animal wellness action



animal wellness foundation

# **Mink Fur Farming**

March 2024

Phase Out Highly Pathogenic, Inhumane American Mink Fur Farms

- Farmed mink may be America's greatest zoonotic disease threat.
- As SARS-Cov-2 risk in farmed mink recedes, a greater threat arises from HPAI H5N1.
- Time for Congress to authorize a voluntary mink buy-out and mink farming ban.

American mink farms are largely unprofitable, poorly regulated, exceptionally secretive, in long-term decline, and kept afloat by government <u>subsidies</u> in some states. In addition to the demonstrable cruelty associated with extreme cage confinement of semi-aquatic wildlife, mink ranching represents a high impact if unpredictable zoonotic hazard, as shown by the <u>worldwide</u> <u>zoonotic COVID-19 pandemic in farmed mink from 2020-2022</u> and the <u>recent outbreak in 2022-2023</u> causing infections and deaths of thousands of farmed mink from the zoonotic bird flu H5N1 virus.

It is unethical, unjustifiable, and reckless to keep the failing and inhumane mink industry that threatens human, domestic animal, and wildlife health for the sake of a luxury fashion commodity exported to China and Russia that American consumers, retailers, and fashion designers reject and want no part of.

**I - Mink farms: animal cruelty epicenters.** Non-domesticated American mink (*Neogale vison*, formerly *Neovison vison*) are intensively farmed by the millions in Europe, North America, and China for their dense and warm fur pelts. Farmed mink are raised in intensive, high density, high volume, low welfare, poor hygiene barns. Industry housing norms place mink in tiny wire cages (about one square foot of floor space per mink, two adult mink per cage) with thousands (typically 10,000 to 50,000 minks per farm) of conspecifics. As highly aggressive hunter-predators, captive mink often fight with, injure, kill, and even cannibalize weaker cage-mates. They are fed a poorquality diet of slaughterhouse offal.

Unlike any cattle, pig, sheep, or poultry operation, mink farms raise wild, solitary, aggressive, and semi-aquatic carnivores, not for food but for their dense winter fur coat. Mink are neither herd nor flock animals, nor even truly domesticated; the USDA classifies farmed mink as wild animals. The whole industrial mink farming setup—semiaquatic carnivores never getting to swim or hunt or roam and kept in a tiny austere cage—causes blatant cruelty, numerous abnormal behaviors (stereotypies), high stress and distress, and endless frustration.

**II - Mink farms: zoonotic virus utopias.** With a high population density in a very small area, low genetic heterogeneity, inbreeding to produce an array of coat colors (which also lowers disease resilience), filthy living conditions, <u>innate mink/carnivore susceptibility to infections</u>, <u>modest (at</u>

best) biosecurity practices, unending distress, and stress-induced immunosuppression, mink farms are highly conducive to contagions of all sorts. Their livestock and poultry slaughterhouse offal feed may be contaminated with various animal pathogens. Farmed mink are notoriously vulnerable to infectious, multi-host, and zoonotic (i.e. spread from animals to humans) diseases and "species jumping," i.e., when a pathogen infects a new host species.

Mink farms are near-perfect habitats for infectious agents to spawn, fester, mutate, and spread. Poor mink welfare and high animal/zoonotic disease risk cannot be disentangled. The same intensive confinement conditions that simplify the mass-rearing of mink create ideal environments for animal or human pathogens to prosper and evolve.

For example, mink farm outbreaks are facilitated by housing in adjoining bare wire cages that allow for both free airflow and direct animal contact within their densely packed barns. There are unintended if predictable disease consequences to raising normally solitary and unsocial wild mink under intensive confinement to which they are evolutionarily maladapted. Of particular current concern is the marked farmed mink vulnerability to two epidemic and zoonotic viruses: SARS-CoV-2 and Influenza A, the cause of most human, swine, and avian flu infections.

**COVID-19**: Farmed mink became infamous as zoonotic virus reservoirs during the SARS-CoV-2 pandemic. By late 2020, SARS-CoV-2 had spilled over from humans to farmed mink across Europe and North America, where the virus then mutated and sometimes spilled back to infect thousands of people on at least five separate occasions, including in the United States. Twenty million mink globally were culled to prevent a novel mink mutant strain from going rogue.

