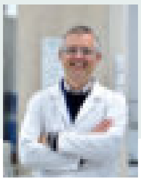
Tick and flea treatments

A hidden chemical threat in our waterways



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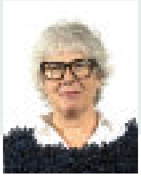

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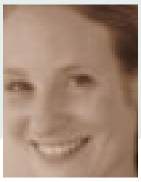

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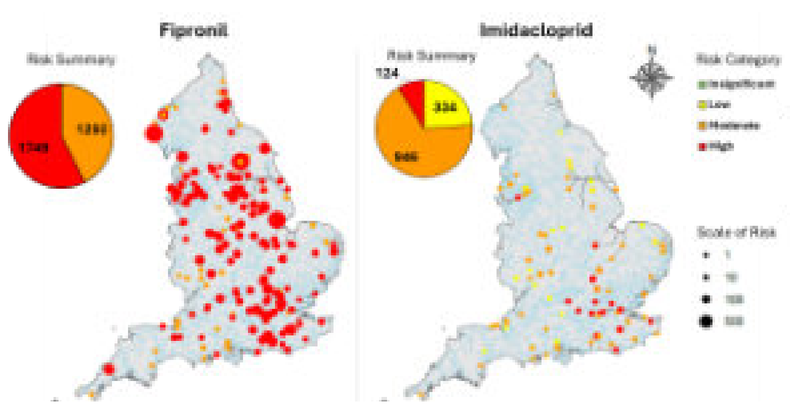
The poor state of waterways is a source of public anger. In England, only 14 % of rivers have 'good' ecological status. More worryingly, no English river now has good chemical status. Chemicals enter our environment in many ways, with the dominant routes including agricultural and surface runoff as well as wastewater. Approximately 350,000 chemicals are used commercially worldwide[1] and while many are beneficial, safe to use and not harmful in the environment, we understand very little about the wider impacts of the vast majority, especially when present in mixtures.

Of all the organic chemicals monitored in UK waters by the Environment Agency, a common pet parasiticide (fipronil) was ranked highest in terms of environmental risk[2] (Figure 1). We found that another pet parasiticide (imidacloprid, a neonicotinoid) also presented risks to aquatic invertebrates in urban water bodies impacted by wastewater[3]. These are the same chemicals that were banned by 2018 for use in outdoor agriculture in the EU and UK because of their devastating effects on pollinators. For context, one typical monthly dose of imidacloprid for a large dog is enough to kill 25 million bees[4]. There are over 21.4 million pet dogs and cats in the UK, with many receiving preventative routine treatments for ticks and fleas, even in the absence of any evidence of infestation.

In this article, we explore this issue and outline how and why these pet parasiticides are entering our surface waters to a degree that makes them a major cause for concern. We also propose practical recommendations to help manage their risks.

Figure 1: Locations and environmental risk of two tick and flea treatments to aquatic life (Environment Agency samples, June 2018–June 2024)



Risks calculated using measured environmental concentrations and lowest predicted no-effect concentrations (PNEC) to aquatic wildlife published by the Norman Network Ecotoxicology Database (accessed 17/3/2025) Risk Categories: Insignificant risks <0.1, low risk =0.1–1.0; moderate risk =1.0–10; and high risks >10.

Pie charts show number of samples that tested positive and how many fell into each risk category.

Why the major source of tick and flea treatments in our environment is wastewater

Before chemical products are marketed, an environmental risk assessment is required. For this, the hazard (its potential to cause harm) and exposure (the degree to which organisms come into contact with it) need to be characterised. Hazard and exposure combine to give us the scale of risk. Despite being persistent on pet fur and broadly toxic to invertebrates, an assumption still exists that there is little chance of pet parasiticides reaching the environment, negating an in-depth risk assessment under current policy[5]. This assumption is inaccurate, and multiple routes have been shown to exist (Figure 2). For example, Perkins et al. measured three "down the drain" routes for fipronil and imidacloprid following use in spot-on flea products[6]. Bathing, pet bed laundering and hand washing all contributed to wastewater contamination. Other unquantified sources exist including washing of upholstery, clothing and fabrics, surface contamination (e.g., floor mopping, etc.), and disposal of pet excreta, dust and hair via toilets, among others. After a single treatment, pesticide residues were still washing off for at least 28 days, including from the owner's hands. Importantly, current wastewater treatment is ineffective at removing some of these chemicals, especially fipronil and imidacloprid.

