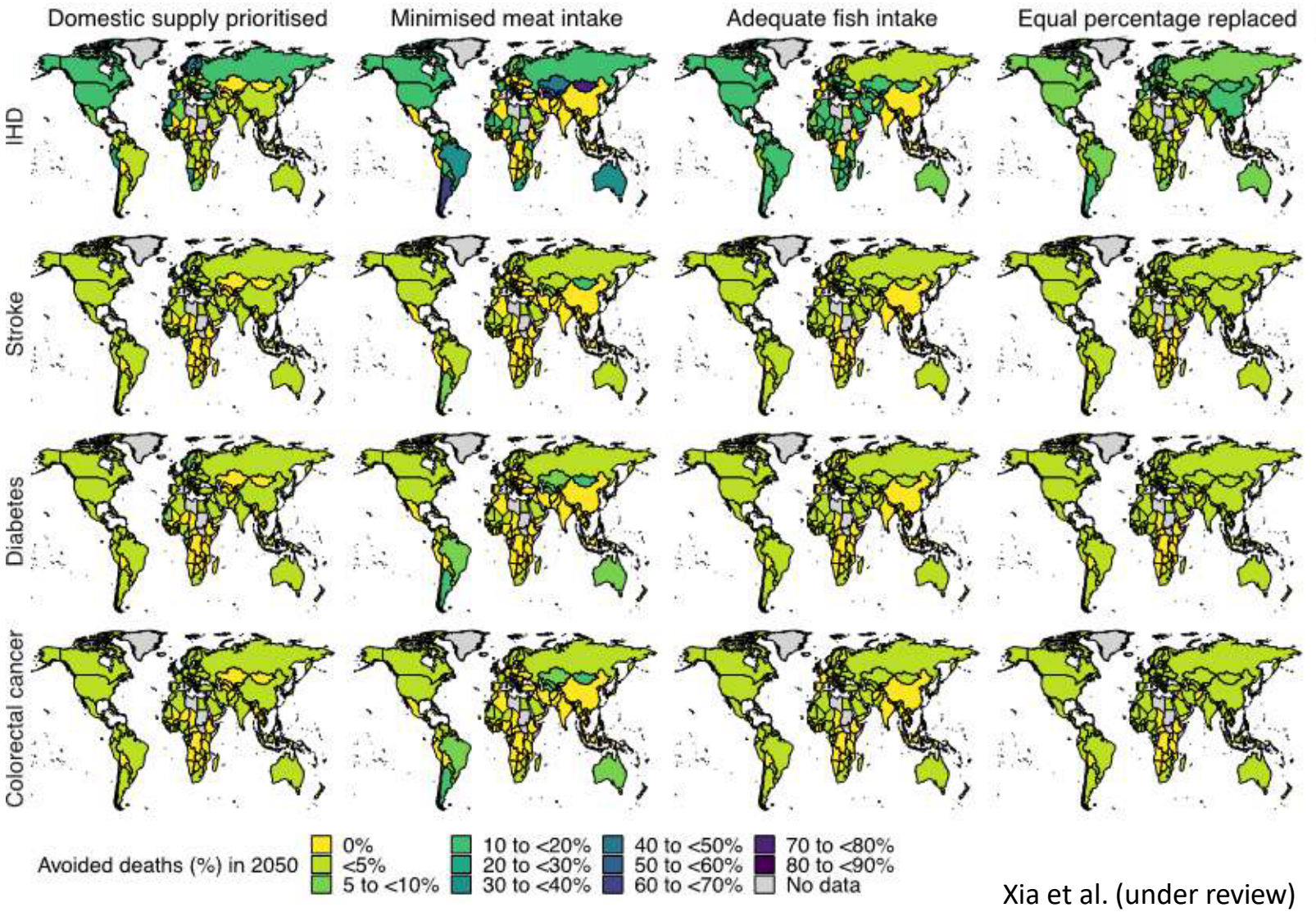
How much of the daily per capita intake of red meat is replaced by forage fish?



Xia et al. (under review)