From 2020-2022, SARS-CoV-2 outbreaks occurred on at <u>least 450 mink farms in 13 countries in Europe, Canada, and the United States</u>. The virus infected seven million mink and killed about 700,000 animals, including thousands of animals on 18 American mink farms. Captive mink are SARS-CoV-2 "super-recipients" and "super-spreaders." They readily contract the virus from infected farm workers, rapidly spread it to virtually all mink on the farm (killing about 10% of exposed mink), and then (unlike any other animal) spill the virus back to people, sometimes as a dangerous mutant that may resist human vaccines and treatments.

Farmed mink in Denmark, France, Latvia, Poland, and <u>Michigan</u> spawned dangerous SARS-CoV-2 mutants that collectively infected thousands of people. Denmark (the world's largest pre-Covid mink producer) and the Netherlands slaughtered all 20 million of their mink (one-third of the global 2020 farmed population) and banned mink farming in the fall of 2020 to successfully prevent the spread of the mink "Cluster 5" variant to people at a time when a human Covid vaccine was not yet available.

COVID-19 outbreaks at mink farms in Wisconsin, Utah, Oregon, and Michigan in 2020-22 are certainly an undercount. Unlike Europe or Canada, we have no active or mandatory COVID-19 surveillance or testing of mink farms or farmers by federal (CDC, USDA) or state agencies. A new mink COVID-19 variant could silently emerge and disseminate from any of these farms, imperil more people, and force us to yet again make lifestyle and work adjustments and incur high health and financial costs.

Another problem: mink are lithe and athletic and readily escape by the thousands. Farmed mink can infect wild mink with COVID-19, potentially creating an ineradicable SARS-CoV-2 reservoir in North America, just as zoonotic rabies, plague, and brucellosis have taken permanent hold in our native wildlife populations. As carriers of SARS-CoV-2 and other animal or zoonotic pathogens, escaped or released farmed mink are also serious disease vectors, ecological disruptors, and injurious species to our native wildlife. SARS-CoV-2 spillover from farmed mink to native wildlife may decrease biodiversity and damage natural ecosystems. Mustelids such as native wild mink and the endangered black-footed ferret are particularly vulnerable to disease introductions from feral mink.

An experimental SARS-CoV-2 veterinary vaccine has been available to U.S. mink farms since 2022. However, some mink farmers are resistant to delivering the mink vaccine for cost, practicality, labor, and philosophical reasons. There is no data available on the vaccine's effectiveness or industry usage. As in humans, new mink vaccine formulations will need to be routinely adjusted to combat new virus variants that make the original vaccine ineffective.

Furthermore, <u>a Danish study</u> demonstrated that farmed mink can be heavily infected by SARS-CoV-2, seroconvert (i.e., become "immune" with antibodies), and then be heavily re-infected less than three months later with essentially the same virus strain. This finding does not bode well for mink COVID-19 protection via natural infection or immunization. <u>Our 105-page Animal Wellness Action report</u> summarizes the risks of SARS-CoV-2 in farmed mink.

**Highly pathogenic avian influenza (HPAI) A H5N1:** The possibility always exists for pandemics caused by viruses that are more severe than COVID-19. Avian influenza A viruses are by consensus most likely known viruses with pandemic potential, i.e., could become adapted to and adept at human-to-human transmission with high morbidity and mortality. These "bird flu" viruses are highly contagious, with variable, strain-dependent morbidity and mortality. Host immunity may be short-lived and is not cross-protective between strain variants.

• In October 2022, an outbreak of HPAI H5N1 occurred in intensively farmed mink in northwest Spain described in a January 2023 scientific report. Alarmingly, the virus spread mink-to-mink, crossing the bird-mammal species barrier with ease. All 52,000 mink on this farm not already killed by the virus were quickly and preemptively culled to prevent something much worse: a mink-adapted H5N1 bird flu strain that could infect and kill people with similar ease.

