Non-invasive Assessment of Anthropogenic Microparticles in Cassin's Auklets on Southeast Farallon Island



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Project Objectives

Q1: *How frequently are anthropogenic microparticles detected in Cassin's Auklets on the Southeast Farallon Islands?*

To address this question, we will measure the prevalence of anthropogenic microparticles in the diet of Cassin's Auklet chicks and adults during the 2025 breeding season, using:

- 100 adult guano samples
- 100 chick guano samples
- 50 regurgitation samples

Project Objectives

Q2: *What are the dominant morphologies and chemical polymers of anthropogenic microparticles moving through the SEFI ecosystem?*

To address this question, we will perform a two-step chemical fingerprinting analysis using fluorescence microscopy and Fourier-Transform Infrared (FTIR) spectroscopy.

Not Every Microparticle is a Microplastic

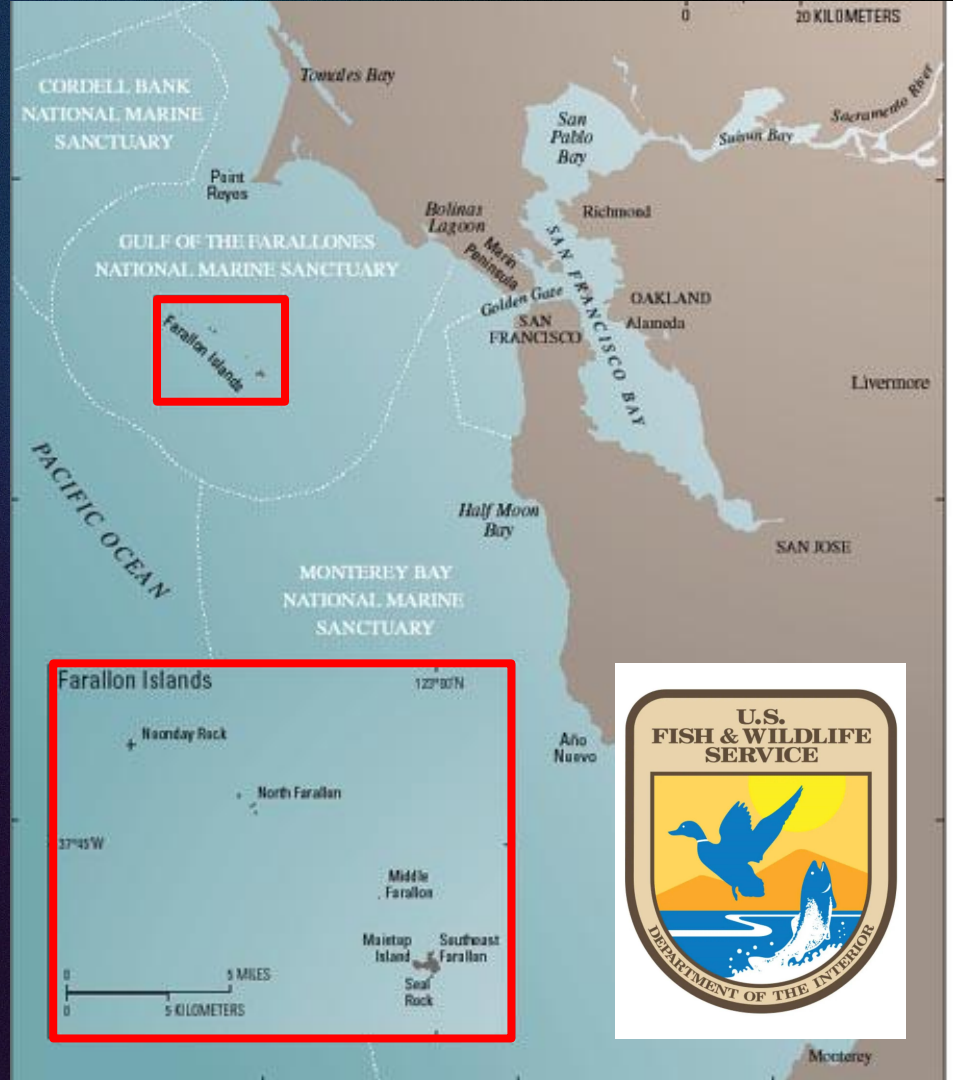
Visual identification alone cannot reliably establish material identity.

