Georeferencing Fish Occurrences

A Community-Based Model

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FishNet 2

NSF

Challenge

- Assigning geographic coordinates to hundreds of thousands of newly digitized collection records from across the globe produced by different TCNs.
- Many samples of even different kinds of organisms taken from the same locality.
- How can projects avoid duplicating effort georeferencing these?
- How can georeferencing process be efficiently managed, regionally specialized, broadened in participation?

Solution

- GEOLocate's Collaborative Georeferencing (CoGe) Platform.
- Presenting results of 2012 CSBR project involving fish collection data.
- First large scale test of CoGe system.
- Preliminary results of experiments in crowd-sourced georeferencing.

FishNet 2

global network

71 data providers

3.7 million lots

35+ million specimens

57% georeferenced

Objectives

Expand the number of records within FishNet 2 to approximately 4 million lots representing over 30 million specimens

Georeference all records lacking geographic coordinates

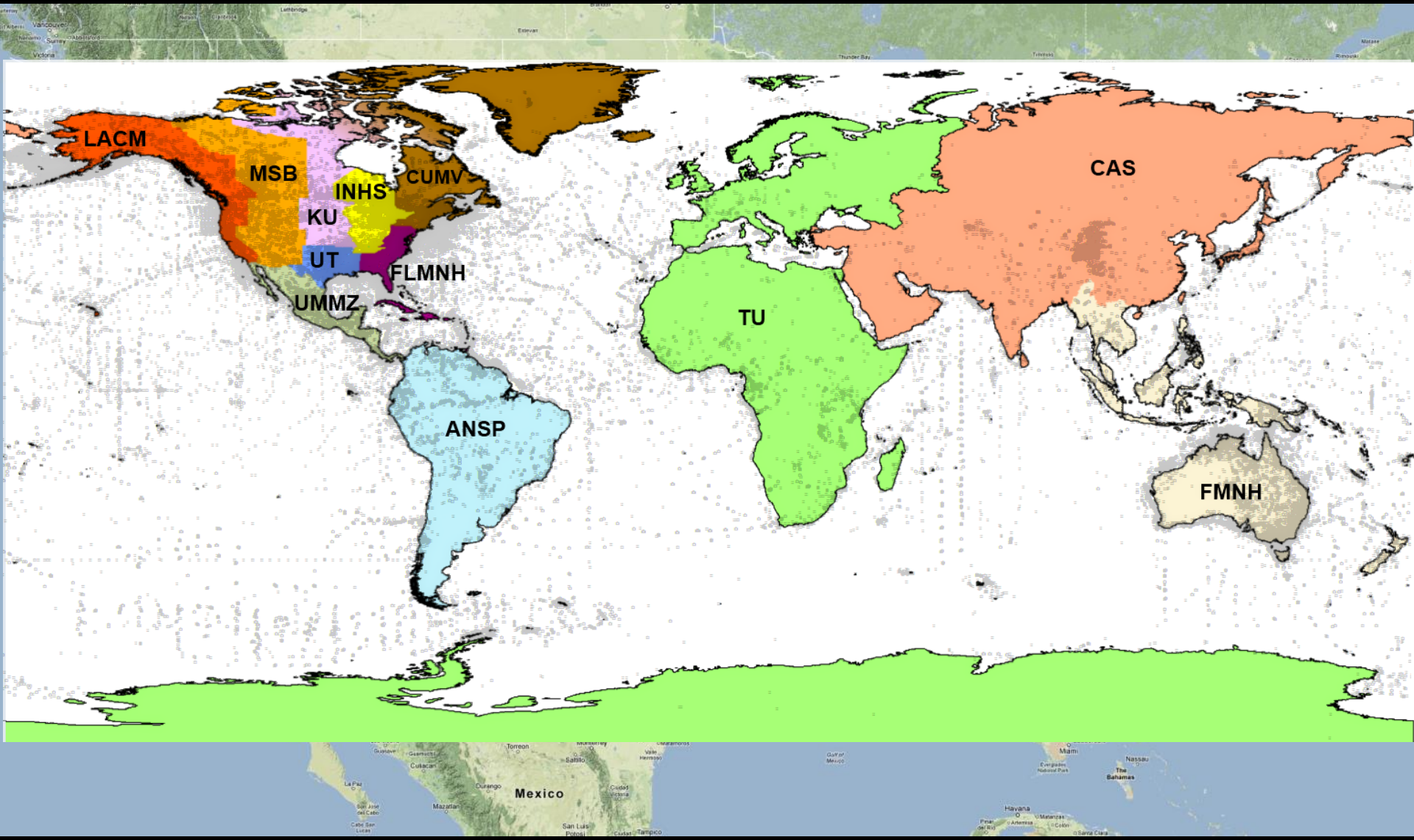
Repatriate results to source data providers