There were two crucial aspects of this outbreak:

- (1) This was the first known HPAI H5N1 outbreak with sustained mammal-to-mammal virus transmission.
- (2) The mink viruses possessed an uncommon mutation (T271A) in the PB2 gene. This mutation allows the virus to replicate at the lower body temperature of mammals vs. birds, evidence that the virus is evolving to adapt to mammals.
- From July to September 2023, <u>HPAI H5N1 outbreaks occurred on at least 27 mink, raccoon dog, and fox farms in Finland</u>. At least five mink farms were infected, with sustained mink-to-mink spread and virus adaptation to mammals likely. Authorities ordered the killing of the

approximately 135,000 animals where the bird flu was detected, including 50,000 mink, 79,000 foxes, and 6,000 raccoon dogs.

The avian H5N1 strain first emerged in southern China in a domestic goose in 1997. Its descendants have circled the globe counterclockwise over the past quarter century, marching across Asia, Europe, and Africa until finally reaching North America and Latin America in 2022. The bird flu H5N1 virus is now circulating uncontrolled around much of the globe despite draconian veterinary disease control efforts, devastating not just wild birds and domestic poultry, but killing wide swaths of the animal kingdom including foxes, bobcats, pigs, grizzly bears, seals, dolphins, and sea lions.

The H<sub>5</sub>N<sub>1</sub> virus cluster has cut a vast swath of suffering and death, unlike any previous animal influenza virus, killing perhaps 600 million poultry globally, untold millions of waterfowl and wild birds, and thousands of land and marine carnivorous and scavenger mammals who dined on birds killed by the virus. A few hundred people have also died from the H<sub>5</sub>N<sub>1</sub> virus, mostly those who had close contact with infected poultry, such as cockfighters in Southeast Asia. It has a human case fatality rate of about 50%, much higher than any known influenza virus including the infamous 1918 H<sub>1</sub>N<sub>1</sub> pandemic strain.

In the United States, as of March 12, 2024, about 82 million backyard and commercial poultry in 48 states (all states except Louisiana and Hawaii) have died or been killed since the outbreak began in February of 2022, mostly egg-laying chickens and meat turkeys. This includes 1,109 flocks: 472 commercial enterprises and 637 "backyard" flocks. (Our national flock consists of about 330 million egg-laying chickens and about 217 million turkeys). Skyrocketing egg and turkey meat prices in 2022 and again in 2024 were/are not a surprise. The agricultural economic cost to the United States alone will be many billions of dollars for this animal health, animal welfare, and looming public health disaster.

Both pigs and mink uniquely possess receptors for both avian (alpha 2-3-galactose sialic acid) and human (alpha 2-6-galactose sialic acid) influenza A viruses. Thus both swine and mink can be naturally infected with both human and avian influenza strains and function as virus "mixing vessels." If an avian and human flu virus co-infects the same mink or pig host cell, they can swap parts during replication, producing a chimeric human-avian flu virus (a reassortant) that can more easily infect mammals or humans. All five pandemic flu viruses since 1918 have been reassortants.

Mink of all ages are highly susceptible to influenza A strains of avian, human, and mammalian (e.g. swine, equine, canine) origin. Mink host a wider biodiversity of avian-, swine-, and human-derived influenza A virus HN subtypes than any other mammal. This makes mink superior to even swine as ideal mixing vessels to create novel flu virus variants by antigenic drift (random viral RNA mutation) or antigenic shift (viral reassortment).

The HPAI H5N1 virus did not appear to have sustained mammal-to-mammal transmission until <u>the farmed mink outbreak in Spain in October 2022</u> and possibly in the mass deaths of <u>sea lions in Peru</u> (fall 2022 to Feb 2023) and seals in southern Russia (Feb 2023).

Overall, intensified livestock farming in general and factory fur farming in particular have created an important interface between humans and mink and made bird flu H5N1 zoonotic events and the risk of emergence as a human-transmissible virus more likely. Most mammalian species infected

with the bird flu H5N1 virus so far are wild predators and scavengers (e.g., foxes, wolves, bears, raccoons, skunks) feeding on infected birds—usually solitary nocturnal or crepuscular animals that rarely interact closely with people. They are very unlikely to spread the virus far or infect people.

