

Surveillance of highly pathogenic avian influenza viruses in sediment from wild bird habitats using targeted genomic sequencing

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High-pathogenicity avian influenza

- **High-pathogenicity avian influenzas (HPAIs):** strains of influenza A virus that cause severe disease in poultry
- Most HPAIs from H5 and H7 subtypes
- Current global enemy #1: H5
goose/Guangdong/96 clade 2.3.4.4b
("H5N1")



Avian influenza surveillance

- Avian influenza viruses naturally circulate in wild birds, especially waterfowl and shore birds
- HPAs spread along migratory flyways
- Influenza surveillance in wild birds is a cornerstone for HPAI outbreak prevention



Photo from Ducks Unlimited Canada

Avian influenza surveillance

- Two approaches:
 - Active surveillance
 - Passive surveillance
- Both approaches have limitations and biases



Photo by USGS

Environmental surveillance

- Test sediment specimens from wetland habitats instead of testing animals
- Viruses from numerous hosts accumulates in sediment – including rare and cautious species
- Does not depend on lethality in wildlife host
- Specimen collection is easy and minimally disruptive to wildlife

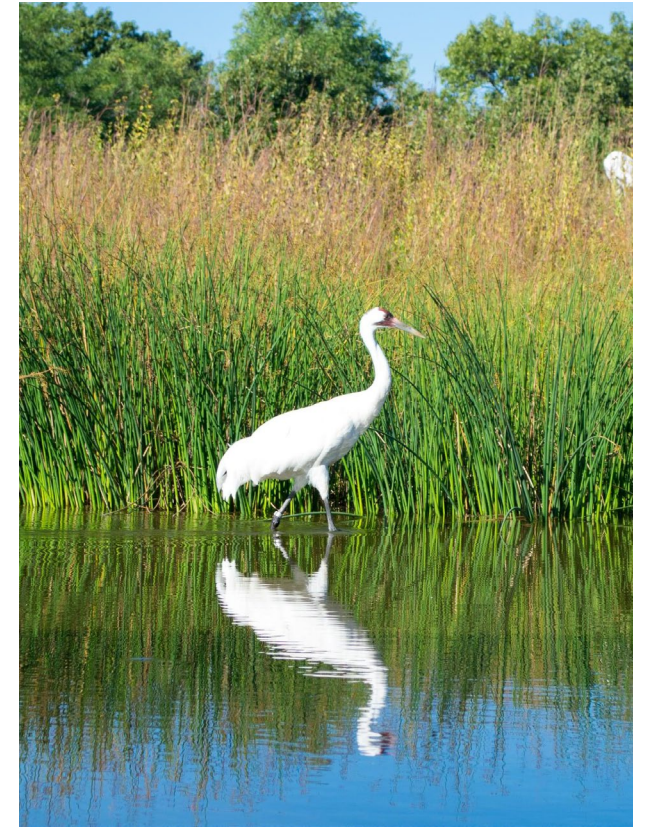


Photo from The Nature Conservancy

Methodology

- Many technical challenges to overcome:
 - Inhibitory compounds in sediment
 - Avian influenzas are hyperdiverse target
 - Avian influenza genomic material diluted and fragmentary



qPCR screening for
avian influenza
genomic material



Targeted genomic
sequencing (qPCR-
positives only)

Article about methods:



Bioinformatic tools:

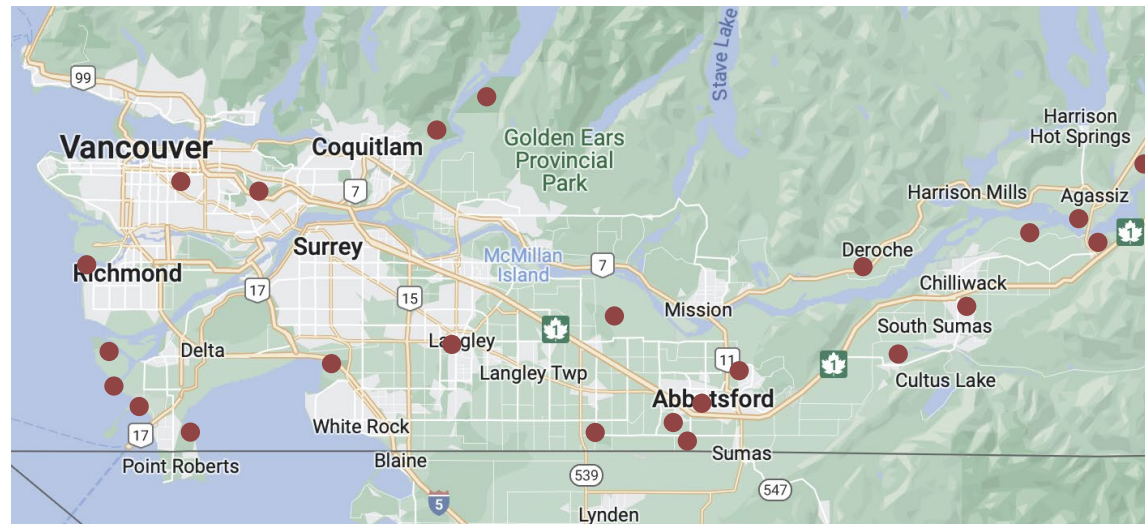
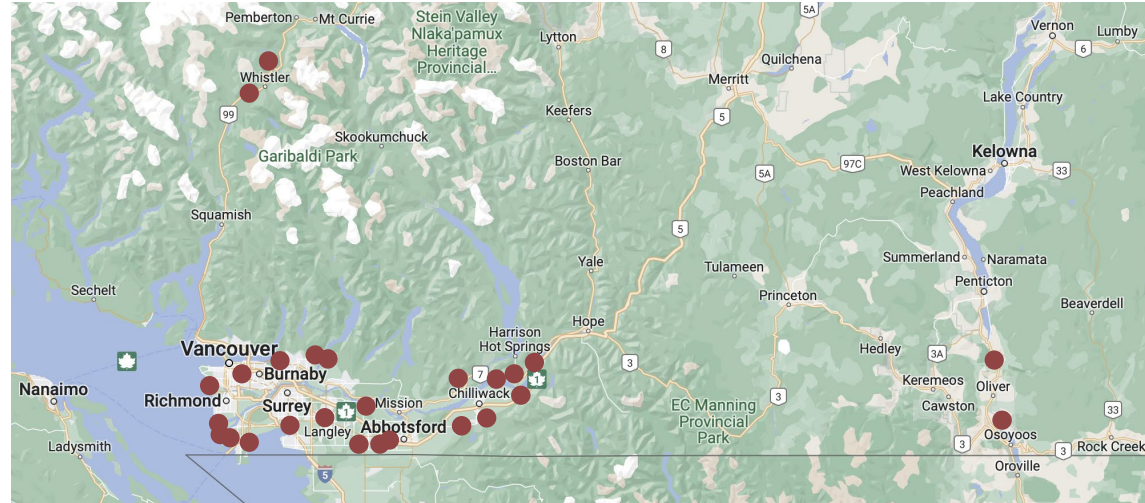