321,102 collecting events, representing **1,568,695** specimen lots, in need of georeferencing in FishNet2

Georeferencing FishNet 2

- 250,000 collecting events
- 18 months
- 12 technicians
- 12+ volunteers
- GEOLocate's CoGe System
- Crowdsourcing experiments

The Dirty Dozen



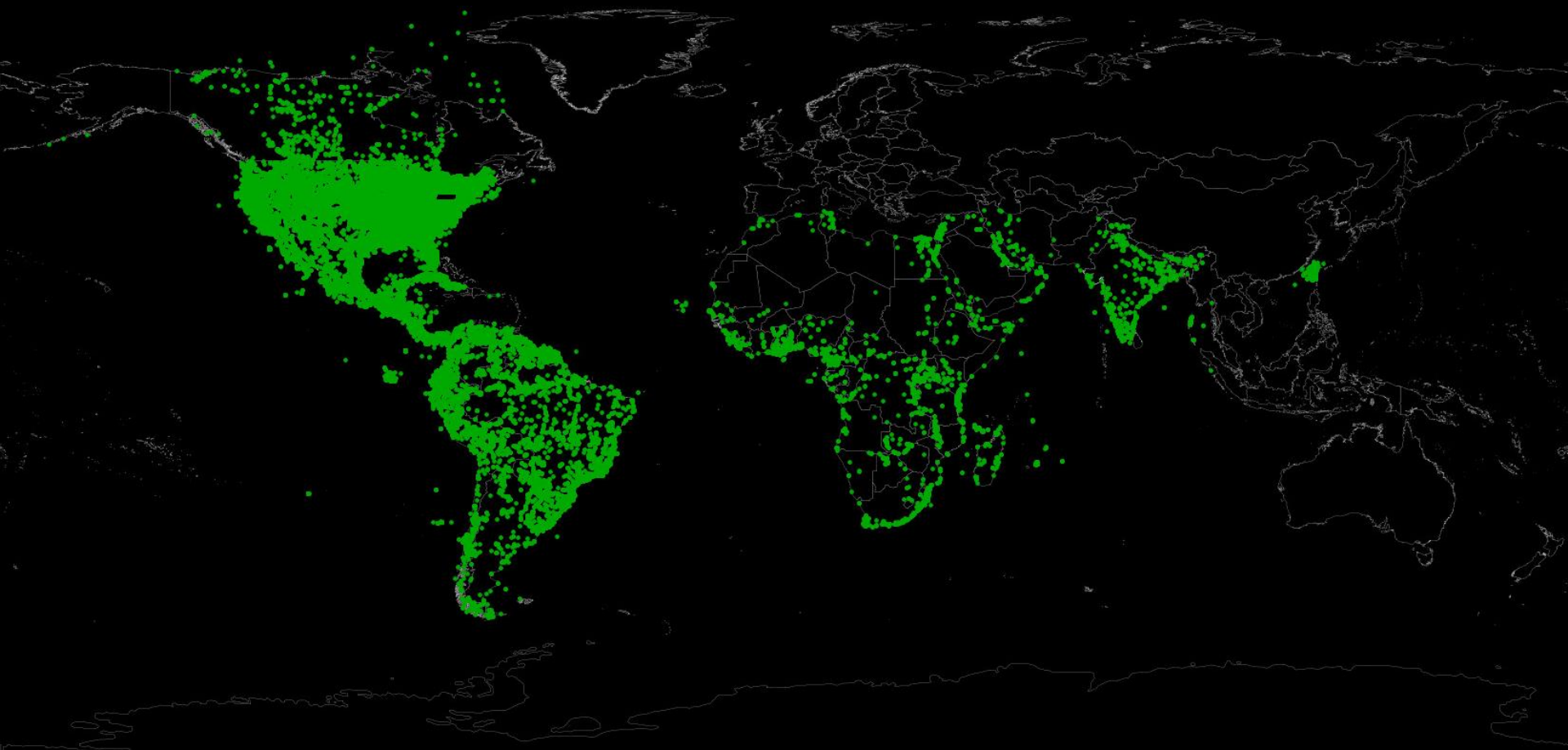
Workflow

- Harvest data by Institution from FishNet 2
- Standardize higher geographies
- Partition into regional datasets
- Upload to data portal
- Assign datasets to technicians
- GEOLocate
- Review results
- Repatriate