At mink farms, however, thousands of such normally solitary carnivores are forced to live together, creating ideal conditions for the avian virus to adapt to mammals. Their operators have close daily contact with farmed mink. Furthermore, most farmed mink are fed uncooked poultry or swine slaughterhouse residues, including avian and pig lungs potentially infected with avian or swine influenza viruses. Several farmed mink outbreaks have been attributed to influenza viruscontaminated feed. A better bio-system to encourage or maximize antigenic shift or reassortant generation could not be devised.

The crowded, confined, and intensive fur farming practices also expose mink to human flu viruses (from sick workers) and equally well expose humans to flu viruses from mink. Because mink are often housed in open-sided or open-front sheds, they may have contact with aquatic fowl or migratory birds infected with H5N1 (or other avian influenza viruses). In other words, much of the mink pandemic zoonotic risk from avian influenza H5N1 is a human construct.

As <u>Yasmin Tayag recently wrote</u> in *The Atlantic*, "Mink may never pass bird flu to us. But that doesn't mean they won't be a risk the next time a novel influenza virus or coronavirus comes around. Doing nothing about mink essentially means choosing luck as a public health strategy. Sooner or later, it will run out." Others have also called for a <u>ban on mink farming due to the high zoonotic disease risk</u>.

**III - Mink ranching: a fur-farming financial fiasco.** The most recent <u>USDA mink report</u> documents the continuing sharp economic decline of the U.S. mink industry as major designers and retailers globally abandon fur. In 2011, U.S. mink pelt values averaged \$94.30 and the industry generated over \$290 million in farm-gate income. By 2019, before COVID-19 struck, prices had plummeted to \$21.90 per pelt, with gross revenues below \$60 million. Even as production was relatively stable, total revenues for the industry decreased five-fold.

American mink farms produced just 1.28 million pelts in 2022, the lowest output on record. The average price per pelt in 2022 was \$31.68, while the value of American mink pelts (no. of pelts x average pelt value) was just \$39.2 million, the lowest ever value. The market price per pelt has been below the breakeven price of \$35 in six of the past 10 years. There are an estimated 50 to 80 active mink fur farms across the entire United States, down from 7,200 mink farms in 1959.

**IV - Mink farms: serving a foreign luxury market.** Major fashion houses, clothing retailers, and American and European consumers have largely sworn off fur fashions. Americans have lost their appetite for mink, and major designers and retailers—from Neiman Marcus to Macy's to Armani—no longer sell fur. Today, America-produced mink pelts go to China and Russia, where a small sliver of elite consumers wrap themselves in fur, outsourcing the viral risks to our homeland.

**Conclusion:** It is past time to end mink fur farming in America. Given (1) the inordinate zoonotic risks that mink farming poses to America, (2) the inherent industry cruelty, (3) the small size (perhaps 50 active mink farms) and financial fragility of mink ranching, and (4) the near-total rejection of fur for garments by American society, a voluntary but permanent buy-out of the mink

farmers by the USDA (or other federal agency) is in order. Some mink producers may welcome a buyout to relieve financial duress and pursue new opportunities. Expedited action to end mink farming by our political leaders and agricultural and health authorities is warranted.

More so than any other farmed animal, mink <u>pose a substantial risk for the emergence of future human disease outbreaks and the evolution of future pandemics</u>. Without fearmongering or exaggerating risk, we ignore at our peril the real and perhaps accelerating farmed mink zoonotic disease threat.

Any uncontrolled situation in which an RNA virus (e.g. bird flu H5N1 or SARS-CoV-2) is allowed to spread freely among densely housed highly susceptible animals like mink <u>may lead to virus evolution</u>, <u>mutation</u>, and <u>new host adaptation</u>, including viruses with enhanced pandemic potential.

An equivalent laboratory "experiment" of this type would be classified as "gain of function" research and would be prohibited by most scientific regulatory authorities. Approval of such an experiment would require an *a priori* extensive and favorable benefit-to-risk assessment and performance of the experiment under high-containment conditions.

