

An aerial photograph of the Salton Sea, a large body of water in the southwestern United States. The sea is a deep blue color, contrasting with the surrounding landscape. In the foreground, there is a vast expanse of agricultural fields, organized in a grid pattern, with various shades of green and brown. The background shows rolling hills and a clear blue sky. The title text is overlaid on the upper left portion of the image.

The Salton Sea – Dust Emissions, Lung Inflammation, and Asthma

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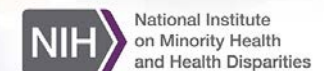
The Extended Family

- › Community Engagement
 - › Ann Cheney, Maria Pozar, Sahar Foruzan, Gaby Ortiz
- › Comic book artists
 - › Yuki Murayama, Yuxin Lin
- › Field collection, environmental microbiology
 - › Emma Aronson, Jon Botthoff, Mark Swenson, Mia Maltz
- › Climate modeling, transport studies
 - › Will Porter, Yaning Miao
- › Lo Lab chamber studies
 - › Qi Li, Ryan Drover, Daniel Gonzalez (David Cocker Lab)
 - › Trevor Biddle, Keziah Yisrael, Diana del Castillo

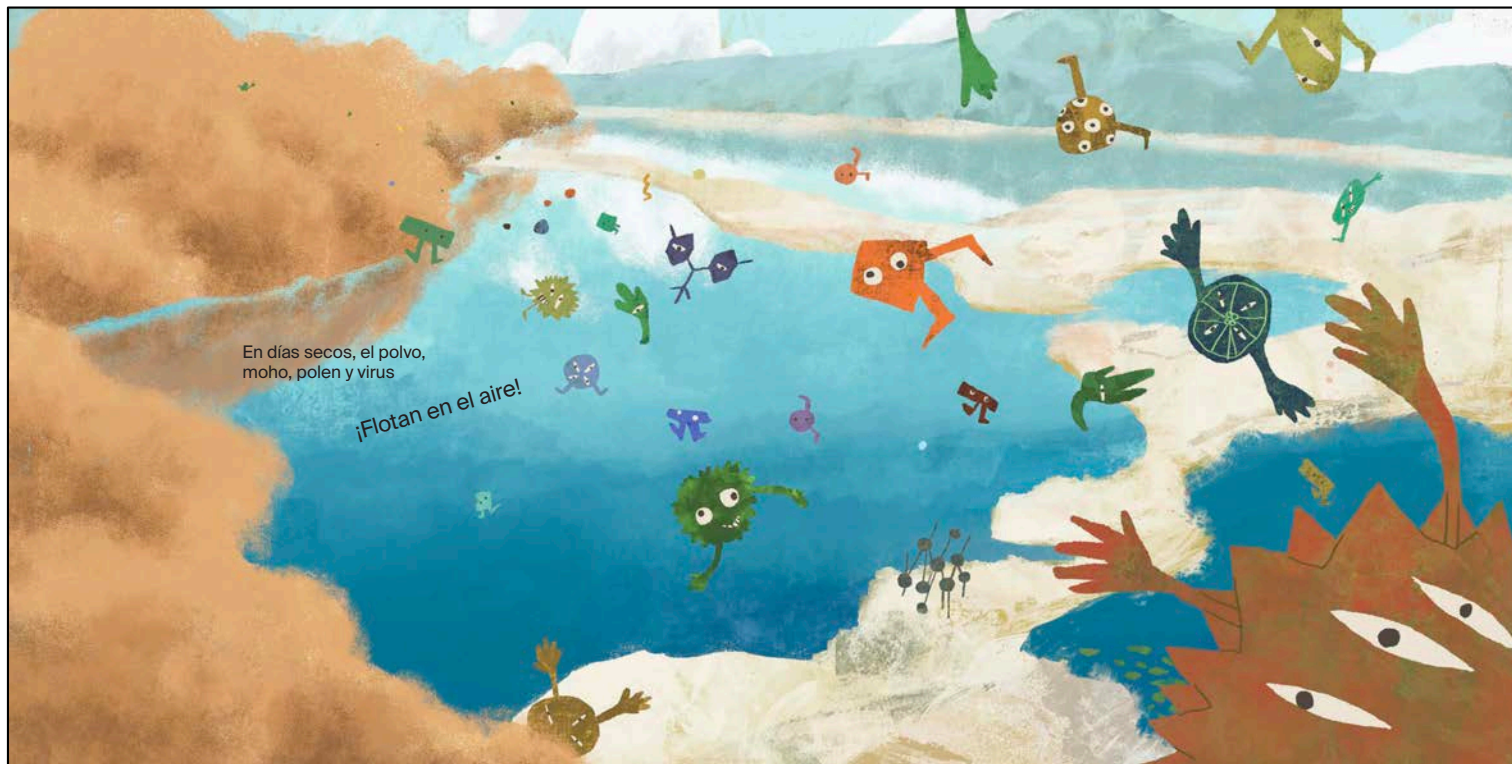


(Yuxin Lin)

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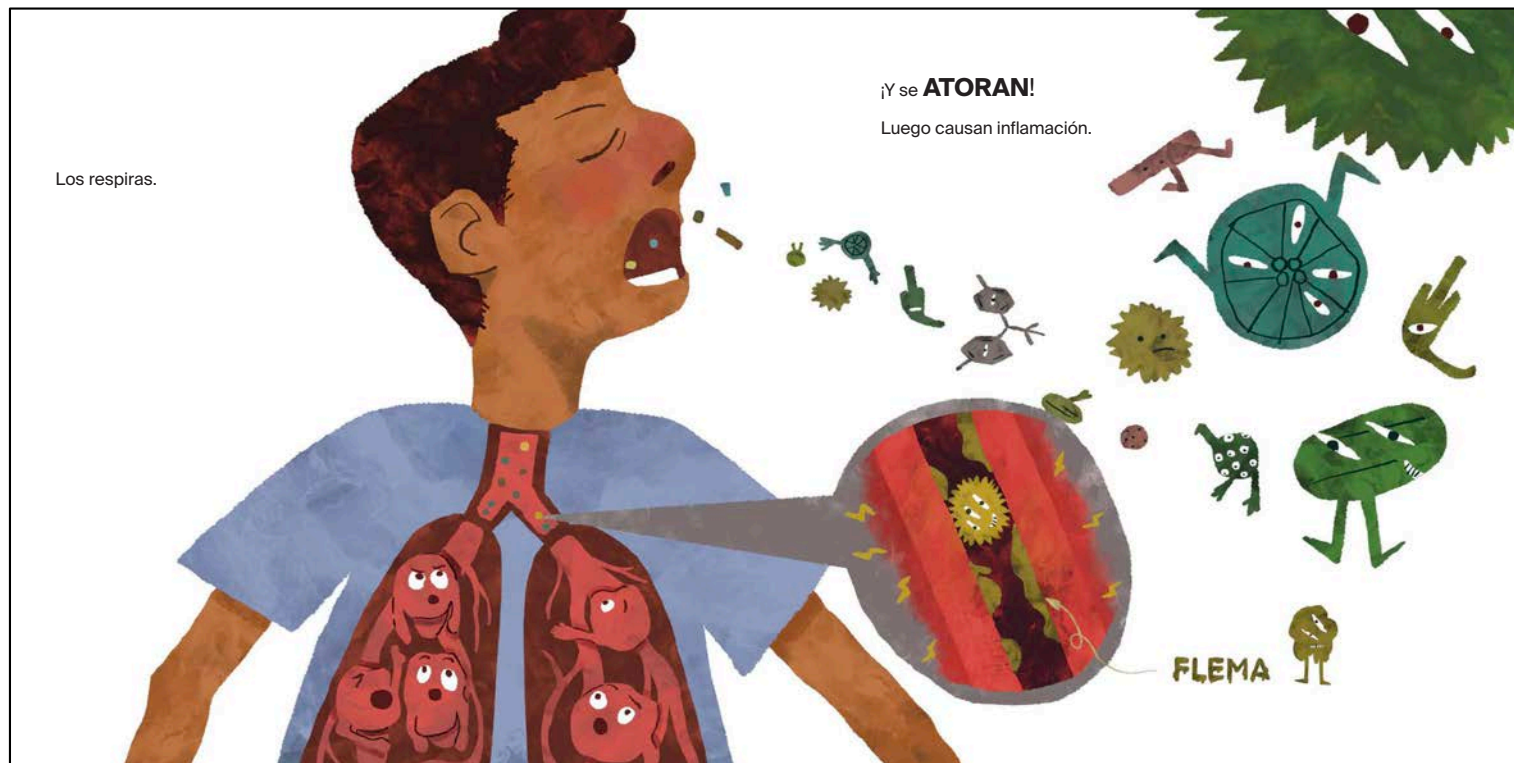


