Moss Landing Battery Fire

Update from EMBER to Monterey County Supervisors

17 March 2026

Photo: Mike Takaki, from Packard Ranch

EMBER

Estuary **M**onitoring of **B**attery **E**missions and **R**esidues resulting from the Moss Landing battery fire

https://elkhornslough.org/moss-landing-battery-fire/

Elkhorn Slough National Estuarine Research Reserve

ELKHORN SLOUGH FOUNDATION Since 1982

Moss Landing Marine Laboratories

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Key theme of this talk

To detect ecological impacts of the battery fire, appropriate sampling is essential. This includes:

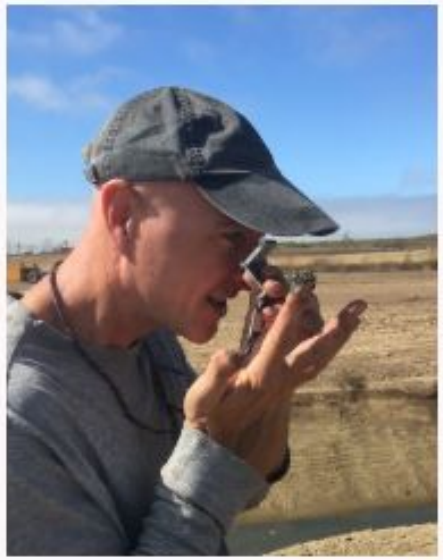
- sampling soil surfaces immediately after the fire to detect ash layer
- sampling with high spatial coverage to detect patchy deposition
- sampling diverse organisms for a long time after the fire to track potential bioaccumulation

EMBER has done this. Others have not.

Sediment and geospatial team

Tracking spatial and temporal distribution of metals before and after the battery fire

Sediment and geospatial team



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Geological Oceanography
Moss Landing Marine Labs

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First EMBER publication

scientific reports

Check for updates

OPEN

Coastal wetland deposition of cathode metals from the world's largest lithium-ion battery fire

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Fires at lithium-ion battery storage facilities pose emerging environmental risks that remain largely undocumented under real-world conditions. Following a major fire at the world's largest Battery Energy Storage System (BESS) in Moss Landing, California, we conducted rapid, high-resolution soil surveys to quantify metal fallout in adjacent estuarine wetlands. Field-portable X-ray fluorescence (FpXRF), validated by SEM/EDS, laboratory XRF, and ICP-MS, revealed a significant but transient surface enrichment of nickel (Ni), manganese (Mn), and cobalt (Co). This enrichment had Ni: Co mass ratios near 2:1 serving as a geochemical fingerprint of NMC-type cathode materials. The metals were confined to a shallow surface layer (< 5 mm). Surface concentrations declined rapidly following precipitation and tidal inundation. The fallout's thin, transient and patchy distribution would have eluded standard coring methods but was detected through spatially intensive FpXRF sampling, highlighting the importance of rapid detection and the mobilization of metals into wetland ecosystems. These findings underscore the need for adaptive environmental monitoring following battery fires and raise critical considerations for ecosystem protection and infrastructure as energy storage systems expand.

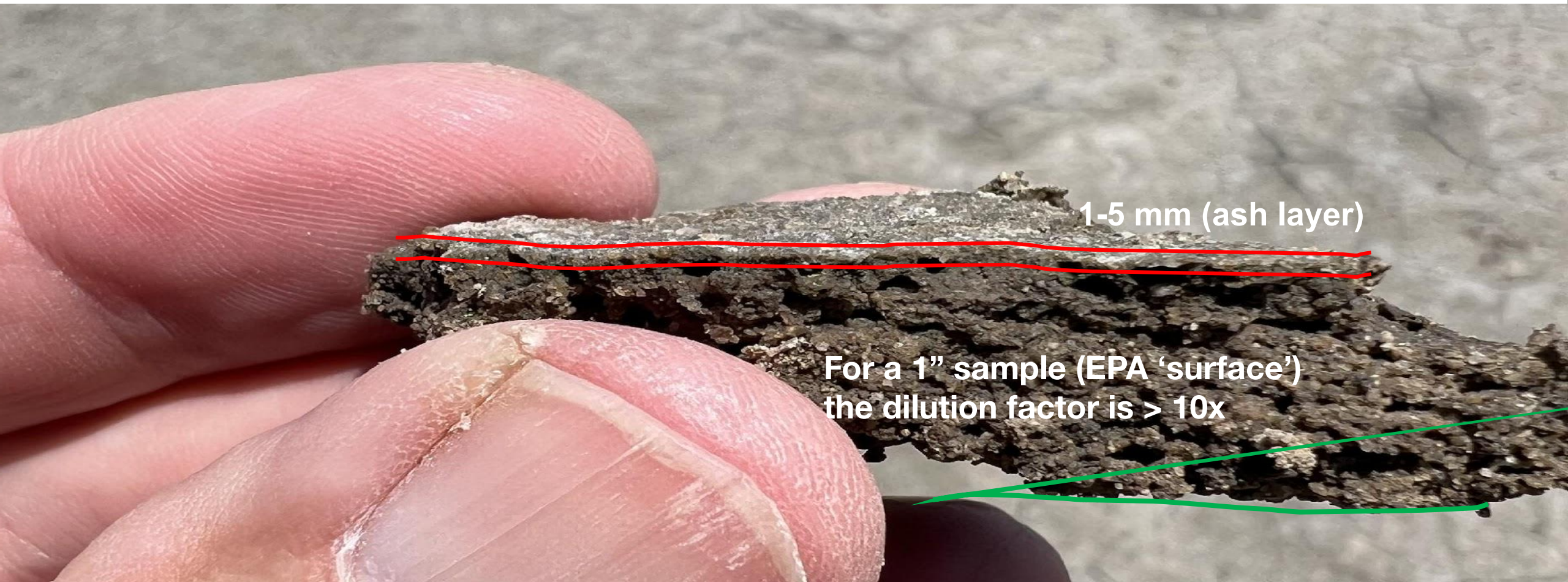
Robust pre- & post- fire comparison

- Metal concentrations measured with field X-ray fluorescence analyzer
- Baseline concentrations established in 2023 at Hester Marsh permanent transects
- Same spots resampled after fire