Sediment surveillance program in British Columbia

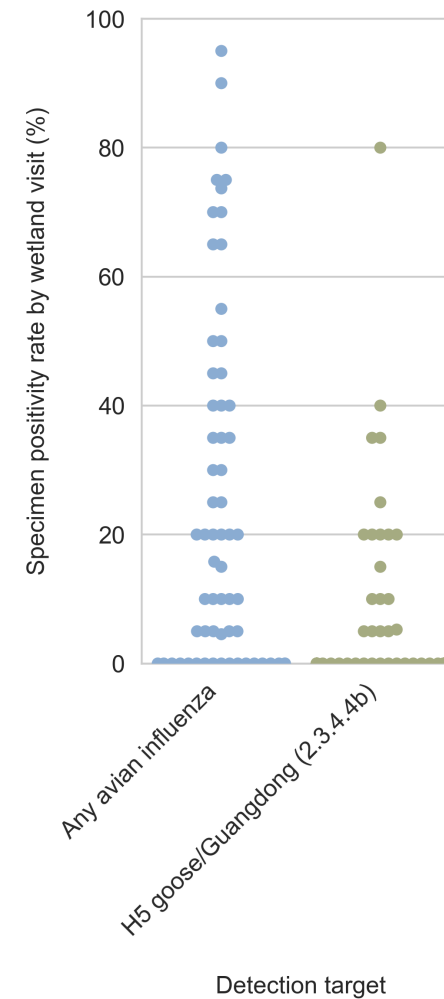
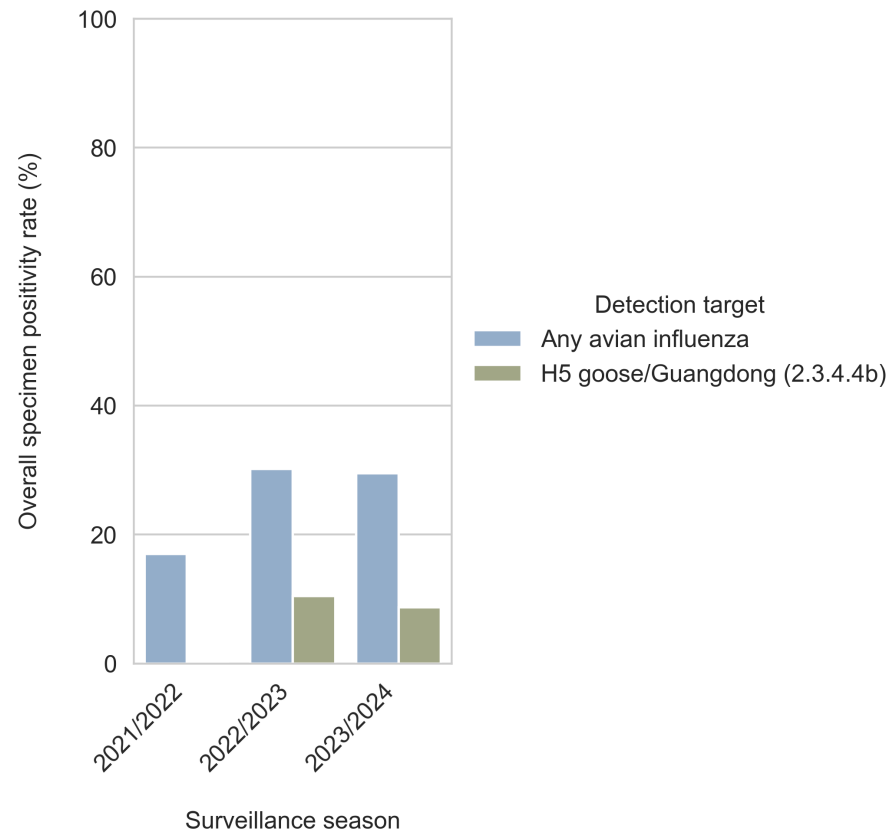
- Since 2021, sediment surveillance deployed during fall migration season:

Season	First collection date	Last collection date	Wetlands visited (#)	Specimens collected (#)
2021/2022	2021-10-06	2022-01-17	22	435
2022/2023	2022-10-27	2023-03-02	20	401
2023/2024	2023-10-05	2023-11-30	15	400