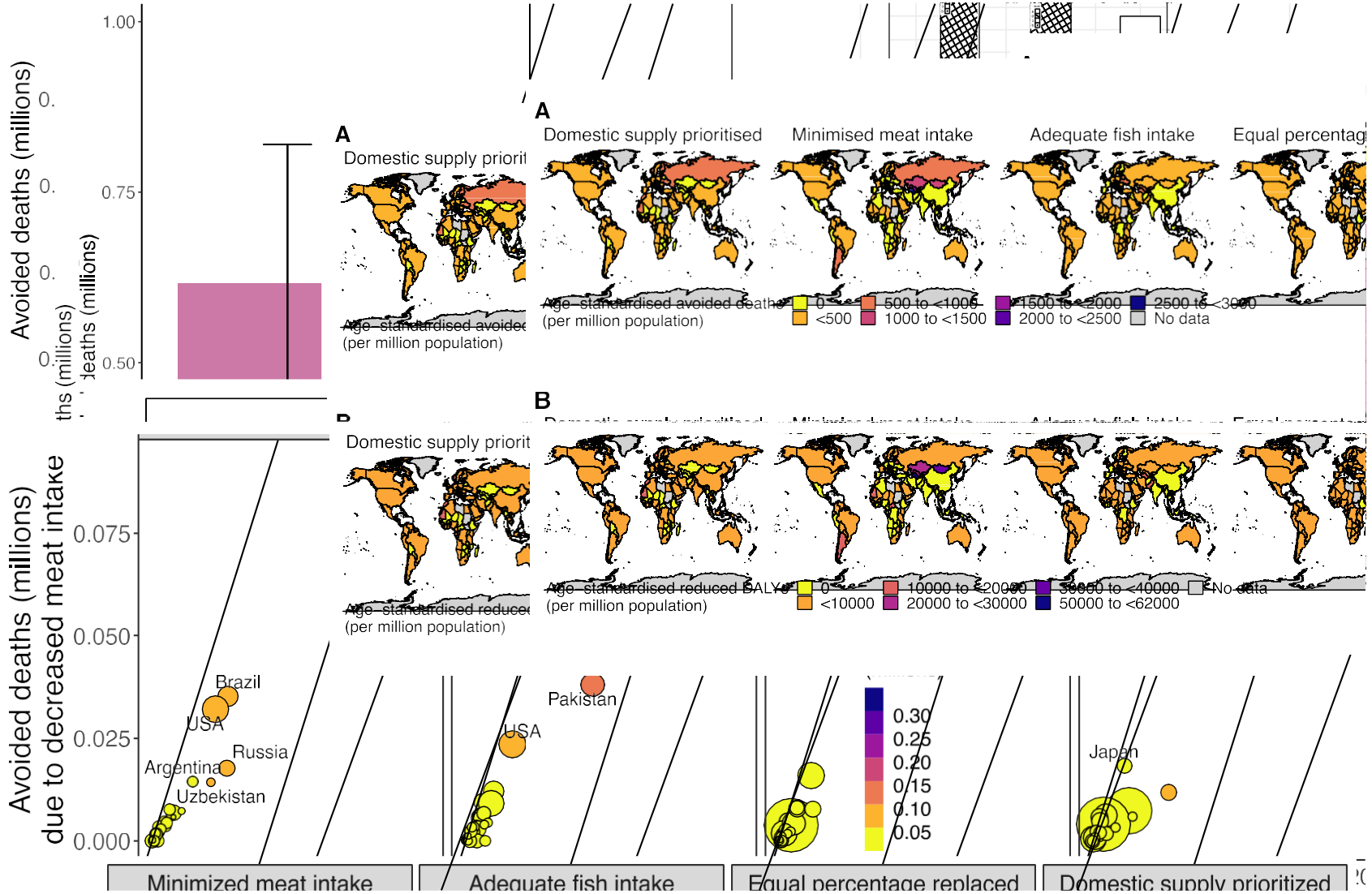
Contribution of forage fish to improving nutrition

Percentage of avoided deaths



Xia et al. (under review)

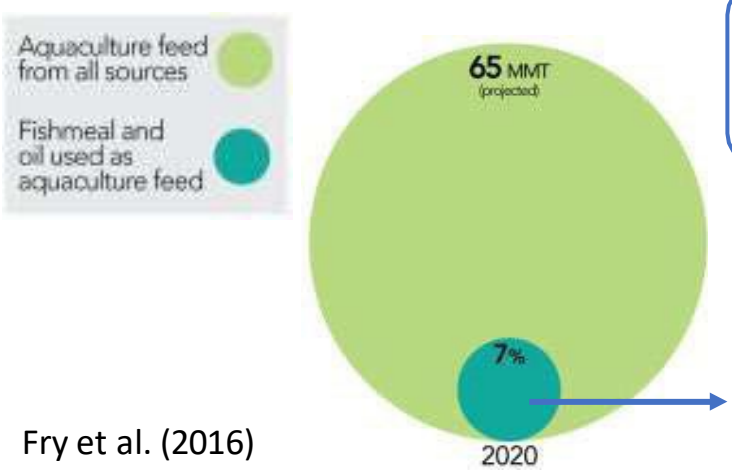
Number of avoided deaths by region and country



Xia et al. (under review)

Concerns about converting forage fish to human consumption

1) May alternative feedstuffs result in an increase in land use?



Fry et al. (2016)

Aquaculture requires significantly less crop than ruminants to produce equivalent edible protein (Froehlich et al. 2018).

This part could be replaced by other feeds (e.g., crops and microalgae) and may not require additional land use.

2) Low level of consumer preference for forage fish as food

Efforts (Fréon et al. 2014): Distributing anchovy surimi in primary schools; Improving canning techniques; Educating consumers about its high nutritional value; Placing climate impact labels on foods.

Question:
How much can forage fish contribute to human health (nutrition and non-communicable diseases) if all of them are used as food?

- Depending on the distribution of forage fish, for many regions, eating less meat and more forage fish can fill or greatly reduce gaps in **DHA+EPA**, and **vitamin B12** intake.
- Such a substitution may avoid **0.5–0.75 million** (2%) deaths globally.

→ Forage fish can be part of a portfolio of sustainable dietary solutions, and help achieve the SDGs (SDG3: good health and well-being, and SDG13: climate action).

→ Policies targeting the allocation of forage fish to regions where they are needed (e.g., the Global South), could be more effective in maximising the potential of forage fish.