



GM Contamination Update: ANIMALS

- Researchers have found escaped genetically engineered (genetically modified or GM) ornamental aquarium zebrafish (GloFish®) multiplying in streams in Brazil. **This is the world's first ecosystem contamination from a GM fish.**
- Two food system contamination incidents from experimental GM pigs have already occurred in Canada.
- Escape and contamination incidents with genetically modified crop plants have been observed in Canada - with GM canola, flax, and wheat.
- GM contamination is an ongoing concern, including because a GM Atlantic salmon is now being produced in an on-land facility in Prince Edward Island.

Ornamental GloFish® escape in Brazil: World's first ecosystem contamination from GM fish

A new study has found genetically engineered (genetically modified or GM) zebrafish (*Danio rerio*) have escaped from fish farms in Brazil and are multiplying in creeks in Brazil.¹

The transgenic zebrafish are ornamental aquarium fish that are genetically engineered to have fluorescent colours, with the trademarked name GloFish®, from the company Spectrum Brands.

The florescent GM fish were first seen in Brazil in 2015, in waters that border the largest facility in Latin America that produces fish for the ornamental trade (in Muriaé, Minas Gerais state). The study found the fish in headwater creeks in the Atlantic Forest biome, one of the most important biodiversity hotspots in the world.

The fish are reproducing all year round, with a peak during the rainy season — just as native zebrafish do in Asia.² The GM fish appear to achieve sexual maturity earlier than their forebears, allowing them to reproduce more and spread faster.

The researchers say that their results “confirm that escapes from aquaculture facilities are common, and could bring severe consequences to local fish populations including endemic, rare, and threatened species.” They conclude that the production of non-native species should be avoided and transgenic fish should be banned.³

GloFish® in Canada

Since 2018, many different types of tropical GloFish® - three species with various genetically engineered colours - have been **approved and sold in Canada** for home aquaria (ornamental trade): fluorescent tetras (*Gymnocorymbus ternetzi*), danios (*Danio rerio*) and bettas (*Betta splendens*).

Canadian government regulators concluded that the likelihood of contamination in Canada was low because these tropical species are not able to survive Canada's winters. However, regulators confirmed that release of aquarium fish into the environment is likely: *"there is abundant evidence that aquarium fish do get released to freshwater environments and that the practice of releasing aquarium fish into the environment is ongoing. Once the organism has been sold into the retail market, it is no longer under the direct control of the importer and there can be no guarantee of appropriate containment and disposal. Consequently, there is a high likelihood that [this fish] will be introduced to the Canadian environment..."*⁴ In a 2021 submission to the Canadian Government, the conservation group Nature Canada raised concern about the risk that these fish could be released into the wild in warmer climates where they could survive and negatively impact local biodiversity.⁵

Environment and Climate Change Canada is assessing a new request to approve tiger barb (*Puntius tetrazona*) GloFish®. The public can comment until March 1, 2022.⁶

Genetically engineered fish are regulated under the Canadian Environmental Protection Act (CEPA) by Environment and Climate Change Canada, with the Department of Fisheries and Oceans conducting an environmental risk assessment in order to provide advice. **On February 9, 2022, the Minister reintroduced a bill to amend CEPA (Bill S-5).**

GM Contamination

Once released into our environment, genetically modified organisms (GMOs) can be difficult or impossible to control or recall. Human error, biology, pollinator and wind movement, extreme weather events, and other factors make GM contamination predictable.

GM contamination is the unwanted escape and spread of GMOs in the environment or genetic material from GMOs to non-GM plants, animals and foods. GM contamination is living pollution that can self-replicate. Such contamination can have negative environmental, social and economic impacts.

GM Animal Escapes and Contamination

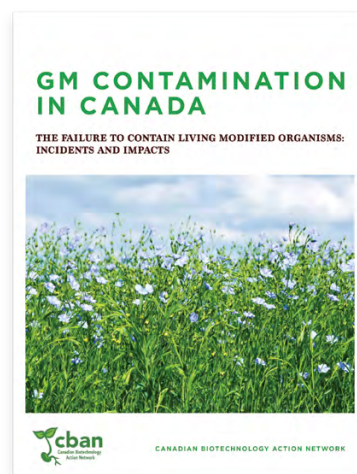
- Ornamental genetically engineered GloFish® have escaped and are **multiplying** in creeks in **Brazil**, where there are no local predators.
- **A single GloFish®** was previously seen in **Florida** in 2014, in waters where it faced predators.⁷
- There have been two separate contamination incidents with GM animals in **Canada**, where **experimental, unapproved genetically engineered pigs entered the food system**: one from the University of Guelph (2002) and the other from a (now defunct) private company (2004). Both of these incidents were caused by human error.⁸

GM Contamination Incidents in Canada

Since the first GM crop was commercialized (in 1996), **there have been escape events in Canada with GM canola, flax, wheat and pigs.**

- Some escape events occurred with approved GMOs (canola and flax), and others with experimental GM plants and animals (wheat and pigs).
- Some were isolated incidents (wheat and pigs), while others are widespread or ongoing contamination cases (canola and flax).