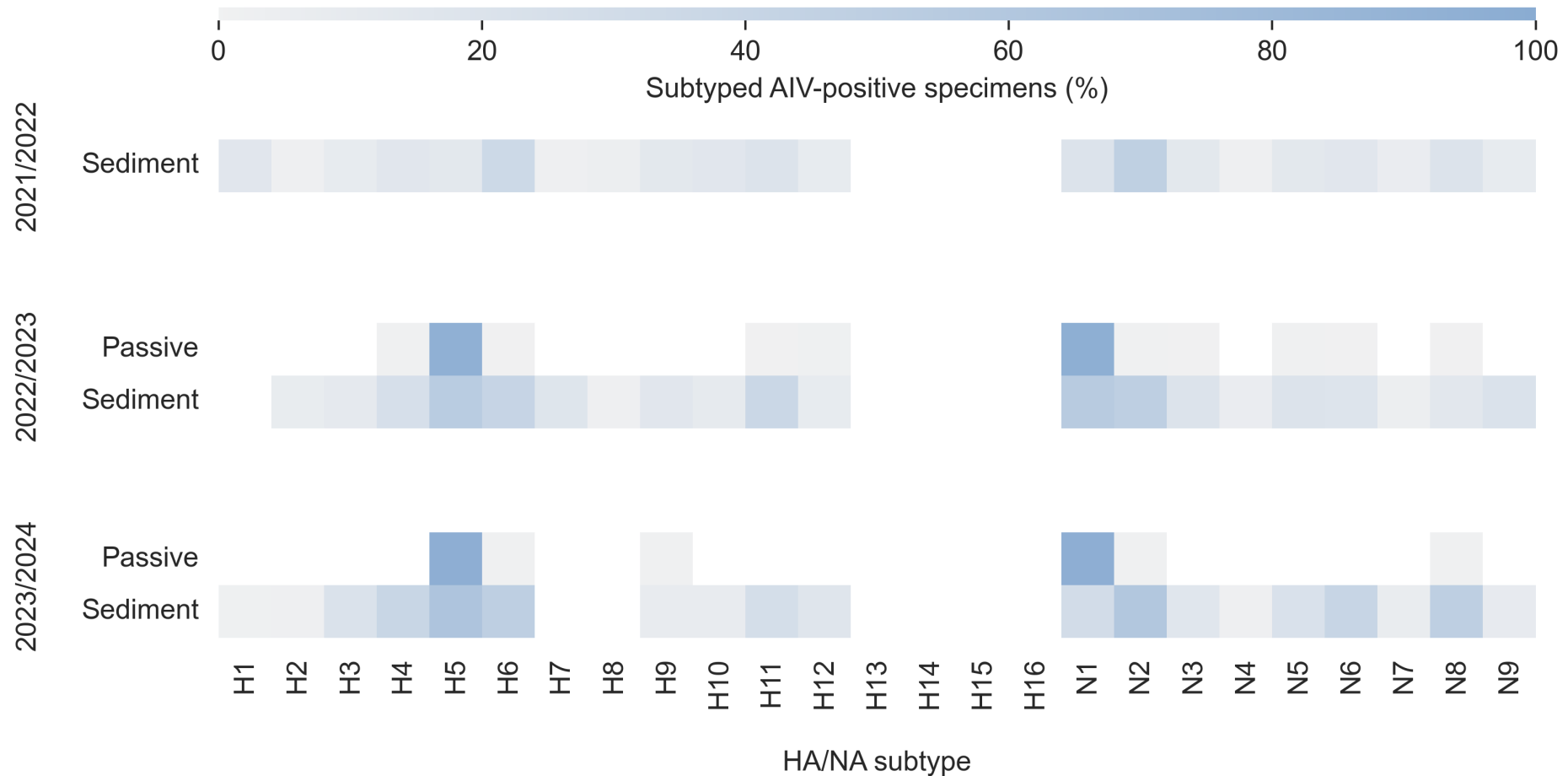
Sediment surveillance program in British Columbia



