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Pollutants Affecting Endangered Whales and their Prey

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POLLUTANTS AFFECTING ENDANGERED WHALES AND THEIR PREY:

Pollutants Affecting Whales and their Prey Inventory Tool

THE SCIENCE BEHIND A NEW WEB APPLICATION FOR ENVIRONMENTAL MONITORING DATA

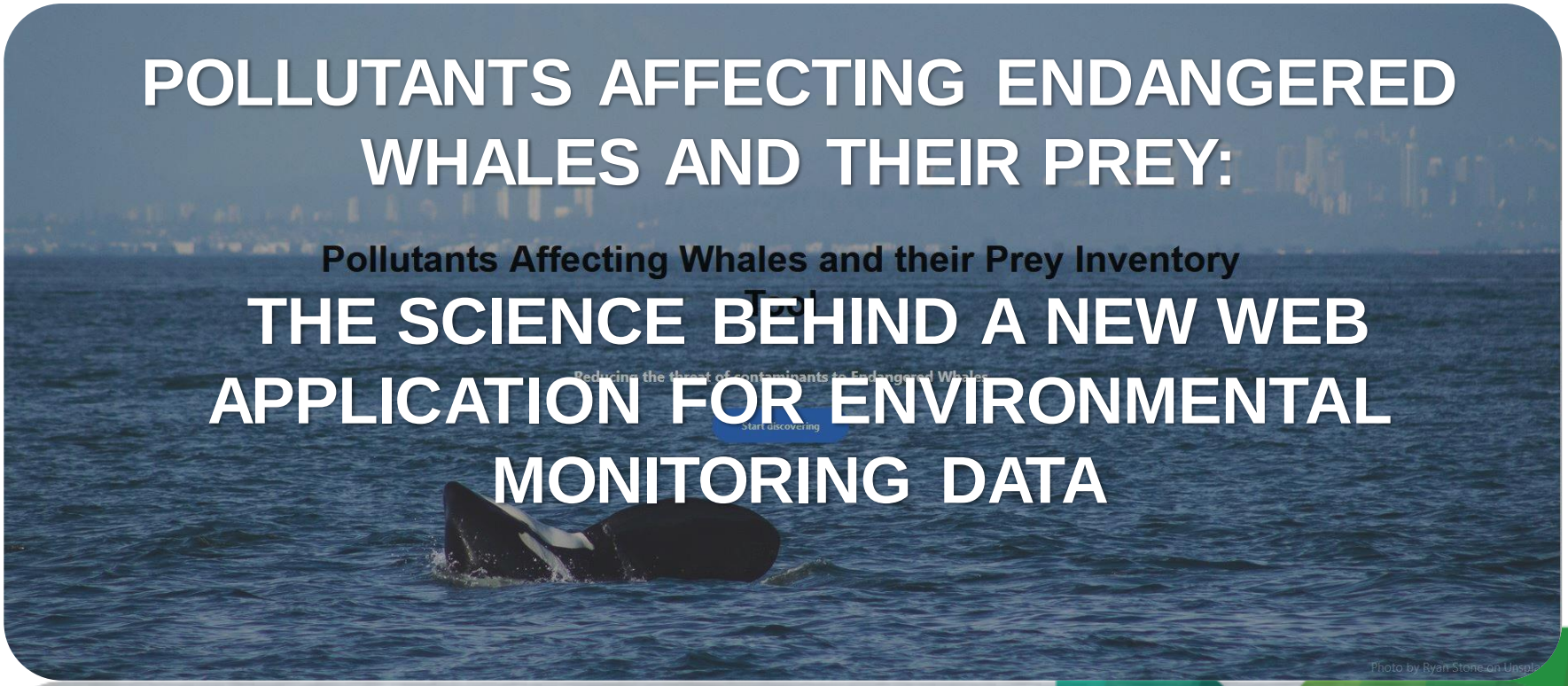

Photo by Ryan Stone on Unsplash

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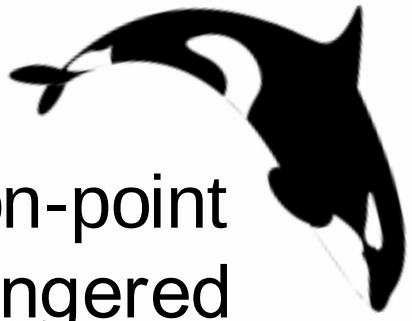
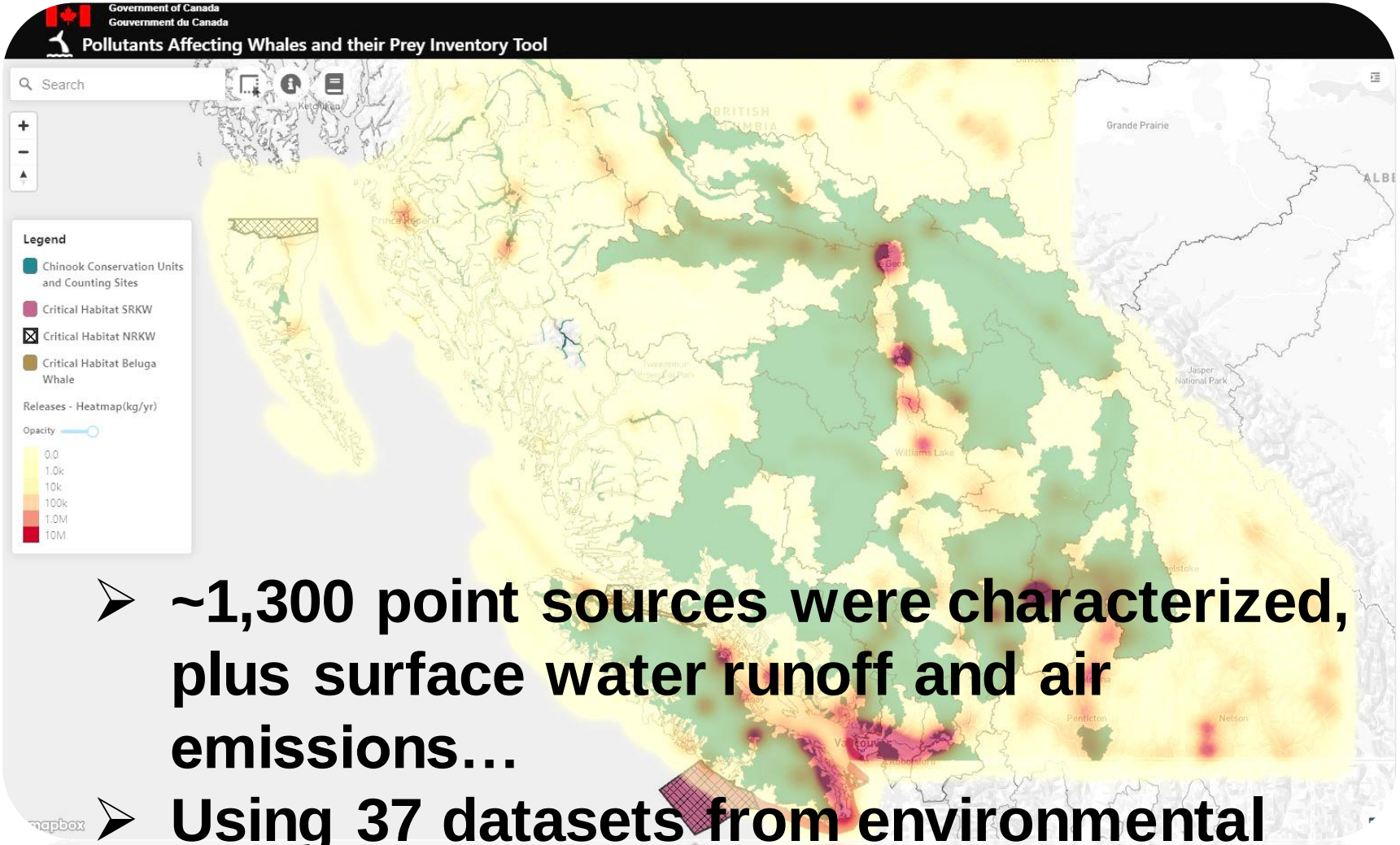
PAWPIT IS:



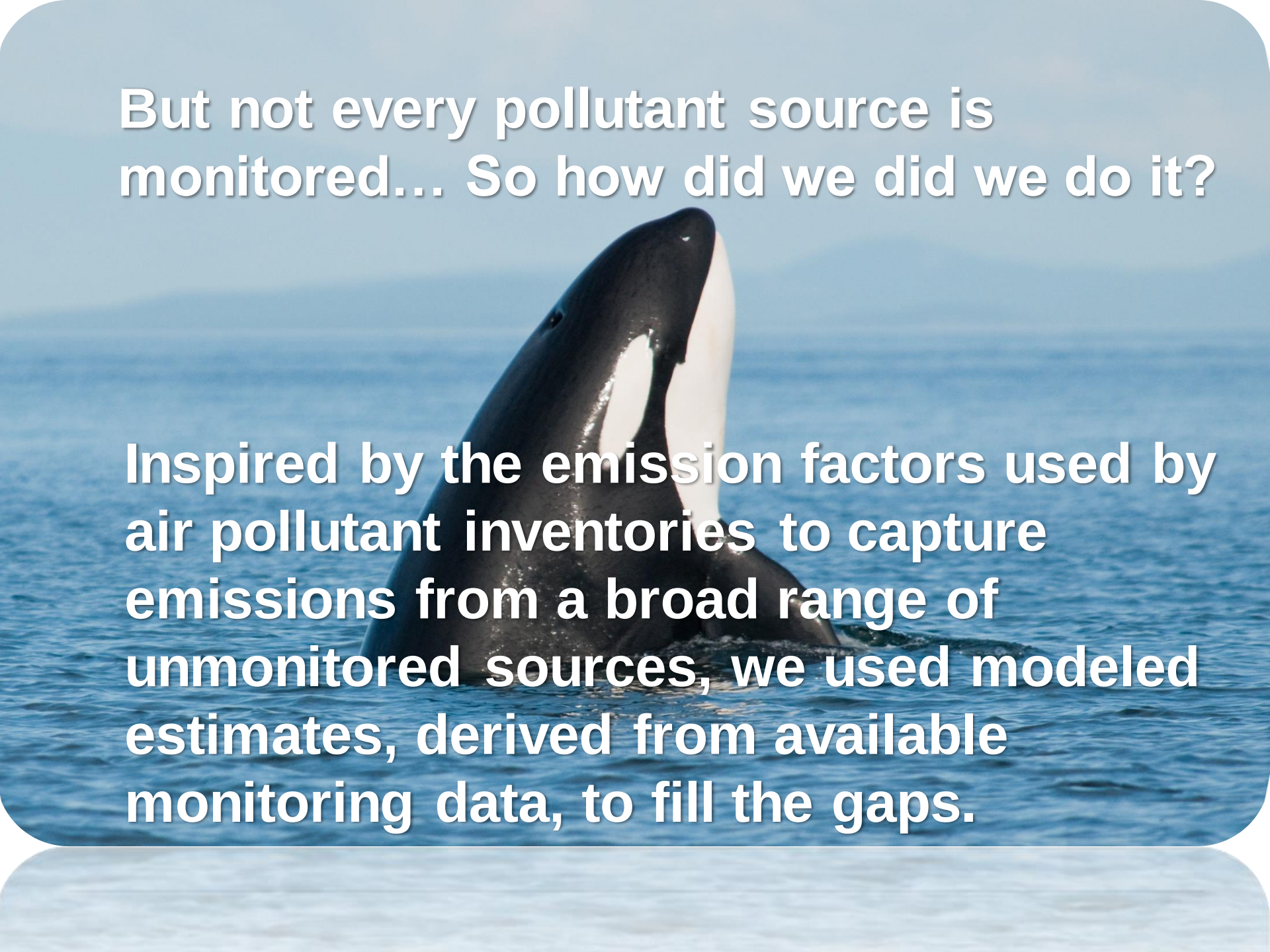
- A geospatial database of estimates of contaminant releases from point and non-point sources in the habitat of Canada's endangered whales and their prey
- Estimates of contaminant loads in ambient freshwater and locations of exceedances of environmental quality guidelines (EQGs)
- A mapping tool to visualize the data
- A compilation of data from many different sources (different levels of government, science literature) to estimate releases to water and ambient loads

PAWPIT WAS DEVELOPED BECAUSE:

- *SARA Recovery Strategy for the Northern and Southern Resident Killer Whales* (NRKW, SRKW) lists environmental contaminants as a key threat to viability and recovery, and recommends *identifying and prioritizing key contaminants*
- The Strategy identifies data gaps, including: *"The full range of anthropogenic environmental contaminants to which killer whales and their prey are exposed, over time and in space…"*
- Environment and Climate Change Canada leads the Contaminants Technical Working Group and one of its objectives was to *Identify and evaluate contributions of contaminant sources* to the SRKW, their habitat, and their prey