The Salton Sea is California's largest lake; while it is pretty in photos, it has a declining ecosystem, and increasing dust emissions are causing health problems



(Yuki Murayama)

The most severe health impact is the high incidence of childhood asthma;
it is believed that the dust from the sea causes the lung inflammation



(Yuki Murayama)

Our Research



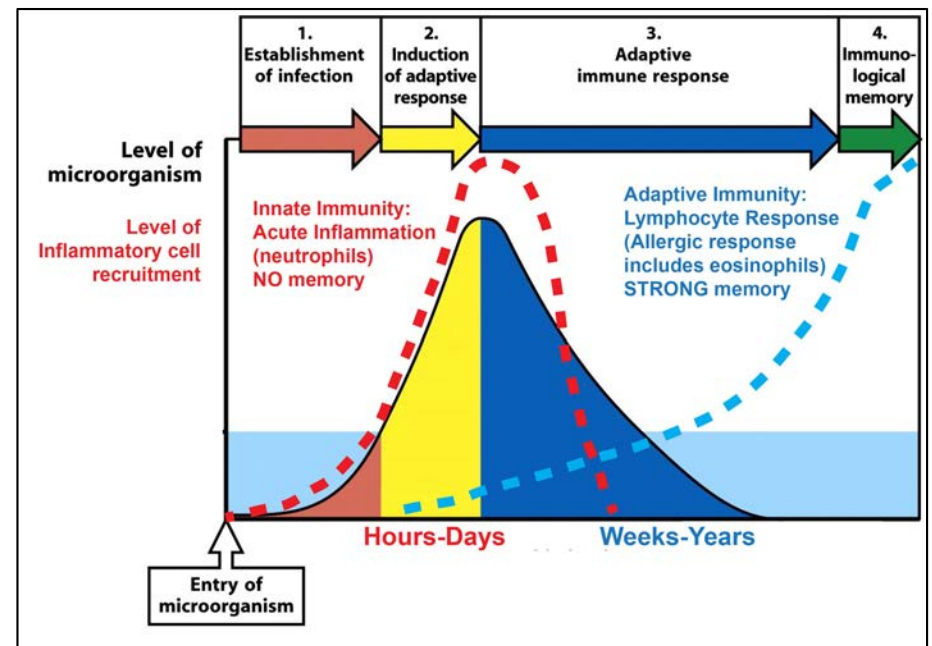
(Yuki Murayama)

- We are studying the effect of aerosol exposures using samples collected from various sites around the Salton Sea, and other more distant sites
- Using an environmental exposure chamber (above), we expose mice continuously to aerosols for various periods, then look at lung inflammation and gene expression