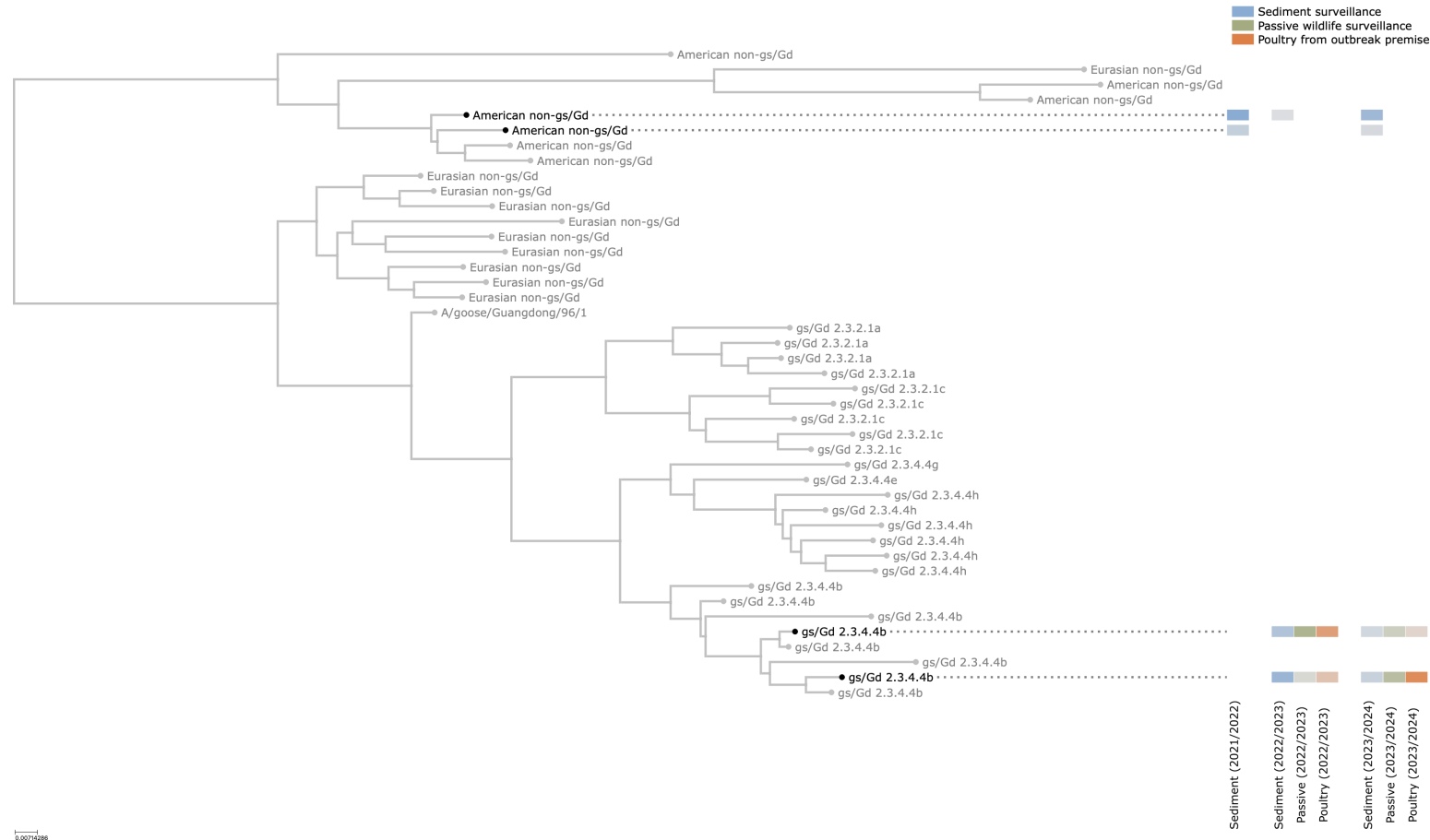
Avian influenza detection in sediment



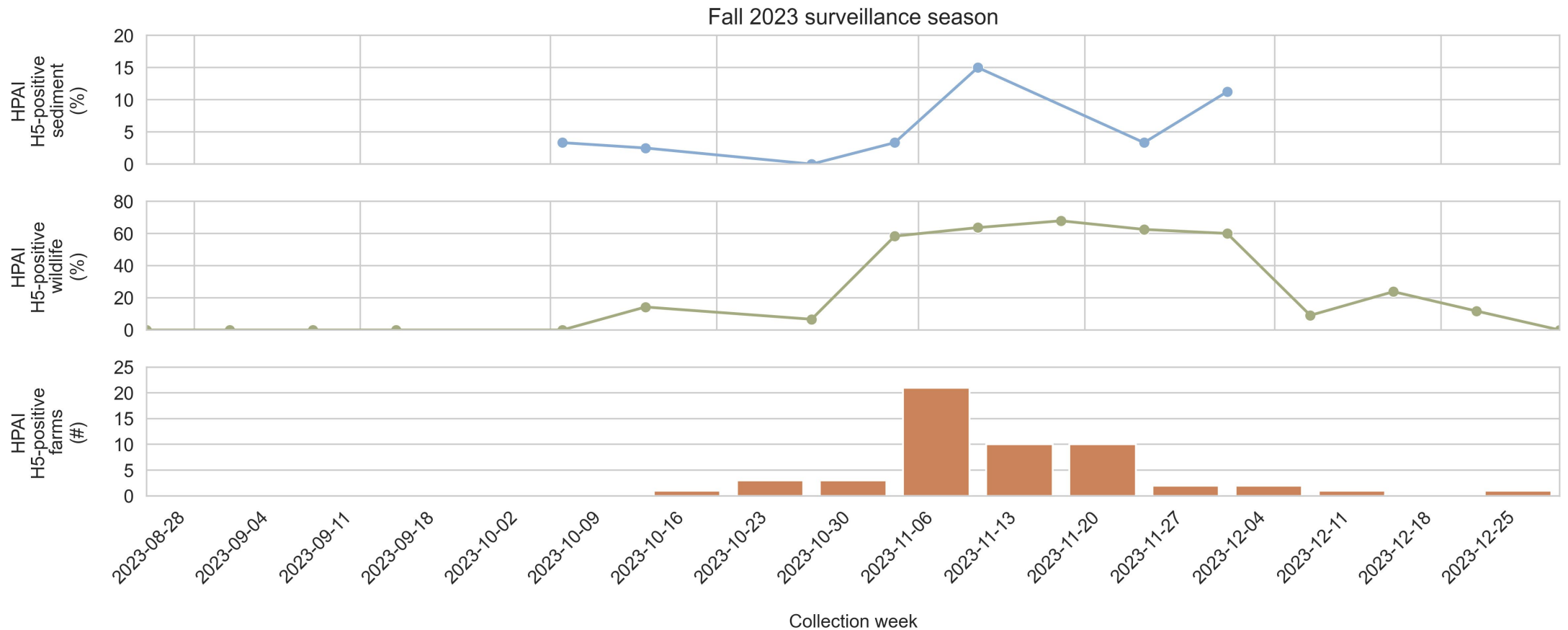
Diverse avian influenza subtypes in sediment



HPAI avian influenzas in sediment matched wildlife and poultry strains



Sediment HPAI detections preceded wildlife detections and farm outbreaks



Conclusions

- Sediment is a viable surveillance specimen for HPAI
- Sediment surveillance detected wider range of avian influenza subtypes than passive surveillance
- Sediment surveillance provided early detection of HPAI incursion
- Sediment surveillance does not require disease/death in wildlife hosts
- Sediment specimens are easy to collect and non-intrusive

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This work was primarily conducted on the unceded, ancestral territories of the x^wməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish), and sel̓íl̓witulh (Tsleil-Waututh) Nations.