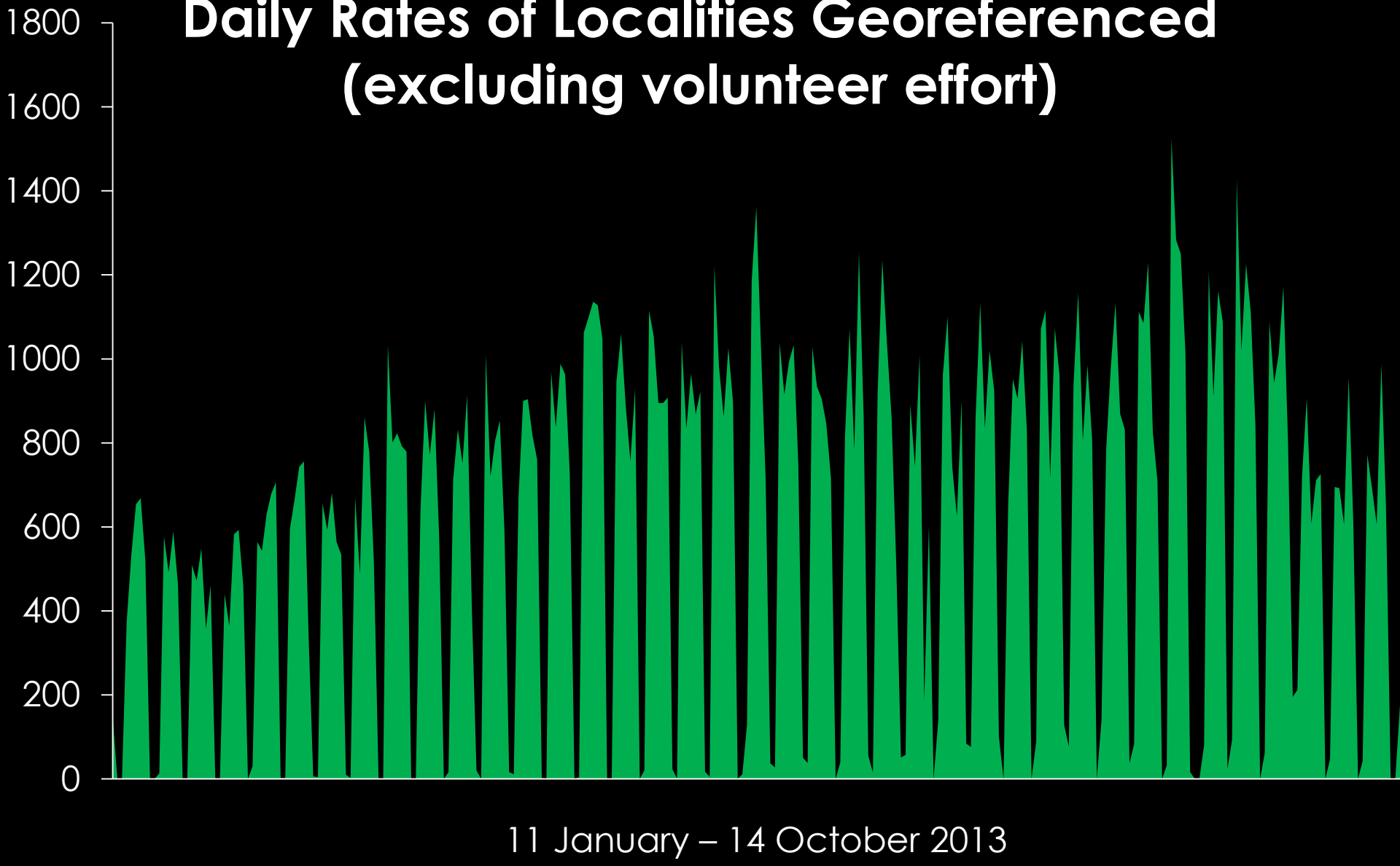
Georeferencing Status

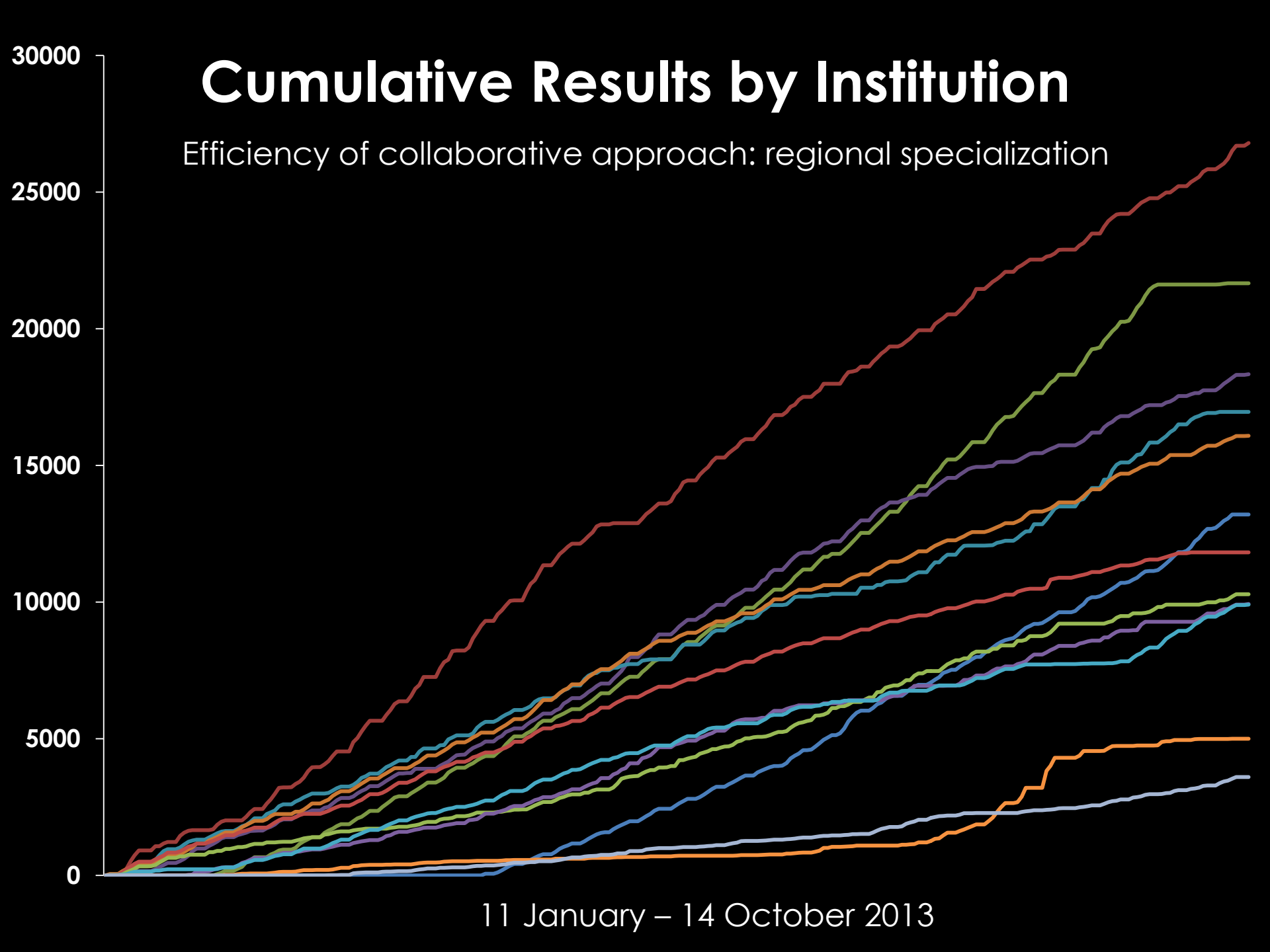
11 January – 14 October 2013

727K Specimens / 168K Localities / 9 Months (67%)