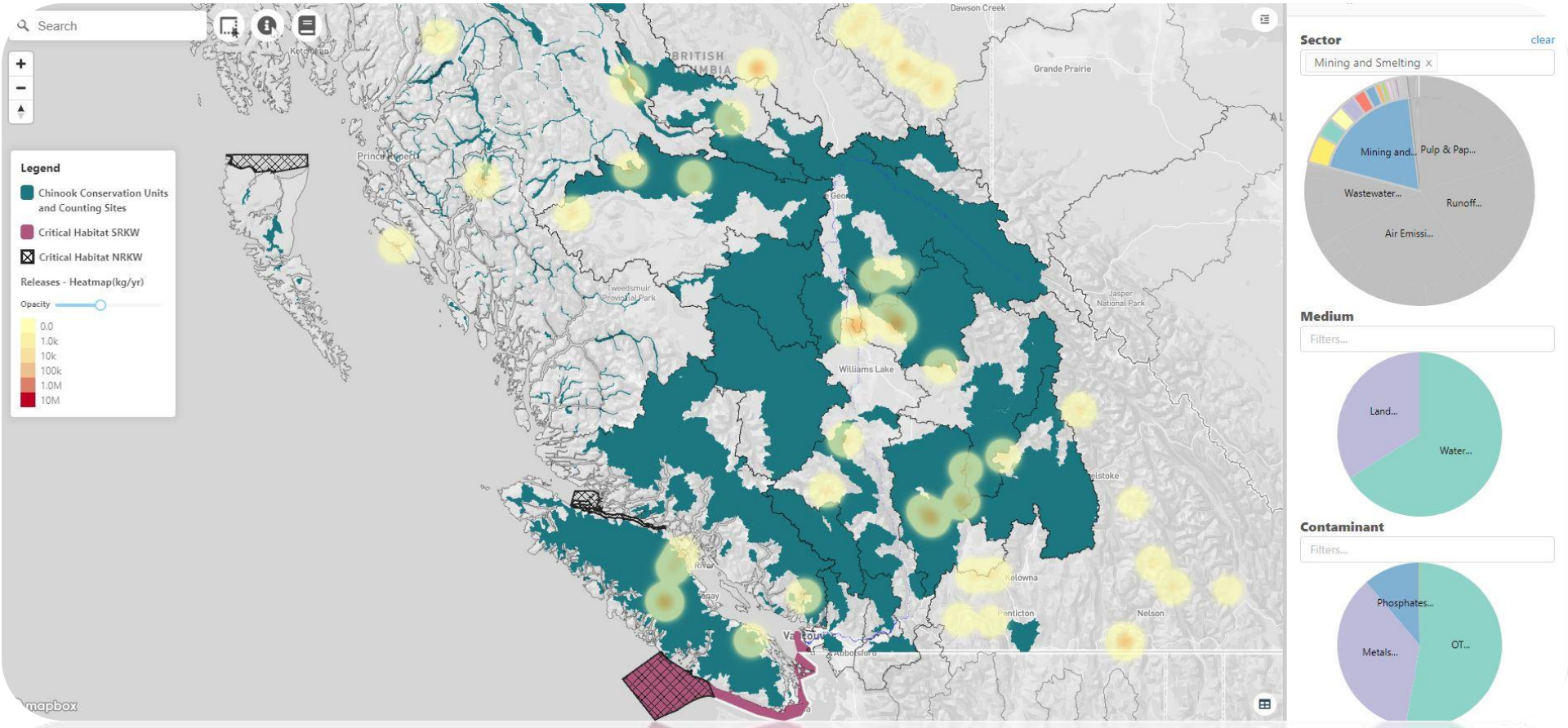
- ~1,300 point sources were characterized, plus surface water runoff and air emissions…
- Using 37 datasets from environmental monitoring and reporting…
- Processed with 28 python scripts…
- To map ~700 substances, classified into 38 “PAWP” classes



But not every pollutant source is monitored… So how did we did we do it?