First, A Brief Immunology Lesson: Inflammation and Lung Disease

The Immune System can be induced by

- › **Innate** immune triggers such as bacterial infection
 - › Rapid first-responder (neutrophil) recruitment, rapid recovery and NO memory or amplification
- › **Adaptive** immune triggers such as **allergens** (e.g., dust mite, ragweed) or viruses (e.g., flu, COVID)
 - › Slow initiation, follows innate response, antigen (allergen) specific, includes memory
 - › *Asthma is usually associated with ALLERGIC responses (adaptive)*



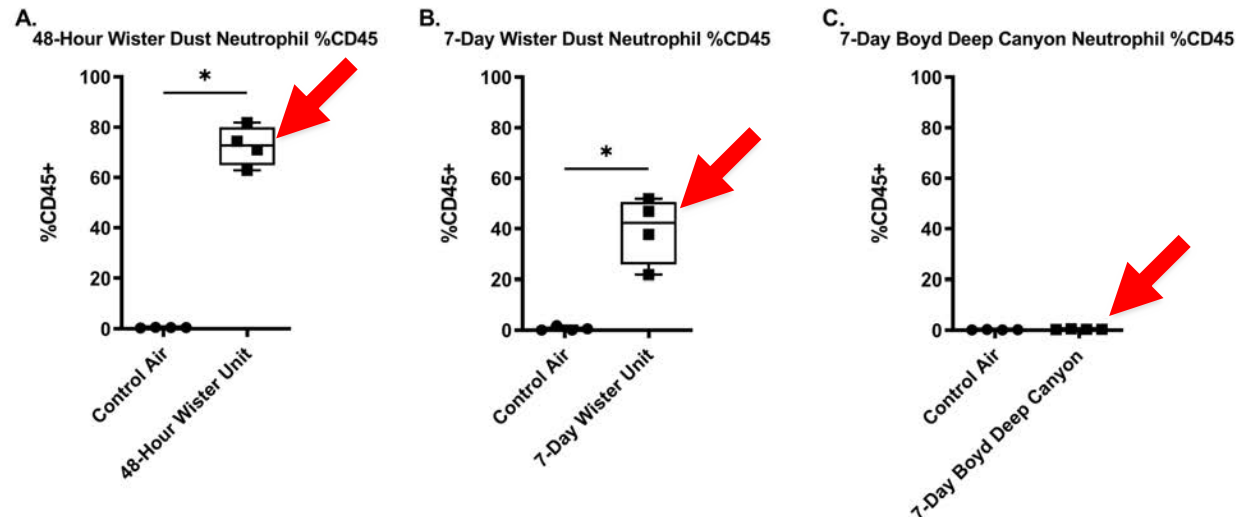
Thus, the character of the response provides clues to the causes

Dust Sources for Exposure Studies

- › Dust was collected from several sites near Salton Sea, as well as from distant sites
 - › Wister, Sonny Bono, both close to the southern end of the Salton Sea
 - › Boyd Deep Canyon near Palm Springs
 - › Dos Palmas near North Shore