The consequences have included the temporary or permanent loss of export markets, lower crop prices in the short or long-term, the loss of access to a particular crop, and the loss of farm-saved seed.



Canadian farmers grow GM canola, corn, soy and white sugarbeet, as well as a small amount of GM alfalfa in the Eastern provinces. A GM salmon is also now produced on-land in Prince Edward Island.

See CBAN's Report: *GM Contamination in Canada: The failure to contain living modified organisms – Incidents and impacts* www.cban.ca/ContaminationReport2019

Conclusion

While the risks of escape and contamination are not uniform across all organisms, human error, biology, pollinator and wind movement, extreme weather events and other factors make GM contamination predictable. Some GMOs are particularly prone to escape, and others have impacts that could be extremely serious if escape occurs.

The newly documented GloFish® escape in Brazil, along with the incidents of escape and contamination already observed in Canada with GM pigs and GM crop plants, show that these risks cannot be managed by current government regulation nor through industry-developed best practices.

Recommendations

- Assess regulated segregation and containment measures for GMOs and acknowledge that the only way to prevent contamination, or serious impacts if escape occurs, from certain GMOs is to prevent their release.
- Halt the Canadian Food Inspection Agency's plans to exempt many new gene-edited GM plants (those with no foreign DNA) from government regulation and, instead, ensure that all genetically engineered organisms are subject to independent government environmental safety regulation. See www.cban.ca/NoExemptions for details.
- The regulation of genetically engineered animals in the Canadian Environmental Protection Act (CEPA) needs to be strengthened through the bill to amend CEPA (Bill S-5).
- Halt any further approvals of genetically engineered animals in Canada until regulation is strengthened, including to be more transparent and increase public participation.

For updates and to find out more, visit www.cban.ca/contamination.

- 1 André Lincoln Barroso Magalhães, Marcelo Fulgêncio Guedes Brito & Luiz Gustavo Martins Silva. 2022. The fluorescent introduction has begun in the southern hemisphere: presence and life-history strategies of the transgenic zebrafish *Danio rerio* (Cypriniformes: Danionidae) in Brazil, *Studies on Neotropical Fauna and Environment*. <https://www.tandfonline.com/doi/full/10.1080/01650521.2021.2024054>
- 2 Sophia Moutinho. 2022. Transgenic glowing fish invades Brazilian streams Transgenic glowing fish invades Brazilian streams, *Science*. February 11. <https://www.science.org/content/article/transgenic-glowing-fish-invades-brazilian-streams>
- 3 Magalhães ALB, Bezerra LAV, Daga VS, Pelicice FM, Vitule JRS, Brito MFG. 2021. *Biotic differentiation in headwater creeks after the massive introduction of non-native freshwater aquarium fish in the Paraíba do Sul River basin, Brazil*. *Neotrop Ichthyol*. 2021; 19(3):e200147. <https://doi.org/10.1590/1982-0224-2020-0147>
- 4 Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Science Advisory Report 2018/2017, Environmental and Indirect Human Health Risk Assessment of the GloFish® Electric Green® Tetra and the GloFish® Long-Fin Electric Green® Tetra (*Gymnocorymbus ternetzi*): A Transgenic Ornamental Fish. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/SAR-AS/2018/2018_027-eng.html

- 5 Nature Canada. 2021. Comments on the proposal by GloFish LLC to sell the genetically engineered Siamese Fighting Fish, *Betta splendens* in Canada. Submission to Environment and Climate Change Canada, April 9. <https://naturecanada.ca/wp-content/uploads/2022/02/NatureCanada-BettaSplendens-April9-21.pdf>
- 6 Environment and Climate Change Canada. 2022. Voluntary public engagement initiative, Active engagement initiatives: Notification for four ornamental aquarium fish that fluoresce. Accessed February 21. <https://www.canada.ca/en/environment-climate-change/services/managing-pollution/evaluating-new-substances/voluntary-public-engagement-initiative.html>
- 7 Sophia Moutinho. 2022. Transgenic glowing fish invades Brazilian streams Transgenic glowing fish invades Brazilian streams, *Science*. February 11. <https://www.science.org/content/article/transgenic-glowing-fish-invades-brazilian-streams>
- 8 Canadian Biotechnology Action Network (CBAN). 2019. GM Contamination in Canada: The failure to contain living modified organisms – Incidents and impacts. www.cban.ca/ContaminationReport2019

The Canadian Biotechnology Action Network (CBAN) brings together 16 groups to research, monitor and raise awareness about issues relating to genetic engineering in food and farming. CBAN members include farmer associations, environmental and social justice organizations, and regional coalitions of grassroots groups. CBAN is a project of MakeWay's shared platform.



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