

What's the carbon footprint of owning pet fish? An expert explains

September 27 2023, by William Perry



Credit: AI-generated image ([disclaimer](#))

While the environmental impact of having dogs and cats as pets has been examined to some extent, the impact of keeping pet fish has remained unexplored—until now.

Dogs in particular have a significant carbon "pawprint." An average-size

dog (weighing 10–20kg) in Europe is [responsible](#) for between 349 and 1,424kg of CO₂-equivalent emissions per year—compared with between 150kg and 251kg of CO₂-eq for an average-size cat (weighing 2kg-6kg).

But there had never been a study examining the carbon footprint of pet fish, despite [4 million](#) households owning them in the UK alone—[70% of which](#) are tropical freshwater fish.

My [study](#) found the carbon footprint of a tropical [aquarium](#) in the UK ranges from 85.3kg to 635.2 kg of CO₂-eq per year—equivalent to between 1.6% and 12.4% of the average UK household's annual emissions. This estimate is based on a range of scenarios including aquarium sizes between 50 and 400 liters and different tank operating conditions. But most household aquariums sold by retailers are in the 50-to-100 liter range.

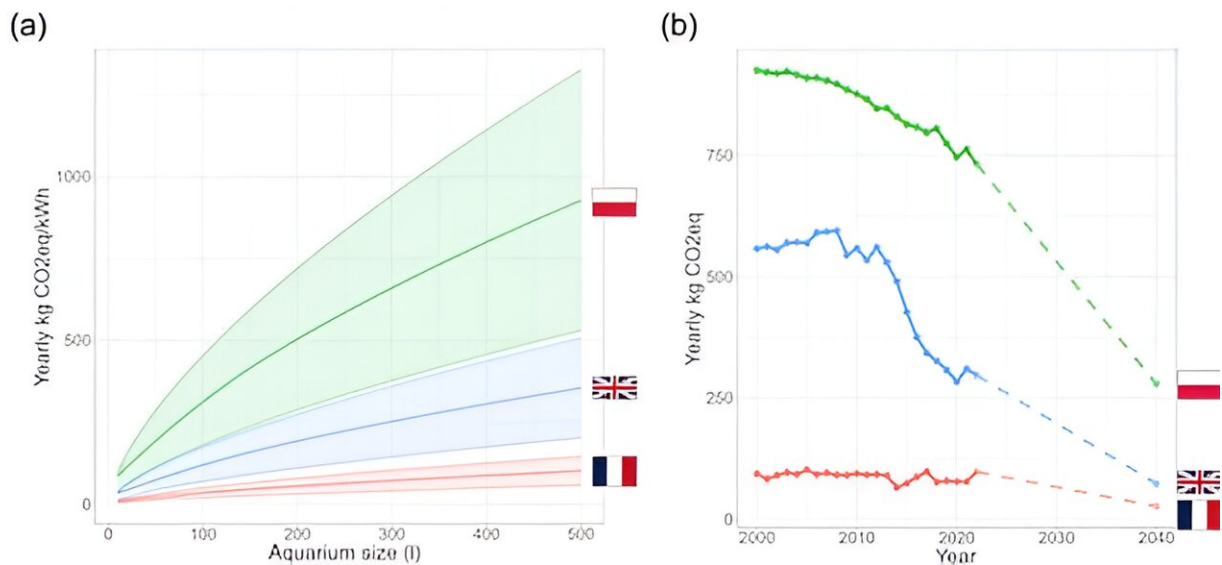
Electricity generation is the main source of emissions from tropical aquariums. Maintaining one requires lots of electricity to power the heaters, lights and pumps. This [electricity consumption](#) is much greater in emissions terms than the CO₂ produced in transporting [tropical fish](#) from countries such as Singapore or Indonesia to the UK and Europe.

However, the precise carbon footprint of an aquarium varies depending on its location. For example, tropical fish kept in France have a much smaller carbon footprint than those kept in the UK, because the French electricity grid is [more decarbonized](#).

This also means that as electricity grids continue to decarbonize globally, and especially in Europe, the carbon footprint of keeping tropical fish will decrease.

Water consumption

Water consumption is another factor to consider. Tropical aquariums are closed systems so fish waste can build up, increasing the levels of ammonia which is deadly to fish. So, fishkeepers must perform regular water changes—which means replacing the aquarium water with treated [tap water](#) or, for marine fish, water that has been purified using [reverse osmosis](#) (whereby water is pushed under pressure through a semi-permeable membrane). However, [reverse osmosis](#) is not efficient and produces five liters of reject water for every one liter of purified water.



(a) Yearly carbon emissions produced by heating different-sized aquariums in three countries (green = Poland, blue = UK, red = France) whose electricity grids have various levels of decarbonisation. (b) Yearly carbon emissions of running a 200 -litre aquarium (2000-2022) and predicted emissions for 2040 based on pledges to decarbonise electricity grids. Credit: Perry; *Journal of Fish Biology* (2023), [CC BY](#)

Estimates of water consumption for tropical aquariums vary depending on aquarium size, use of reverse osmosis, frequency of water changes

and amount of water replaced. Based on industry recommendations and a range of aquarium sizes, I estimated that tropical aquariums can use anywhere between 156 and 31,200 liters of water per year.

For example, if you have a 50-liter aquarium and you change 6% of the water [every week](#) with tap water, you would use 156 liters per year. But if you have a 400-liter aquarium and do a 25% water change every week with a reverse osmosis system, you could use up to 31,200 liters per year.

Clearly, these examples represent two extremes of water consumption, equivalent to between 0.2% and 30.1% of the average UK household's annual water use. While the [upper limit](#) can sound alarming, most aquariums sit in the middle range by both water use and emissions. But, given that drought events are expected to increase under future climate scenarios, any additional levels of water consumption can quickly become unsustainable.

Context is also important, as estimates on [energy consumption](#) are based on the aquarium being in a 20°C (68°F) room. If a central heating system is on all day or it is a warm summer's day, this will reduce the emissions generated from heating the aquarium. Alternatively, if the room is colder than 20°C, those emissions will be higher—although the heat from the aquarium will also heat the room, so may be viewed as an electric radiator.

Ways to reduce environmental impact of pet fish

My estimates provide the first insights into the environmental impact of a popular hobby. They show that keeping tropical fish is generally a more environmentally friendly option than keeping a dog or even a cat.

They can also inform our decisions on how to reduce the [environmental](#)

[impact](#) of keeping fish, such as:

1. Use [renewable electricity](#), generated at home or by changing electricity provider.
2. Keep the water temperature as low as possible according to species guidelines.
3. Put aquarium lights and pumps on timers.
4. Only do water changes when necessary; and
5. Re-use the reject water both from your aquarium and the reverse osmosis system.

Keeping tropical fish is a great way to enjoy beautiful ecosystems in your home. Done correctly, it can also help prevent the world from becoming a little bit more tropical.

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