Yet this dangerous "experiment" likely occurs routinely on high-density, high-volume, low-welfare, low-hygiene, and low-biosecurity industrial mink farms infected with bird flu or SARS-CoV-2. This raises the possibility that dangerous "gain of function" adaptations occur on mink ranches in a completely unregulated and uncontrolled manner. This was and is the rationale to cull all bird flu H5N1-infected mink and fur farms in Spain and Finland in 2022 and 2023, respectively, and to cull all 17 million Danish mink exposed to COVID-19 in 2021.

Unfortunately, unlike in most other countries, American public health agencies (e.g., CDC, USDA) ignore these mink farm risks. <u>Incredibly, the United States has no surveillance, testing, or bio-security protocols and no mandatory disease reporting for mink farms</u>.

To address this shortcoming, at a minimum, enhanced biosecurity practices and mandatory active surveillance for SARS-CoV-2 and influenza A at mink fur farms should be instituted and enforced. This should include regular virologic and sero-surveillance of influenza A virus on mink farms, including HA subtyping and genetic sequencing, with prompt sharing of findings with the scientific community.

However, the only long-term, reasonable, and cost-effective zoonotic risk management is a one-time Federal buy-out of the few remaining active U.S. mink farms for their full value and a permanent sunsetting (phase out) of this industry.

# Twenty European nations have announced or implemented policies to ban mink farming.

Acknowledging animal cruelty, bio-ethical concerns, and zoonotic threats, fur-producing nations such as the Netherlands, Poland, Ireland, Estonia, and France, as well as the Canadian province of British Columbia, announced the permanent closures of mink and other fur farms. Denmark, Sweden, and Italy temporarily banned mink farming due to SARS-CoV-2 concerns, and those bans may become permanent. Nations with long-standing fur-farming prohibitions, e.g., the United Kingdom, are moving towards <u>restrictions on fur sales</u>. Austria, Belgium, Croatia, Slovenia, Bosnia and Herzegovina, Serbia, Macedonia, and Norway previously banned all fur farming.

Congress or relevant federal agencies (USDA, HHS, and USFWS) all have statutory authority to act to protect the public (or native wildlife) and should take steps to end mink farming. These enterprises are fundamentally inhumane for the animals, and a voluntary buy-out is the right precautionary approach at a time when the world vividly understands the disruptive potential of zoonotic threats.

We propose that Congress offer, via a funding reallocation or redirection in the 2023 Farm Bill, a one-time permanent buy-out to all approximately 60-80 active U.S. mink farms. Fair market compensation would be offered to mink farmers by USDA (or another designated agency) based on:

- (a) The average number and quality of mink pelts produced over the past three years (from farm gate receipts); and
- (b) Professionally valuation of mink facilities e.g. condition of barns and equipment.

The Figures that follow are designed to explain major concepts in this fact sheet.

### Time to buy-out & ban U.S. mink fur farms

# Four major insoluble problems within the U.S. fur farmed mink industry



### 1 - Unmitigated cruelty



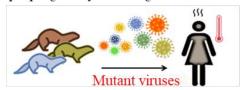
- · Mink are the only factory-farmed wild aquatic carnivore
- Normally solitary & reclusive mink are crowded into filthy, tiny wire cages on large industrial "mink ranches"
- Stress-induced cannibalism, self-mutilation, bite wounds, infanticide, stereotypies & disease are common
- A farmed mink's life: "poor, nasty, brutish & short": 4 min video from
  Polish farm showing poor mink welfare including cannibalism; same as
  most US mink farms. https://www.youtube.com/watch?v=meFB3EJWj-o

### 2 - Two high-consequence zoonotic disease pandemic threats

"Mink, more so than any other farmed species, pose a risk for the emergence of future disease outbreaks and the evolution of future pandemics". *Peacock & Barclay, PNAS 2023* 

#### SARS-CoV-2

- 450 mink farms infected globally 2020-23
- · 20 million farmed mink died or culled
- Five mink mutants infected thousands of people globally including U.S. 2020-22