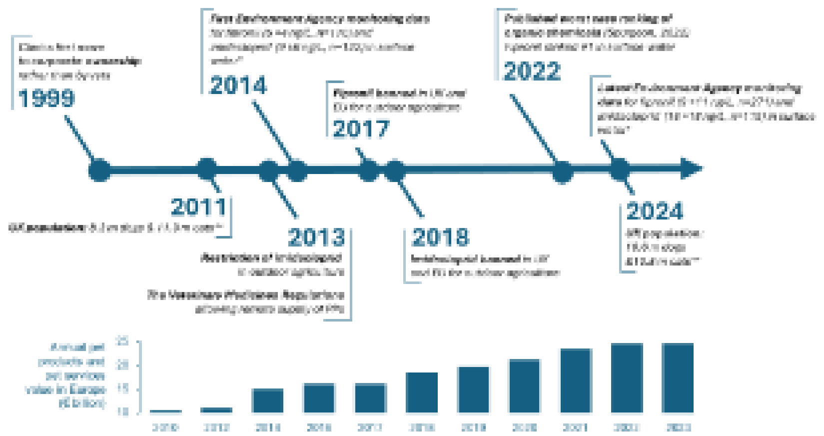
Aside from wastewater, pet swimming has been suggested as a major source of water contamination. Datasheets for spot-on tick and flea treatments provide guidance on how long to wait before swimming should be allowed, to minimise loss of treatment efficacy, but also to mitigate environmental contamination. However, these vary (e.g., from two to four days) and are rarely based on product-specific data. In park ponds designated for dog swimming, parasiticide concentrations are often high, but dilution reduced downstream transmission[7]. This was also found to be the case in rivers regularly used by dogs as this direct contamination was dwarfed by that of wastewater influx[3 8]. It is currently unclear whether this route really dominates over wastewater sources.

Negative impacts of pet parasiticides

Tick and flea treatments are not designed to harm humans and are currently considered low risk, with The Veterinary Medicines Directorate suggesting ≤1 adverse event in humans for every 10,000 doses in collars, spray or spot-on treatments[9]. Imidacloprid is among the most intensively studied of these pesticides, and is known to be harmful to a wide range of non-target wildlife and natural ecosystems, which led to its ban for outdoor agricultural use in 2018. Together with other neonicotinoids, it has been implicated in negative impacts on terrestrial ecosystems, including the recent continental-scale declines in European farmland birds. Its impacts also spill over into other ecosystems, with fresh waters being particularly vulnerable, and many invertebrates such as mayflies, shrimps and dragonflies are highly sensitive to it. Impacts can range from sublethal effects (e.g., impaired feeding, growth and reproduction) to direct mortality via toxic poisoning. In addition to direct impacts, these chemicals can trigger a range of indirect effects as they ripple through food webs, for instance by removing important prey species. As a result, predators, such as fishes, may be left without food, and other stressors can also interact to amplify (or mask) chemical impacts. Recent large-scale field experiments have shown that imidacloprid simplifies entire freshwater food webs, especially when combined with warming[10].

Figure 2: Major activities leading to environmental contamination with pet tick and flea treatments

Figure 3: Key events in surface water contamination with pet parasiticides (1990–2024) and annual value of pet products and services (2010–2023)



* Environment Agency Water GC-MS and LC-MS semi-quantitative screen dataset.
** Pet Animal Wellbeing (PAW) reports 2011 and 2024 published by the People's Dispensary for Sick Animals.