Fire debris contamination

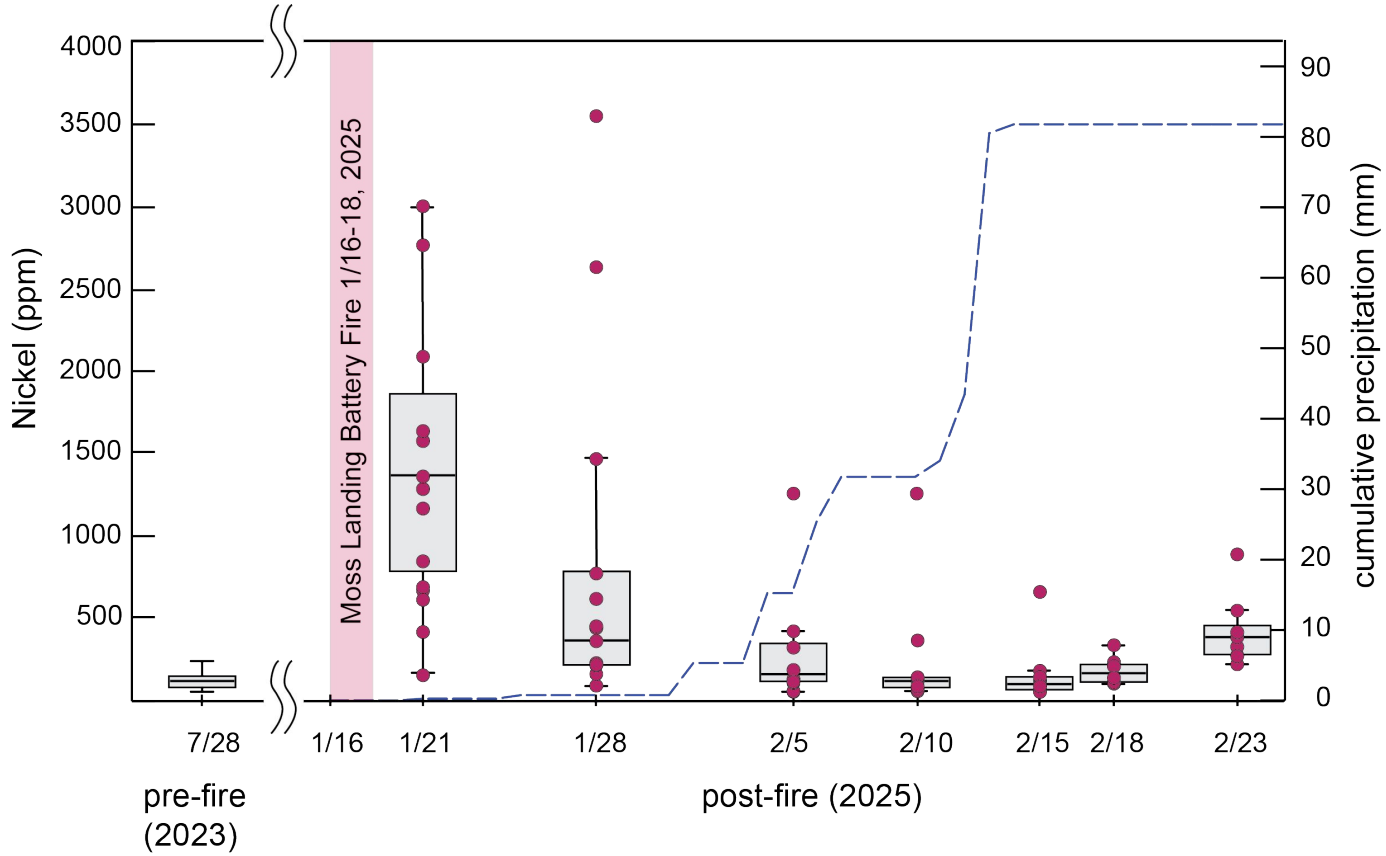
Larger metal debris also detected 1-3 km from fire, consisting of almost pure battery metals; patchy and disappeared rapidly

Ash layer was very thin but concentrated: maximum Nickel concentrations 10x baseline initially, but decreased after rain