Neutrophil Response To Dust Exposures

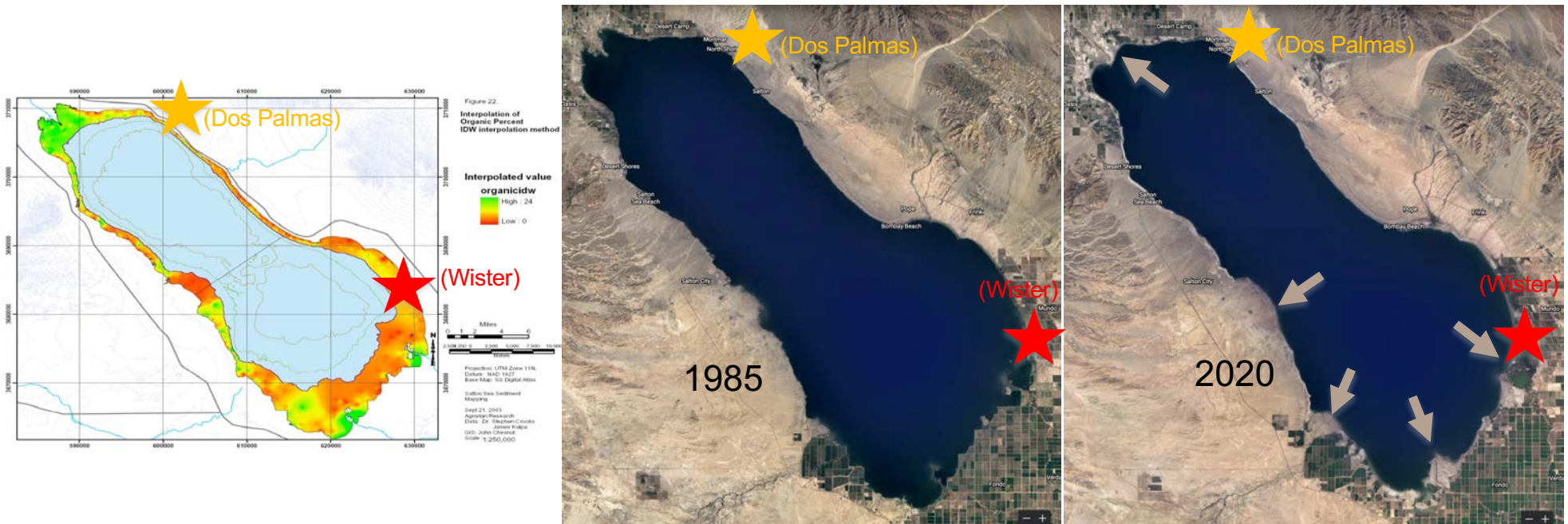


(1) Wister and Sonny Bono dust triggers a neutrophil (innate) inflammatory response in exposed lungs (**NOT** allergic!). Similar results for Dos Palmas near North Shore

(2) NO inflammatory response to Boyd Deep Canyon dust

THUS, Proximity to the Salton Sea is associated with significant dust toxicity

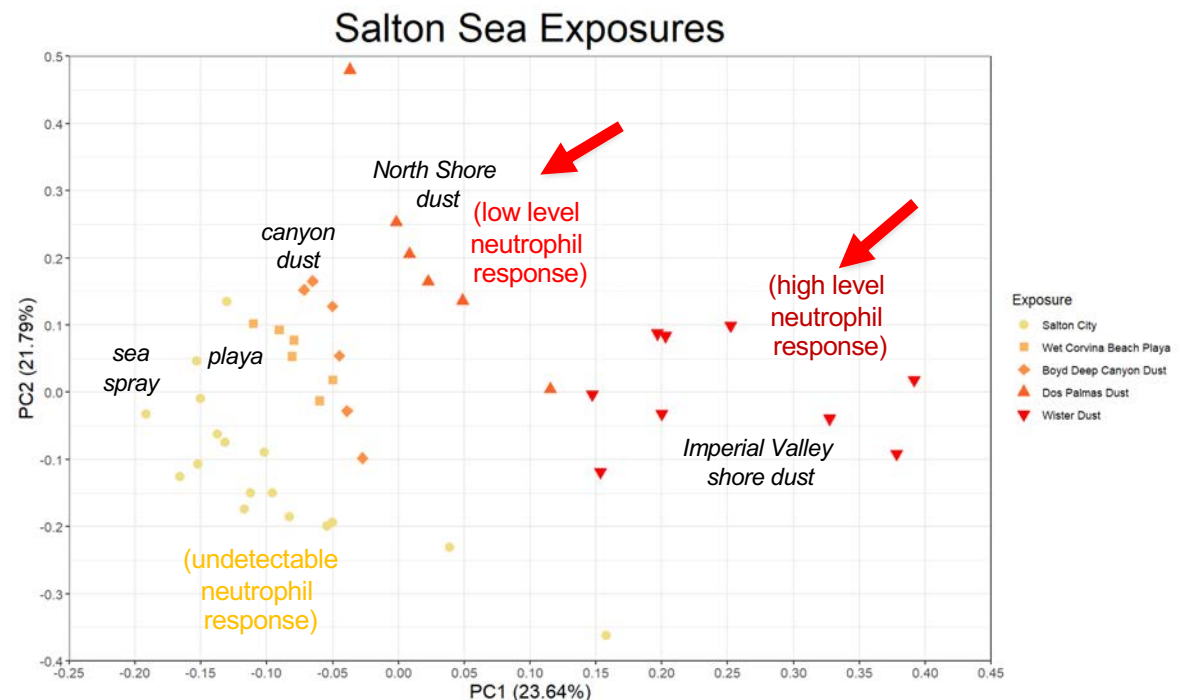
Hypothesis: Proximity to Salton Sea/Playa and Toxicity