#### Highly pathogenic bird flu H5N1

- 82 M poultry, millions of wild birds & hundreds of wild mammal carnivores & scavengers died in U.S. from Feb 2022 - Mar 2024
- First ever mammal-to-mammal spread in farmed mink in Spain Oct 2022 & Finland July 2023
- Mink very susceptible to human, mammal & avian influenza strains so can be intermediary "mixing vessels" creating mutants that spillover to people

#### 3 - Mink farmers in a financial death spiral



- U.S. produced just 1.33 million (M) pelts worth \$39.2 M in 2022
- · Fewest pelts & lowest pelt value since USDA has kept records
- Down from 3.74 M pelts worth \$216 M in 2014
- · Avg pelt price below farm break-even price in six of past eight years
- Sixty to 80 active U.S. mink fur farms, down from 7,200 farms in 1960

### 4 - No U.S. domestic mink demand & rapidly declining world fur market

- American consumers do not want to buy mink garments; few U.S. retailers sell fur outfits
- U.S. mink pelts sold to Russia & China to make luxury garments for their wealthy elites







# Best fair & just solution for our citizens, mink ranchers & farmed mink:

- One-time voluntary but permanent Federal government buy-out of mink farms
- Nancy Mace & Rosa DeLauro Minks in Narrowly Kept Spaces Are Superspreaders (MINKS) Act
   "Doing nothing about mink essentially means choosing luck as a public health strategy. Sooner or
   later, it will run out." Yasmin Tayag, The Atlantic, 2023

### Figure - Two drivers of infectious & zoonotic disease risk in farmed mink

#### (1) Inherent mink biology

- Innate Carnivore hyper-susceptibility to infections; deficient immune system permits mink to be readily infected & then carry (but not kill) bacterial & viral pathogens
- Solitary & anti-social outside of spring breeding season so naturally social distance ("high behavioral immunity")
- Immune system evolved to deal with rare pathogen encounters & infrequent contact with other mink
- Respiratory system anatomy & physiology permissive to & propagate airborne viral & bacterial infections

### (2) Unsafe & unnatural mink farming practices

- Fed slaughter waste may contain viral, bacterial & prion pathogens eg bird flu, sheep scrapie
- High-density, high-volume housing enables rapid pathogen spread; kept entire life in small cage
- · Low welfare, low hygiene; little vet oversight
- Inbred for fur properties, big bodies & large litters but not for tameness lowers disease resistance
- Poor biosecurity & lax bio-surveillance exposes captive mink to human, wildlife & domestic animal pathogens that wild mink never or rarely encounter
- Farms ignored by U.S public health agencies; lax regulation; industry secrecy; frequent escapees











- · Inadequate natural immunity
- Behavioral & physiologic stress & distress from mink maladaptation to intensive farming environment
- Mink genetic homogeneity (inbreeding)
- · Frequent, diverse & high dose pathogen challenge
- Corticosteroid induced immuno-suppression





Extremely high susceptibility to pathogen infections, mutations, transmission, clinical disease & spill-over to new hosts ("species jumping")

• especially via airborne respiratory route

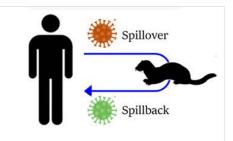












*Figure* - Fourteen countries, four U.S. states, and one Canadian province with farmed mink SARS-CoV-2 outbreaks, 2020-2023. *Note: Bulgaria accidentally excluded as infected country in the Figure*.