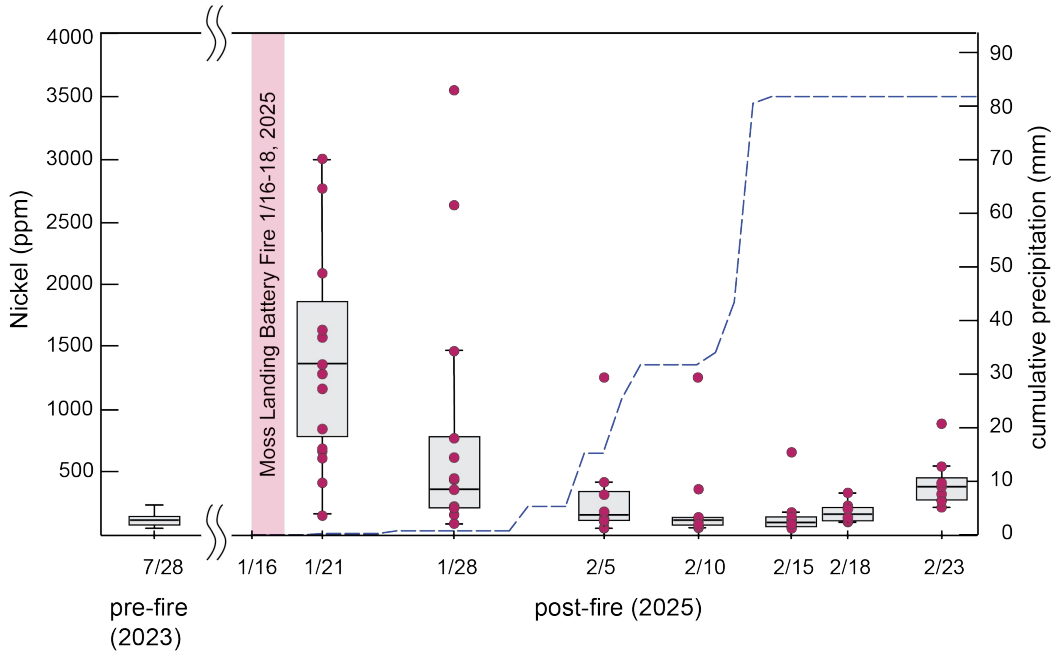
Patchy, short-lived phenomenon

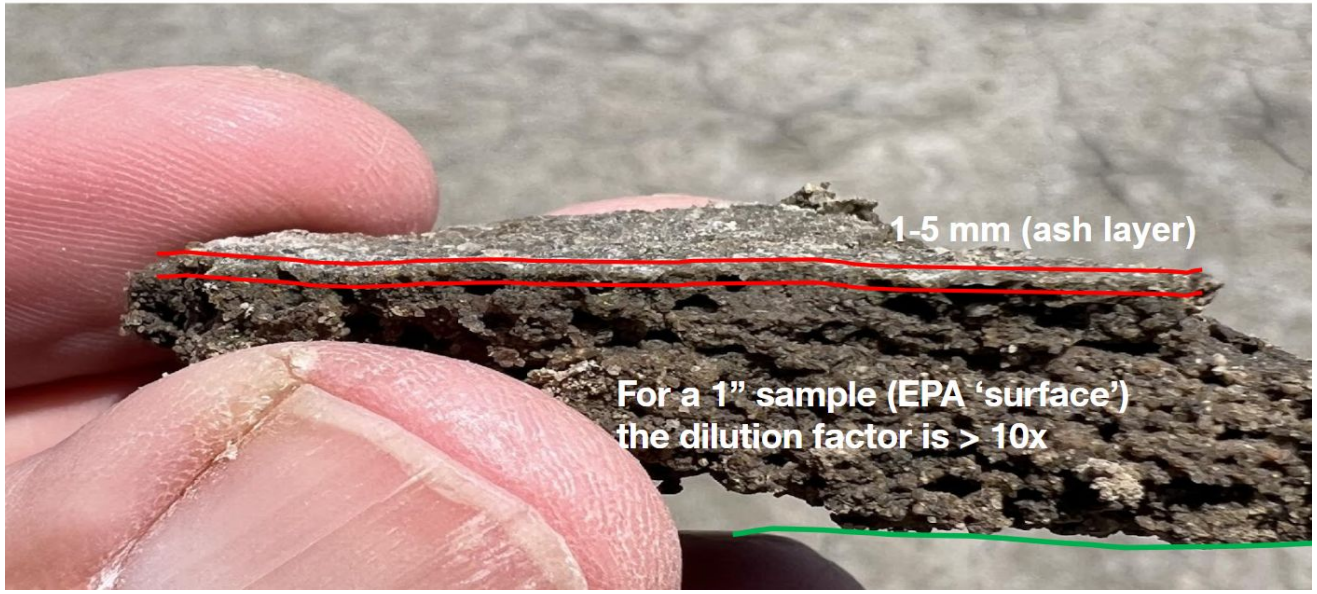
- Time series shows dramatic increase in Nickel in some spots along permanent transects at Hester, but high variance
- Decreased following rains



Patchy, short-lived phenomenon

- Few, deep cores such as those taken by agencies initially were not suited to detecting thin, patchy layer of battery metals on soil surface
- Cores collected 8 months later by Terraphase were taken too late (see letter submitted by EMBER to Nicki Fowler)