- › These maps suggest a relationship between exposed playa and toxicity
 - › Organic content at the shoreline; rate of playa exposure from 1985 to 2020
 - › Toxicity of dust correlates with proximity to freshly exposed playa (arrows)

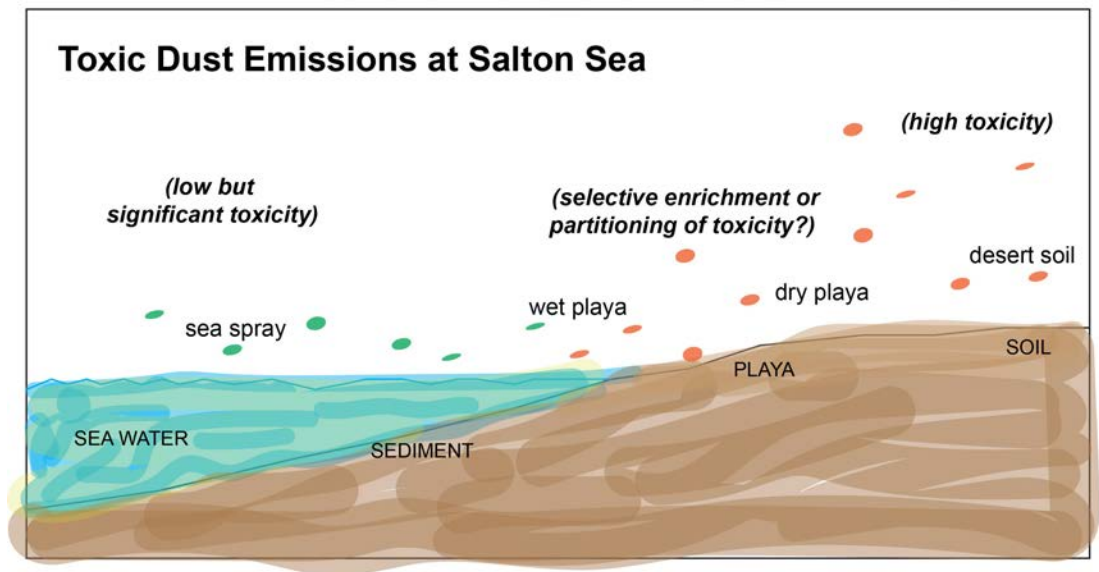
Evidence for Playa Enrichment of Toxins

This is a summary of gene expression patterns after different exposures, from Salton Sea water (sea spray) to playa extract, to dusts near Salton Sea and distant sources. The data show evidence for a progression in responses from sea water to playa to dust. Importantly, the far right two exposures (dust from Salton Sea playa) induce significant lung inflammatory responses.