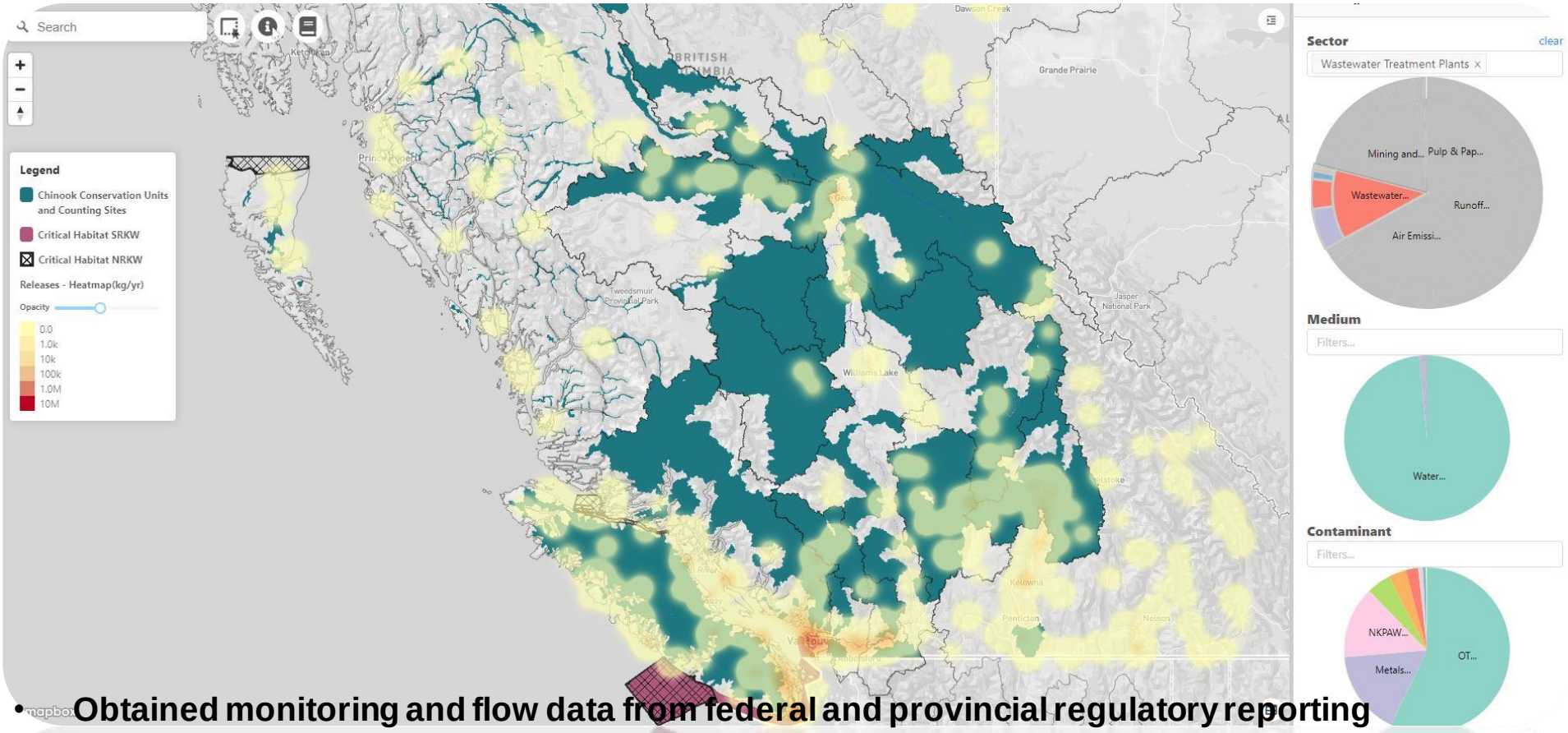
Inspired by the emission factors used by air pollutant inventories to capture emissions from a broad range of unmonitored sources, we used modeled estimates, derived from available monitoring data, to fill the gaps.