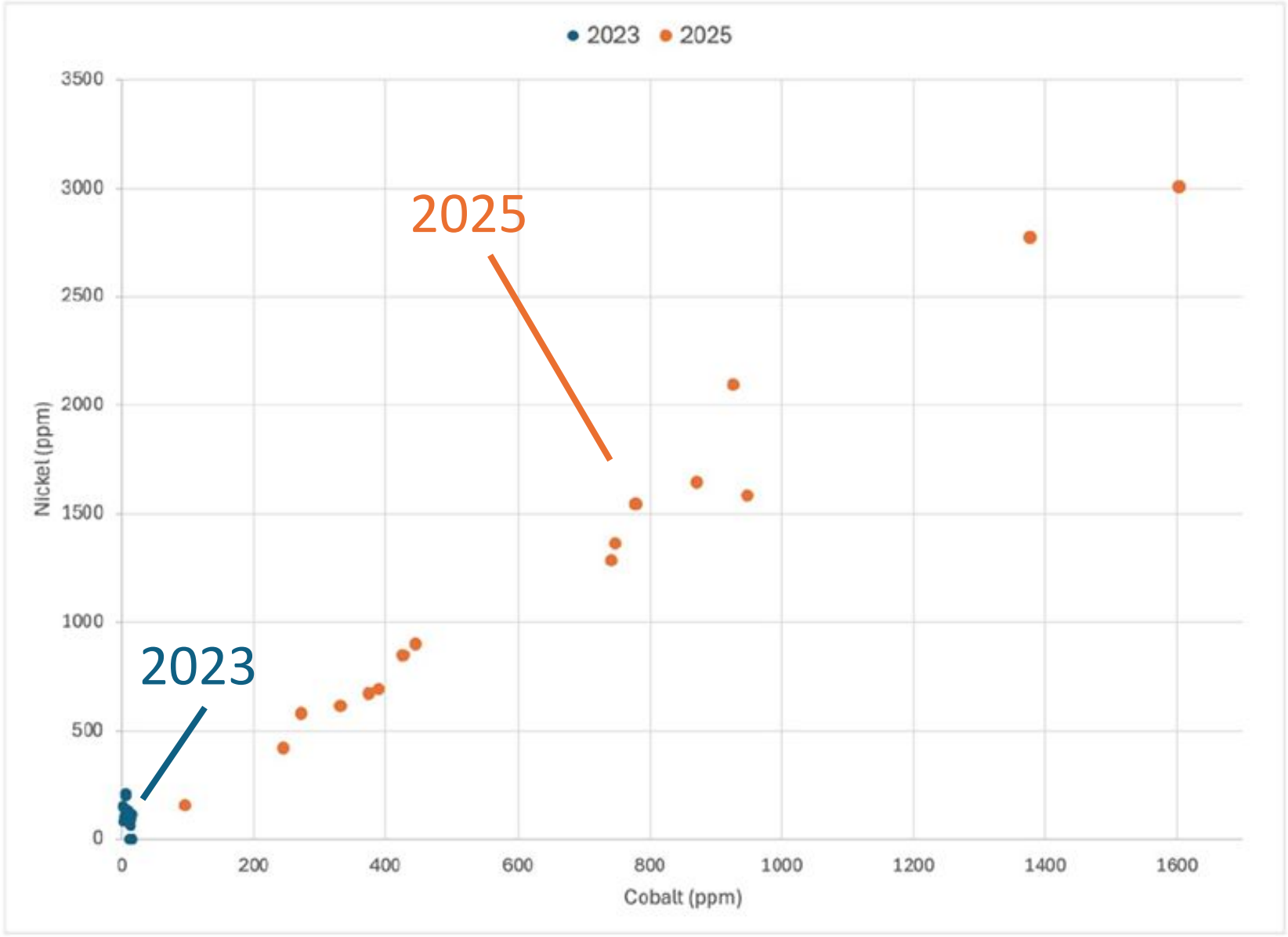




Battery metal signature

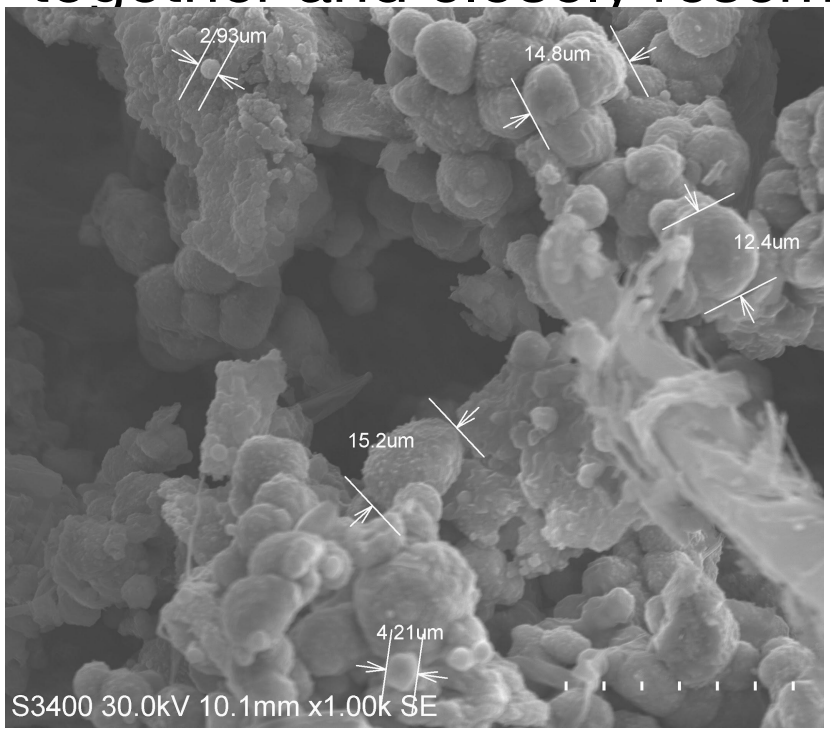
- Ni:Co correlated only after fire, same ratio as batteries
- Peak concentrations dramatically higher in 2025 than 2023

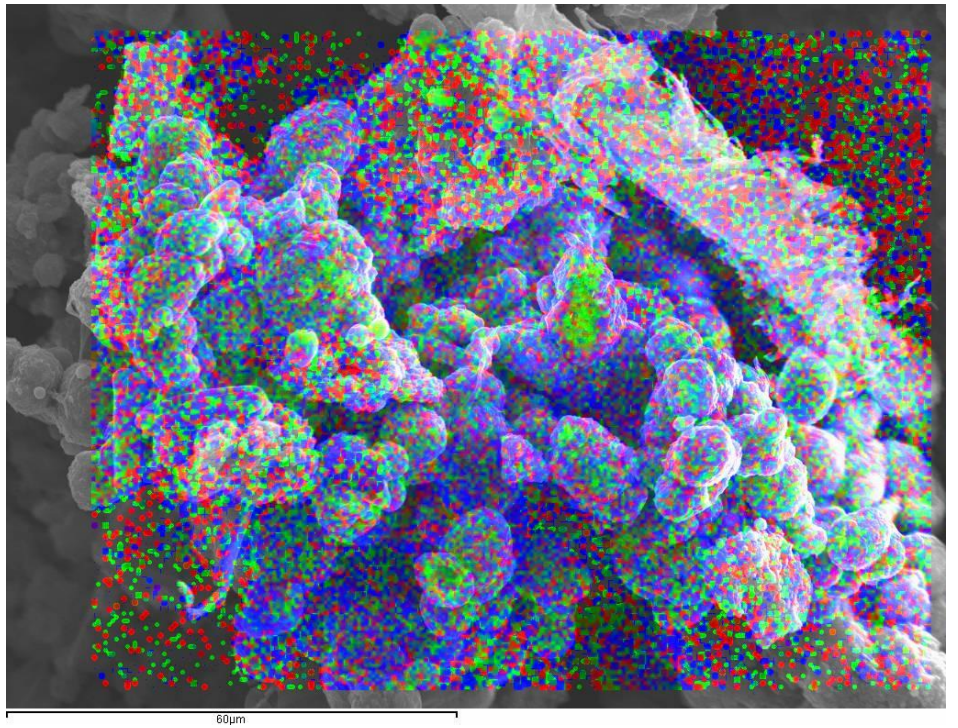
Jan 21, 2025, first sampling



Structure of metals in marsh resembled battery material

Scanning Electron Microscope Energy Dispersive X-ray Spectroscopy: Samples