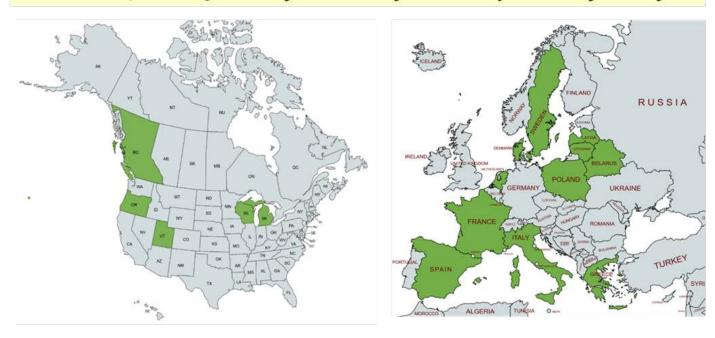
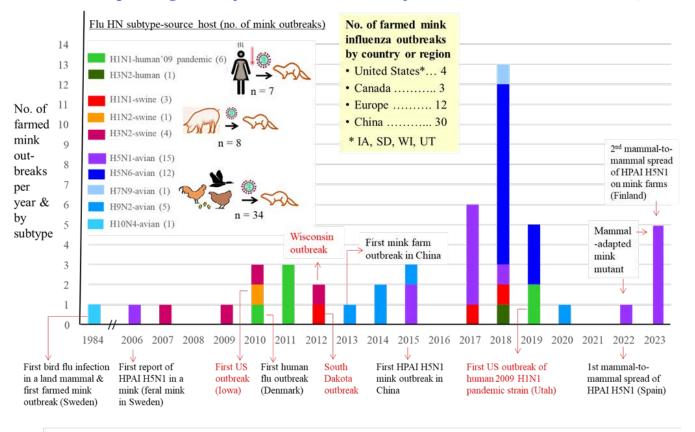


Figure - Panzootic Highly Pathogenic Avian Influenza (HPAI) H5N1 in birds, people & mink through Nov 2023 Finland 2023 Spain 2022 China 2015 Canada 2022 HPAI H5N1 outbreaks & cases Farmed mink (n =15) Wild mink (n = 2) 23 counties reported 878 human cases of bird flu H5N1; 458 were fatal (52%) ■ Wild bird &/or poultry outbreaks reported on all continents except Australia. First Antarctica outbreaks Countries w/ people, poultry & wild birds killed by HPAI H5N1 in Oct 2023. Countries w/ poultry & wild birds killed by, & non-fatal human ■ From Jan 2022 to Oct 2023,>17,000 cases of, HPAI H5N1 poultry HPAI H5N1 outbreaks Countries w/ poultry and/or wild birds killed by HPAI H5N1 but reported by 80 countries to the World no human cases Organization for Animal Health

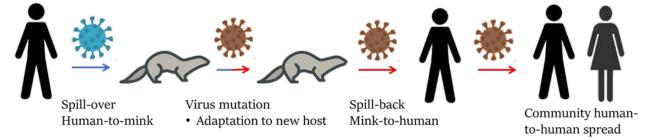
# Reported global Influenza A outbreaks in farmed mink 1984-2023 (n = 49)



These 49 mink influenza A outbreaks in farmed mink are likely just the tip of the disease iceberg because:

- There is no systematic or active surveillance for influenza (or SARS-CoV-2) on mink farms in the U.S. by CDC, USDA or any other public health agency even though there are less than 80 active U.S. mink ranches.
- Influenza A-infected mink may show no clinical signs of disease.
- Mink farmed often have human, swine & avian flu strains circulating on farm premises at the same time a perfect setting to generate new mutant and potentially zoonotic virus variants

Figure - Zoonotic COVID-19 spillover, spillback, mink mutation & community spread



- Outbreaks on at least 450 mink farms in 13 countries in Europe, Canada, and the U.S. (18 farms in MI, OR, UT, WI)
- Mink mortality was 10.5% vs. U.S. human pre-vaccine COVID-19 mortality rate of 1.7%
- Five documented SARS-CoV-2 mutant variants spawned on mink farms spilled back from mink to people, including in one U.S. human outbreak in Michigan that the CDC hid from the public for more than a year
- Mink COVID-19 mutants infected thousands of people worldwide in 2020-2022

Figure - Emergent zoonotic avian influenza HPAI\* H5N1 spill-over to mammals & farmed mink

1 - Virus propagation in permissive avian hosts

**HPAI** spillover (rare) \*\*

- \* HPAI = Highly Pathogenic Avian Influenza H5N1; LPAI = Low PAI
- \*\* Globally, from January 2003 to March 2023, there were 873 cases of human infection with avian influenza H5N1 in 21 countries (including the U.S.), of which 458 were fatal ie case fatality rate of 53%.