Methods for the isolation and identification of microparticles have only recently become sufficiently reliable,
leaving many systems poorly characterized.

The Farallon Islands and The Greater Farallones National Marine Sanctuary

considered the most urban marine sanctuary in the United States.

This is a system where terrestrial and marine sources of pollution intersect with a highly productive, delicate food web.



Seabird Sampling

The Cassin's Auklet is listed as a near threatened species of concern.

Monitoring their exposure to microplastics is essential for their success.

And – the birds provide something incredibly useful:

they are repeatedly sampling the California Current for us.





….so why *guano?*

- Provides a temporal “snapshot” versus lifetime accumulation
- Low cost
- Scalable
- Minimally invasive / non lethal
- Faster processing time



Methodology

The core workflow follows:

1. Diet sample collected during routine nest checks
2. Chemical digestion of organic material
3. Vacuum filtration to isolate inorganic particles
4. Microscopy and spectroscopy for particle characterization

Process details:

- robust field and laboratory blanks
- KOH and H_2O_2 digestion
- 8 µm polycarbonate filter membrane
- epifluorescence screening
- FTIR material identification

Methodological Insights; The Chitin Problem:



Addressing Biopolymers

*Many planktonic animals contain **chitin**, a **biopolymer**, which can mimic the characteristics of plastic - leading to **false positives**.*

- Chitin dissolving enzymes are very expensive.
- Additional H_2O_2 digestion step implemented but not 100% efficient.
- H_2O_2 can cause excessive *foaming* and potential sample loss.
- FTIR will be essential to differentiate synthetic plastics from chitinaceous material



Epifluorescence screening

Most plastics autofluoresce under an epifluorescence microscope.

- Preliminary screening shows suspected anthropogenic microparticles present in 10/10 adult and chick samples.
- fibers and fragments are the dominant morphologies present
- chitin autofluorescence complicates this screening step