from Hester Marsh reveal Mn, Ni, Co metal microparticles clustered together and closely resembling material used in battery cathodes



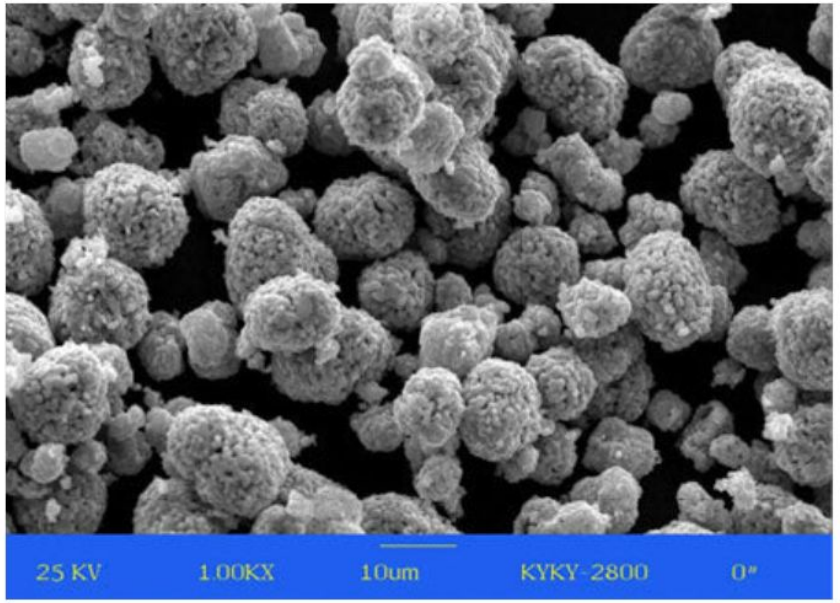


Red: manganese

Green: cobalt

Blue: nickel

Structure of metals in marsh resembled battery material



Geospatial summary

Highly concentrated metals on Elkhorn marshes: thin, patchy fallout layer of Nickel, Cobalt and Manganese deposited on wetlands