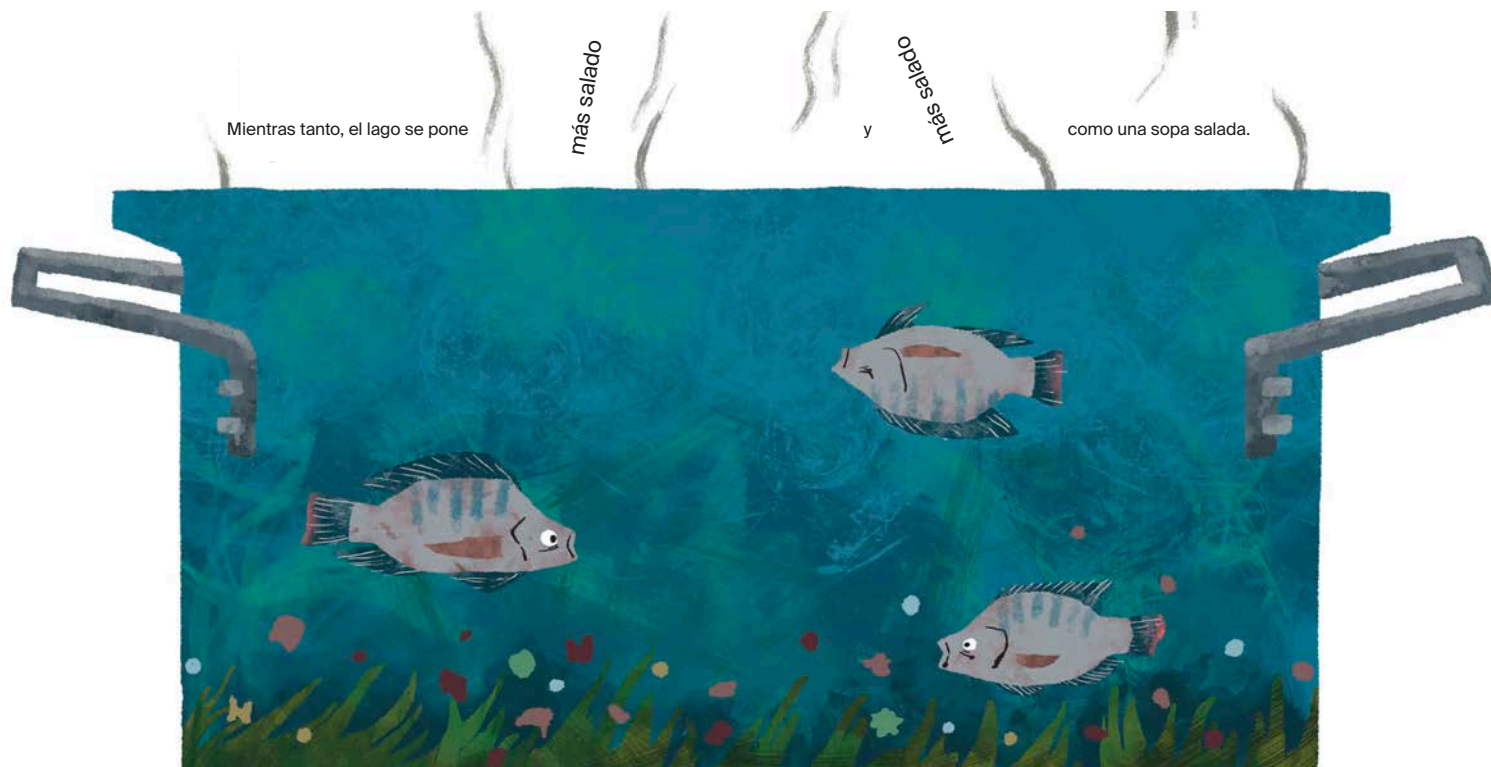


Comments

- ▶ Salton Sea playa aerosol dust exposures show evidence for an **Innate** (not Adaptive Allergic) response in lungs, consistent with a response to microbial toxins
 - ▶ Is there selective enrichment of microbial toxins by dust entrainment at the playa?
 - ▶ What are these toxic components?
 - ▶ Is this inflammatory response consistent with clinical asthma-like symptoms?



It is only getting worse; there is less fresh water runoff into Salton Sea, and with chronic drought and warming temperatures, the sea is drying up



(Yuki Murayama)