EXAMPLE # 1: MINING & SMELTING EFFLUENT



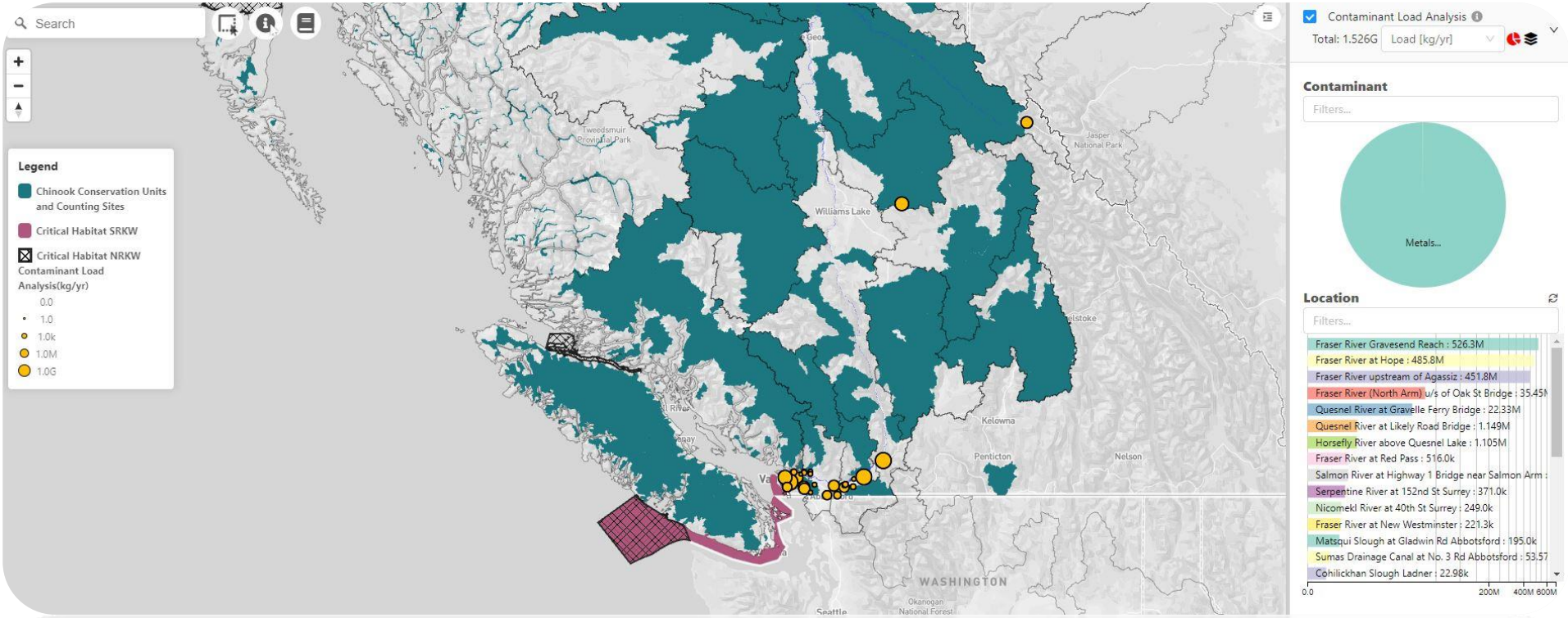
- Obtained monitoring and flow data from federal and provincial regulatory reporting
- Separated it into mine type and operational status (operating, not operating)
- Normalized concentration data to develop characteristic concentration profiles per category
- Took the average effluent flow per category
- Applied actual data to the sites that had it, and applied the characterized data to the sites that did not

EXAMPLE # 2: WASTEWATER TREATMENT PLANTS



- Obtained monitoring and flow data from federal and provincial regulatory reporting
- Categorized according to wastewater treatment type (preliminary, primary, secondary, etc.) and service type (municipal, non-residential, small development, commercial, etc.)
- Normalized concentration data to develop a characteristic influent concentration profile for the region
- Used reported effluent flow when available. If not, it was estimated based population served for municipal sites, and for other types of service, using empirical values from surveys and the literature
- Per contaminant, or per contaminant-type, removal rates based on wastewater treatment level, were used to estimate releases in the effluent

EXAMPLE # 3: AMBIENT LOADS IN THE FRASER



- **Obtained historical (2003-2018) ambient freshwater concentrations from federal and provincial regulatory reporting**
- **Obtained stream flow from ECCC's Hydrometric Station and Network Data (HYDAT) Loads were typically > releases for most types of contaminants, indicating missing sources, such as releases from sediments and deposition from air transport**
- **The exception were pesticides, which may not remain in the water column, and pharmaceutical products, which would primarily be released from wastewater treatment plants.**

LESSONS LEARNED

- Many data gaps & uncertainty, but release estimates can demonstrate contributions by source-types
- Load estimates identified hotspots and concentrations were tested for exceedances of EQGs in the Fraser Basin – PCBs, Pesticides, Copper, Cadmium (so far - data collection and analysis continue)
- Most sources characterized were estimated to be releasing Contaminants of Concern for Killer Whales and Chinook (PCBs, PBDEs, Pesticides, Phthalates, Pharmaceuticals & Personal Care Products, Copper, Cadmium)
- Ambient loads were usually higher than releases, indicating missing sources or concentration data, for example from sediments or long range transport

NEXT STEPS & FUTURE WORK FOR PAWPIT

- Continued improvement to the tool & analyses, including:
  - Addressing existing science gaps & incorporating new data
  - Estimating total maximum daily loads to develop thresholds for priority contaminants
  - Comparing releases/loads: SRKW/Fraser Chinook vs NRKW/Chinook
  - Add temporal changes and scenarios (new measures or releases, e.g. changes in activity)

- Expand tool to include the St Lawrence River Basin and Beluga habitat

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