Battery source: Proportions of metals and particle morphology match batteries

Rapid redistribution: Rain and tides quickly reduced surface concentrations; the metals from the fallout layer were redistributed in estuarine ecosystem

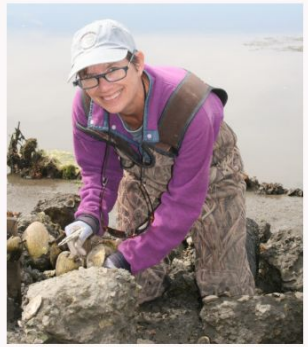
Biota team

Tracking uptake or accumulation of metals related to the battery fire into plants, invertebrates, and fish in Elkhorn Slough

Biota team

Amanda Kahn

Associate Professor, Moss Landing Marine Labs



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Research Assistant MLML, CSU Monterey Bay

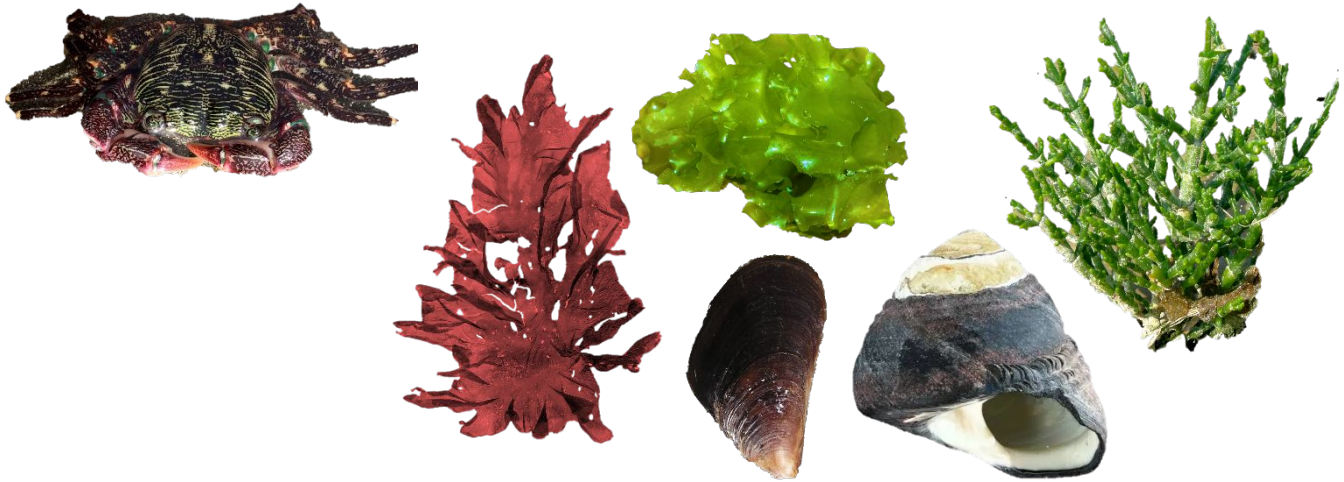
Jacob Harris

Coastal & Ocean Stewardship Program Manager, Amah Mutsun Land Trust

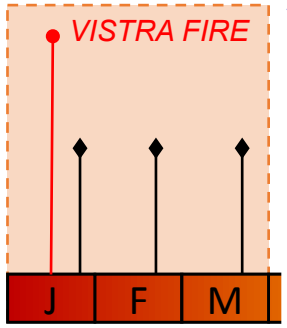
Amah Mutsun Native Stewards

Target species

- **Plants/algae**
- **Molluscs**
- **Crustaceans**
- **Fish**

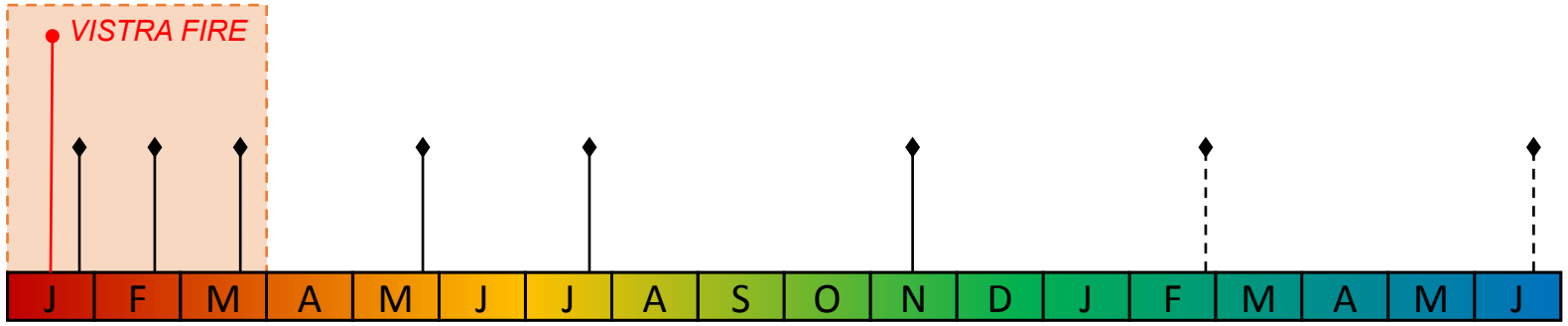


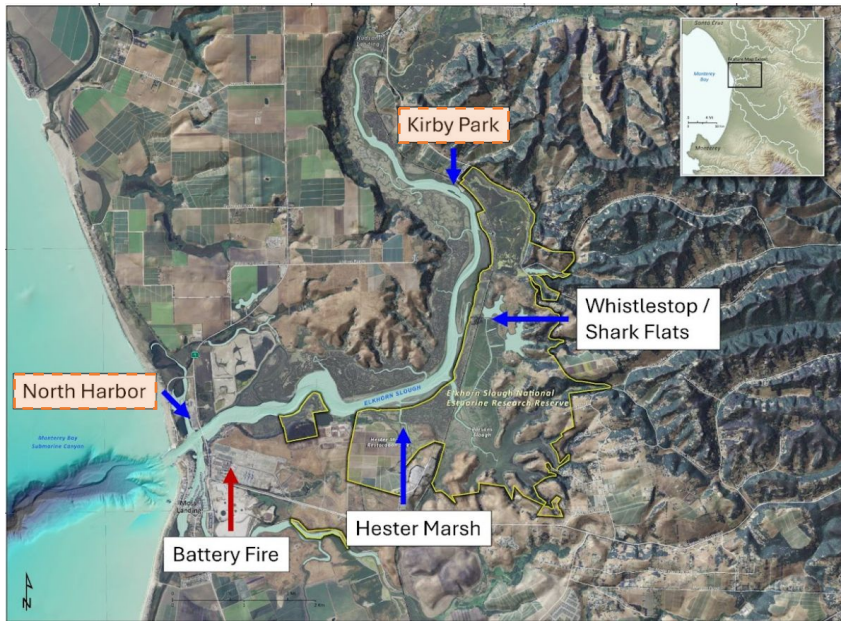
Rapid mobilization after fire



Sampling within week - previously scheduled Tribal-Reserve monitoring pivoted, Moss Landing Marine Laboratories engaged

Field collections continued



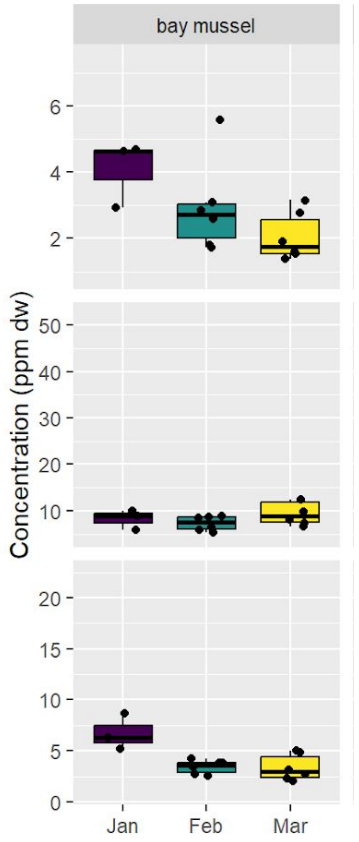


Preliminary results from:

- 2 sites
- 3 months
- 2 taxonomic groups

Results from first months

Bivalves



27
Co
58.93

25
Mn
54.94

28
Ni
58.69

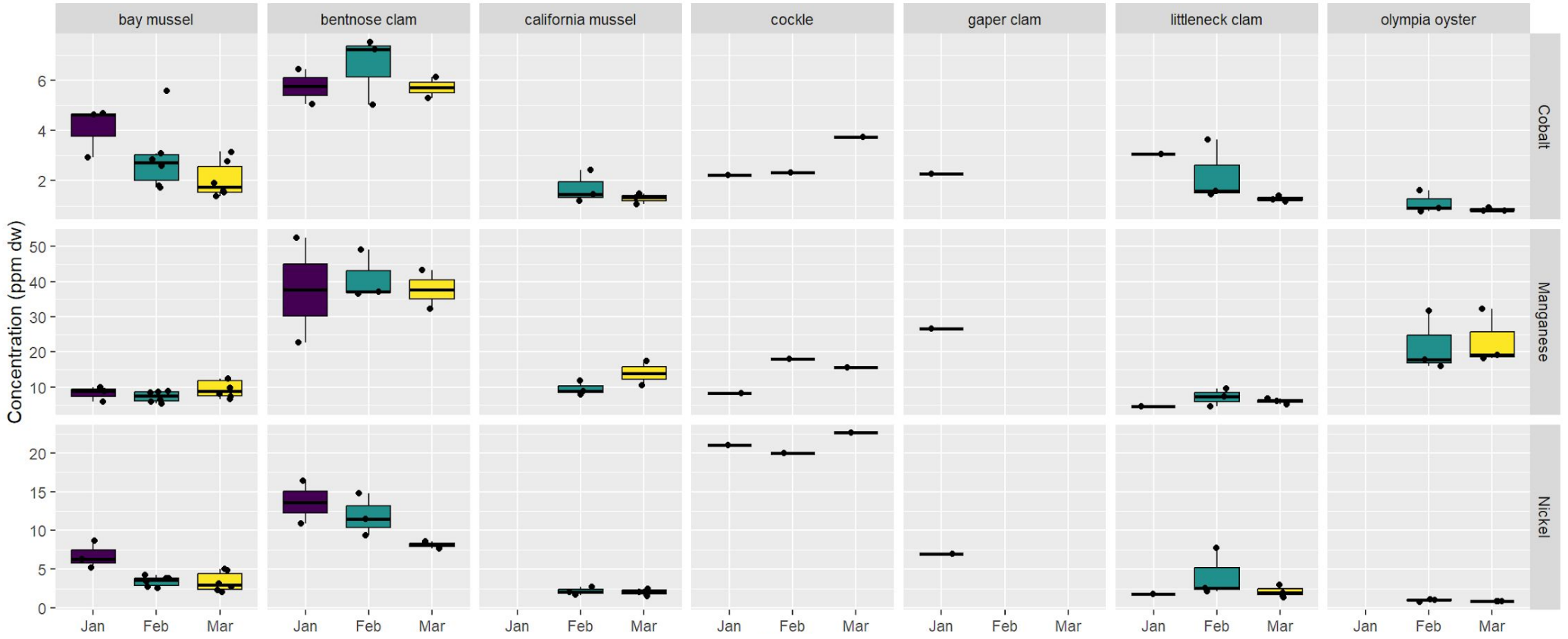
Diversity of animals sampled

Bivalves









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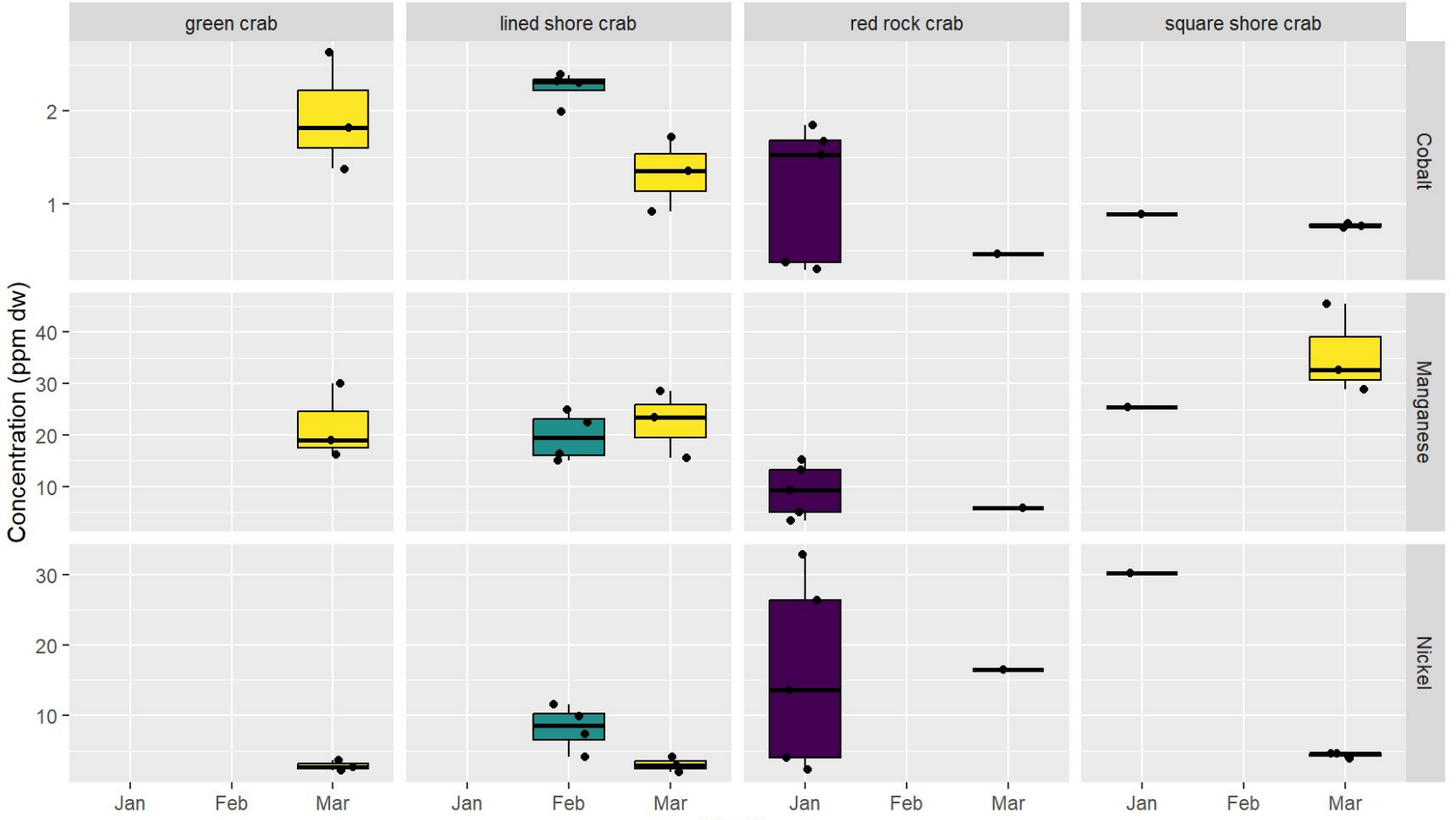
Diversity of animals sampled