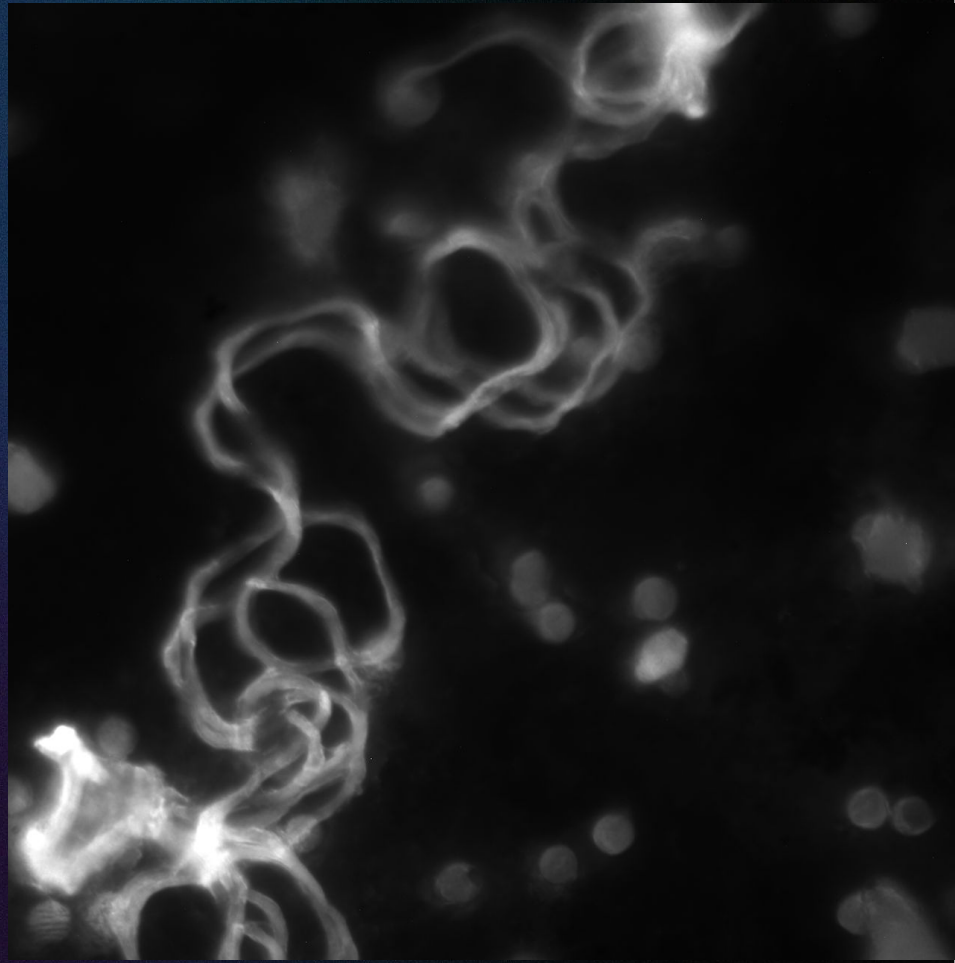


Photo of a suspected anthropogenic microfiber under fluorescence microscope

Fourier-Transform Infrared Spectroscopy

Access to an FTIR instrument and training is limited, and often expensive.

Not all FTIR is equal - Scanning and analysis times can vary greatly:

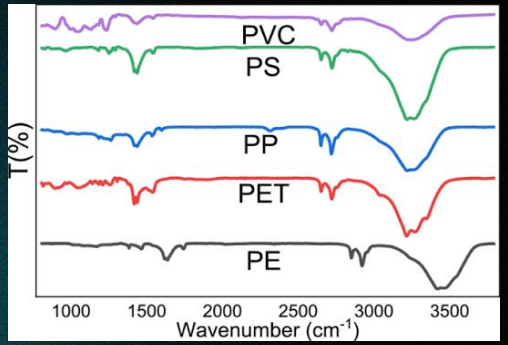
- single-point mapping can be very time consuming
  - often requires close or direct contact with the particle - which poses logistical challenges.
- Modern array and laser technologies offer full-filter chemical mapping in less time.



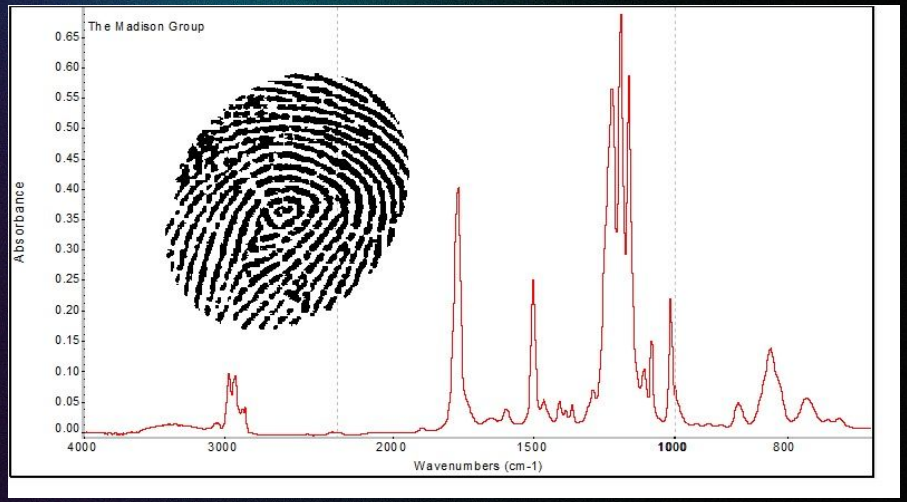
We are currently seeking access to an FTIR instrument to complete this study.

Next Steps:

Samples will be analyzed with FTIR, and matched with a polymer database to determine material identity.



This data will provide a temporal snapshot into microparticle contamination in the planktonic diet of SEFI Cassin's Auklets in 2025.
We will gain insight on trophic transfer of microparticles from zooplankton, to parent, to chick.



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Point Blue
Conservation science for a healthy planet.

Thank You!