Influenza viruses have a relatively high mutation rate that is characteristic of RNA viruses. The segmentation of its genome facilitates genetic recombination by segment reassortment in hosts infected with two different strains of influenza viruses at the same time. A previously uncontagious strain may then be able to pass between humans, one of several possible paths to a pandemic

2 - Dead-end mammalian hosts = spread from birds to mammals but no further spread among mammals

Wild terrestrial carnivores

Wild marine mammals

People w/ close contact w/ infected poultry become sick but usually do not transmit the virus to other persons

3 - First mammal-to-mammal propagating virus spread on mink farm (Spain Oct 2022)







Farmed mink Mutation Farmed mink

Mink mutations could make HPAI H5N1 more readily

- Transmitted from mink-to-people
- Tranmitted from person-to-person (between people).

#### U.S. mink industry is dying rapidly ...

- 2022 = Fewest number of mink pelts produced ever since USDA has kept track
  - = Lowest value ever of mink pelts ever since USDA has kept track
  - = 2nd lowest average pelt price ever; only 2019 was lower
- Due to security concerns, the U.S. farmed mink industry and the USDA currently husband information about mink farm numbers, ranch locations and other details. However, the number of active American mink farming operations is currently estimated to be less than 80, down from 275 farms in 2013.

#### A decade of mink industry decline: 2013 vs. 2022

|            | Average pelt price |                       |                |  | Pelt production   |                | Pelt value = Avg pelt price X no. pelts produced |                       |                |  |
|------------|--------------------|-----------------------|----------------|--|-------------------|----------------|--|-----------------------|----------------|--|
| Year       | Pelt<br>price      | Inflation<br>adjusted | Percent change | Percent<br>change<br>inflation<br>adjusted | No. of<br>pelts   | Percent change | Pelt value                                       | Inflation adjusted    | Percent change | Percent<br>change<br>inflation<br>adjusted |
| 2013       | \$56.30            | \$70.94               | NA             | NA   | 3,544,610         | NA             | \$199,561,543                                    | \$251,447,544         | NA             | NA   |
| 2022       | \$29.40            | \$29.40               | NA             | NA   | 1,332,740         | NA             | \$39,182,556                                     | \$39,182,556          | NA             | NA   |
| Difference | \$26.90<br>less    | \$41.54<br>less       | 48%<br>less    | 59%<br>less                                | 2,211,870<br>less | 62%<br>less    | \$160,378,987<br>less                            | \$212,264,988<br>less | 80%<br>less    | 84%<br>less                                |

Inflation adjusted to 2022 using https://www.usinflationcalculator.com

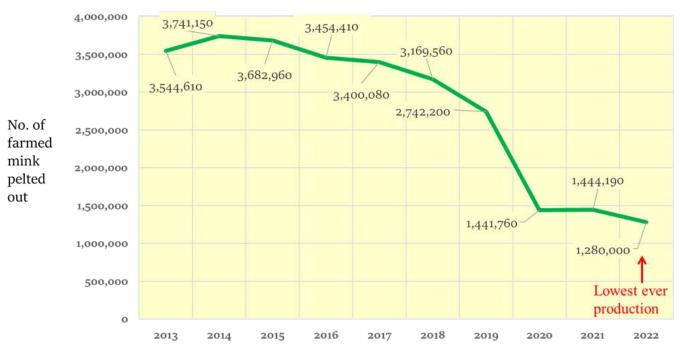
Figure - Average U.S. farmed mink pelt prices 2013-2022 Source: USDA NASS for 2013-2022



Source: https://downloads.usda.library.cornell.edu/usda-esmis/files/2227mp65f/d791tn532/7875fk83r/minko722.pdf

#### Number of U.S. farmed mink pelts produced 2013-2022

Source: USDA NASS for 2013-2021 data; estimate for 2022



Source: https://downloads.usda.library.cornell.edu/usda-esmis/files/2227mp65f/d791tn532/7s75fk83r/minko722.pdf