Crustaceans



27
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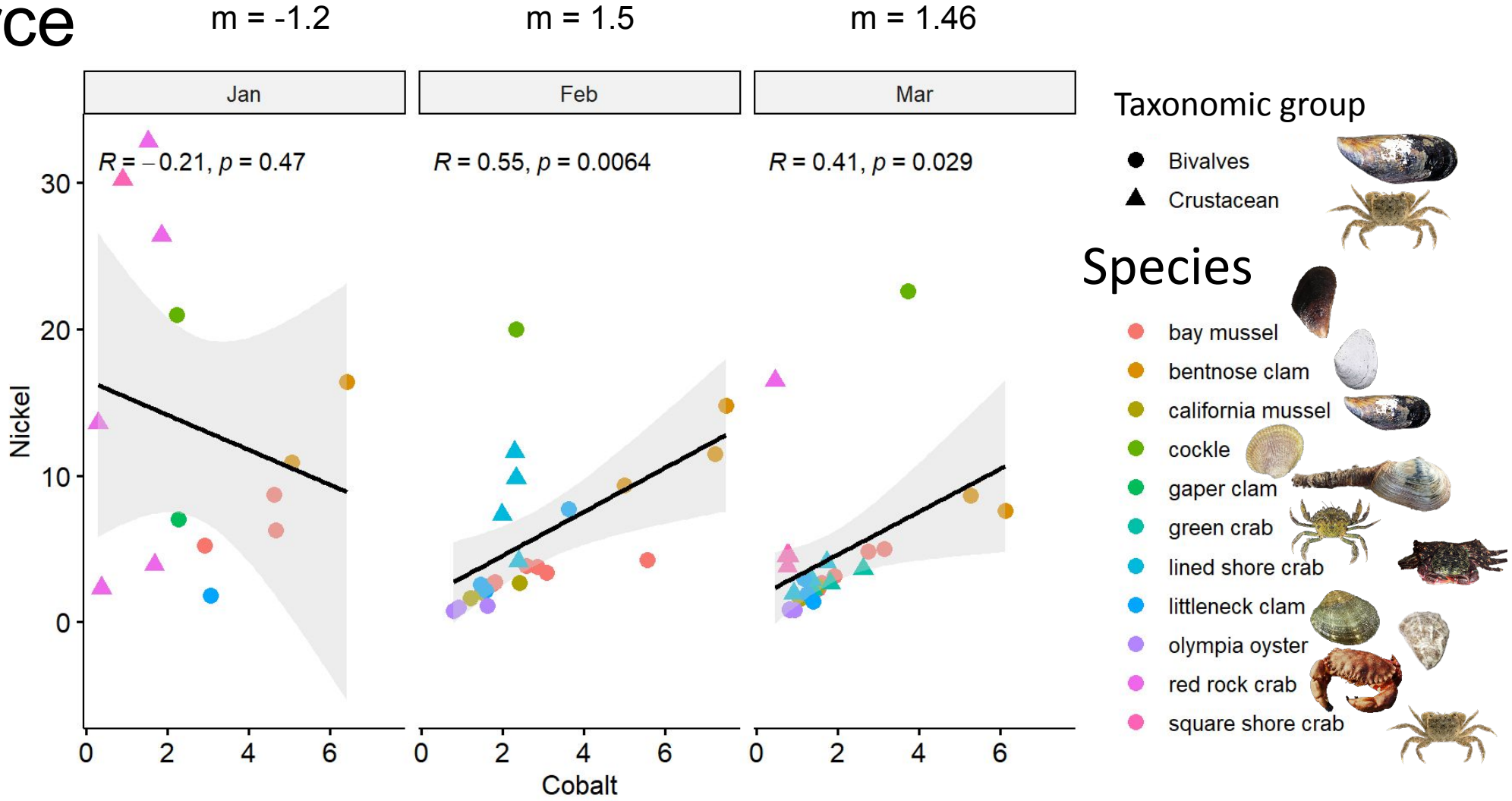
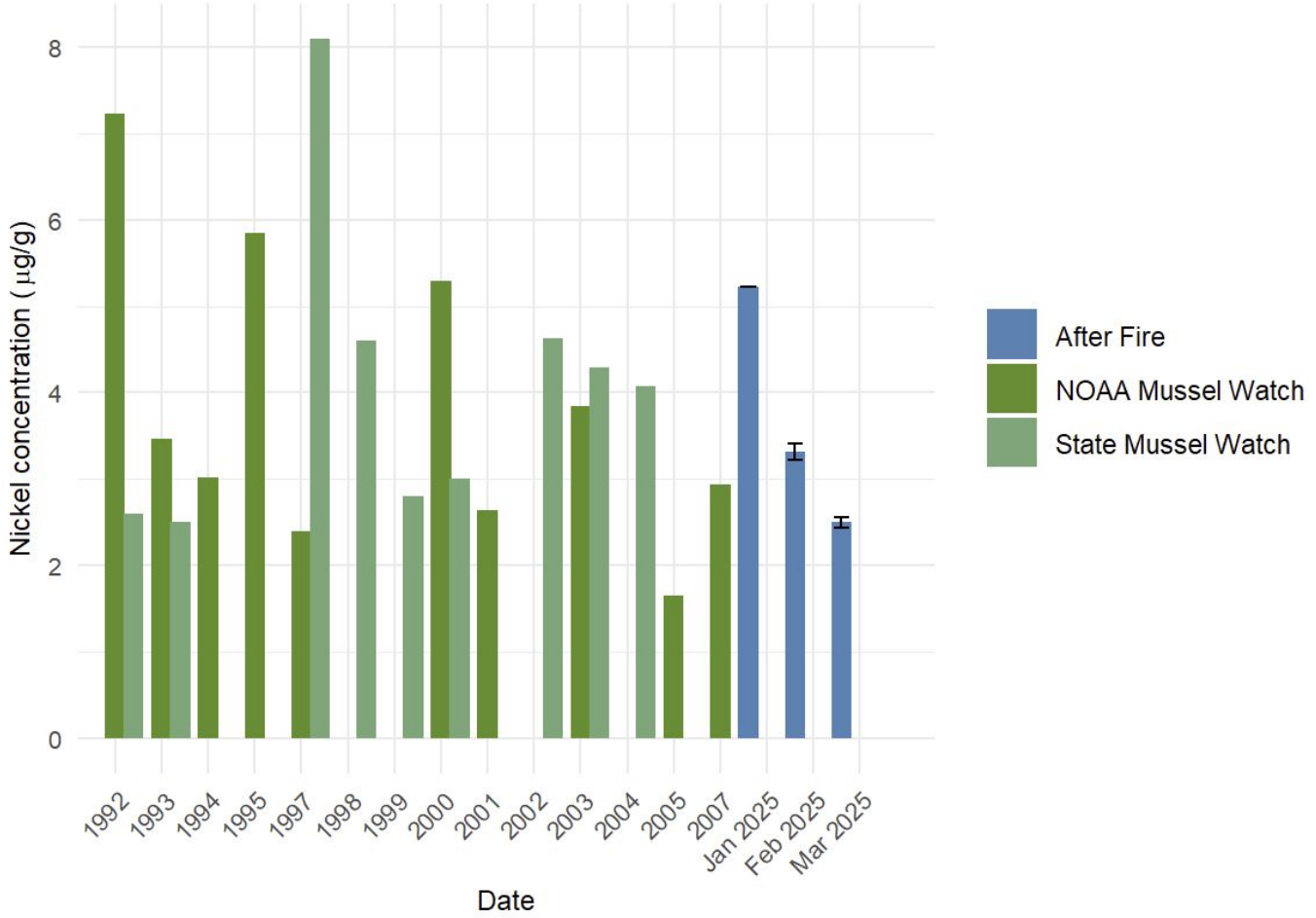
Nickel-Cobalt relationship

Highly correlated in Feb-Mar, consistent with a common, shared source



Temporal context

Metal concentrations in mussels after fire are within range of what has been measured from Elkhorn Slough in the past



Biota summary

Results from the first 3 months after the fire show correlated nickel and cobalt concentrations in Elkhorn Slough animals, which may suggest a battery metal source.

Metal concentrations in mussels are within range with what has been measured from Elkhorn Slough in the past.

No conclusions about ecological impacts of the battery fire should be drawn yet from these initial data. Bioaccumulation can be a slow process and we must analyze data from many species, sites and dates to understand potential impacts.

Key takeaways overall

Battery metals were deposited in adjacent wetlands as a **thin, pachy, concentrated layer**, that dispersed within weeks. Thus sampling with deep cores, and/or little spatial coverage, and/or in later months, cannot detect the contamination that occurred.

Bioaccumulation can occur slowly and unevenly across sites and species, so until many dates, sites and species have been analyzed for metals, conclusions cannot be drawn. So claims of absence of ecological impacts (e.g. Terraphase 12/2025) are premature at best and misleading at worst.

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