The changing market in the UK

Major changes have occurred in the pet tick-and-flea treatment market over the past 25 years (Figure 3). Most importantly, there has been a shift away from reactive treatment (i.e., treatment in response to a parasite being identified) towards blanket preventive treatment of large populations of pets, many of whom will not have fleas or been examined or risk assessed. This is now widespread practice and reinforced by product advertising to both vets and pet owners. Subscription schemes are part of business models of most clinics (over 60% of which belong to one of six major corporate veterinary groups). These schemes routinely include parasite treatment, despite the relatively low incidence of most parasites being treated. The ongoing Competition and Markets Authority investigation recently reported that 37% of pet owners now subscribe to at least one of these schemes. Pet ownership, particularly in urban areas, has changed over the past two decades, with a dramatic 150% rise in related commercial activity (Figure 3). This includes increased demand for premium pet foods, an explosion of pet shops selling luxury items and pet insurance, all reflecting a perceptual shift away from consumers as pet 'owners' to pet 'parents'. In addition to substantial e-commerce and over-the-counter pesticide sales, many insurance schemes exist, which do not always cover preventative application with tick and flea treatments[11].

The mechanisms for change

Behavioural science has been frequently implemented in policy interventions, for example aimed at creating safer communities, the 'good society', or healthy and prosperous lives (e.g., MINDSPACE[12]). Changing pet owners' consumption of pet parasiticides requires careful consideration. It is likely that many consumers follow veterinary advice on preventative treatment, and a change in how advice is given and followed is warranted. It is important that veterinary expertise is not undermined, but that scientific evidence is fed into the process of adjusting consumer behaviour regarding parasiticides. If change rests on individual choice (to consume or not to consume), the change may be slower than the environmental risk demands. Change by choice may be adjusted through other measures, for example price changes, which have a more punitive and reinforced effect. Of course, this punishes consumers who are reliant on these medications indiscriminately. Measures may be required to target communities as groups rather than as individuals, and more broadly consumer norms, beliefs, emotions (such as fear of flea infestation) and, importantly, habits. Regular, preventative application of pet parasiticides has arguably now become ingrained in the care habits of many owners and belief in the effectiveness of this practice will likely make it more difficult to change current levels of consumption. It is important that nuanced interventions, which do not hold pet owners responsible for 'environmental pollution', are put in place and align with evidence.

As wastewater is a major source of water pollution, new technologies to improve treatment effectiveness and capacity are urgently needed, particularly for high-risk chemicals including pet parasiticides. Along with technology upgrades, we recently proposed several measures that could lead to reduced risks[13]. Importantly, we do not recommend an immediate ban on their use to minimise 'regrettable substitution' with potentially more dangerous compounds and to continue effective treatment of pets suffering from parasite infestations. That said, we propose a review of their risk assessment and impact policies including for existing products where their active ingredients have been banned in other sectors. Where these continue to fail to meet risk assessment standards, the specific chemicals should be controlled through reclassification to prescription-only status or phased out. In addition, a regulatory threshold to ensure the risks for products that sell above a certain volume in a given timeframe should be introduced. Importantly, we should move away from preventative use to risk-based use to reduce water and household contamination but also pesticide resistance. This includes better guidance on disposal of used products.

The Royal College of Veterinary Surgeons, the British Veterinary Association and the British Small Animal Veterinary Association now advise against blanket treatment and recommend a risk-based approach to parasite control in pets, targeting preventative use to higher-risk animals. Effectively applying this would enable more judicious use of parasiticides, minimising the likelihood of resistance, unnecessary treatments and environmental harm. The risk of human disease from pet parasites (zoonoses) such as Bartonella (Cat Scratch disease) or Toxocariasis has been used to justify routine, preventative parasite treatment. Such diseases are rare in the UK[14 15]. In the absence of evidence, we argue that blanket parasite treatment cannot be justified based on zoonotic disease prevention, and a risk-based approach is surely more responsible.

In conclusion, pet parasiticides represent a 'hidden' threat to our environment and widely contaminate our waterways. There is a need for balanced, interdisciplinary guidance on their responsible use and control, which considers animal, human and environmental factors. Pet owners should be aware of the risks and benefits of treatments, and further interventions in consumption of pet parasiticides require careful consideration.

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