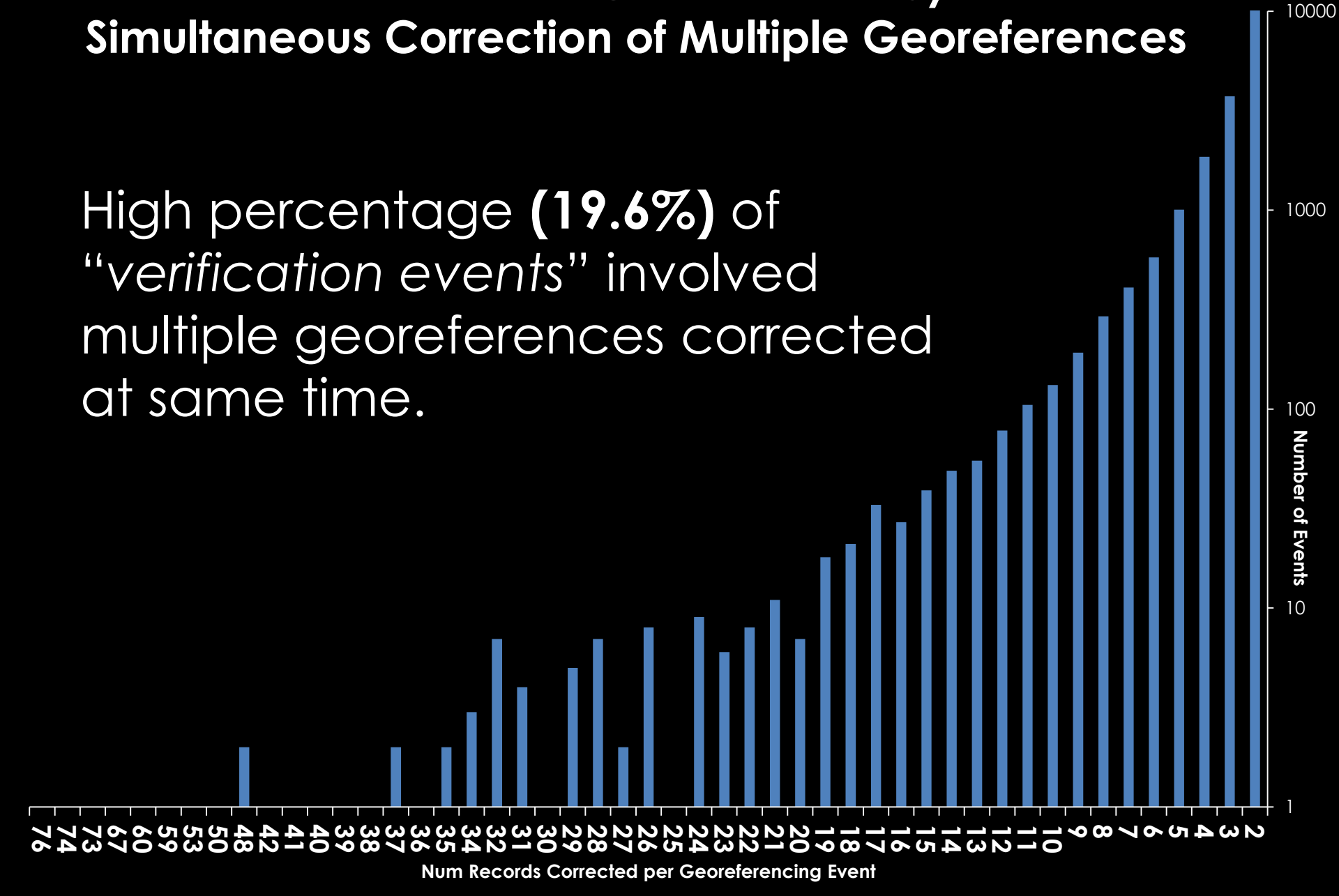
Community-Wide
Daily Rates of Localities Georeferenced
(excluding volunteer effort)



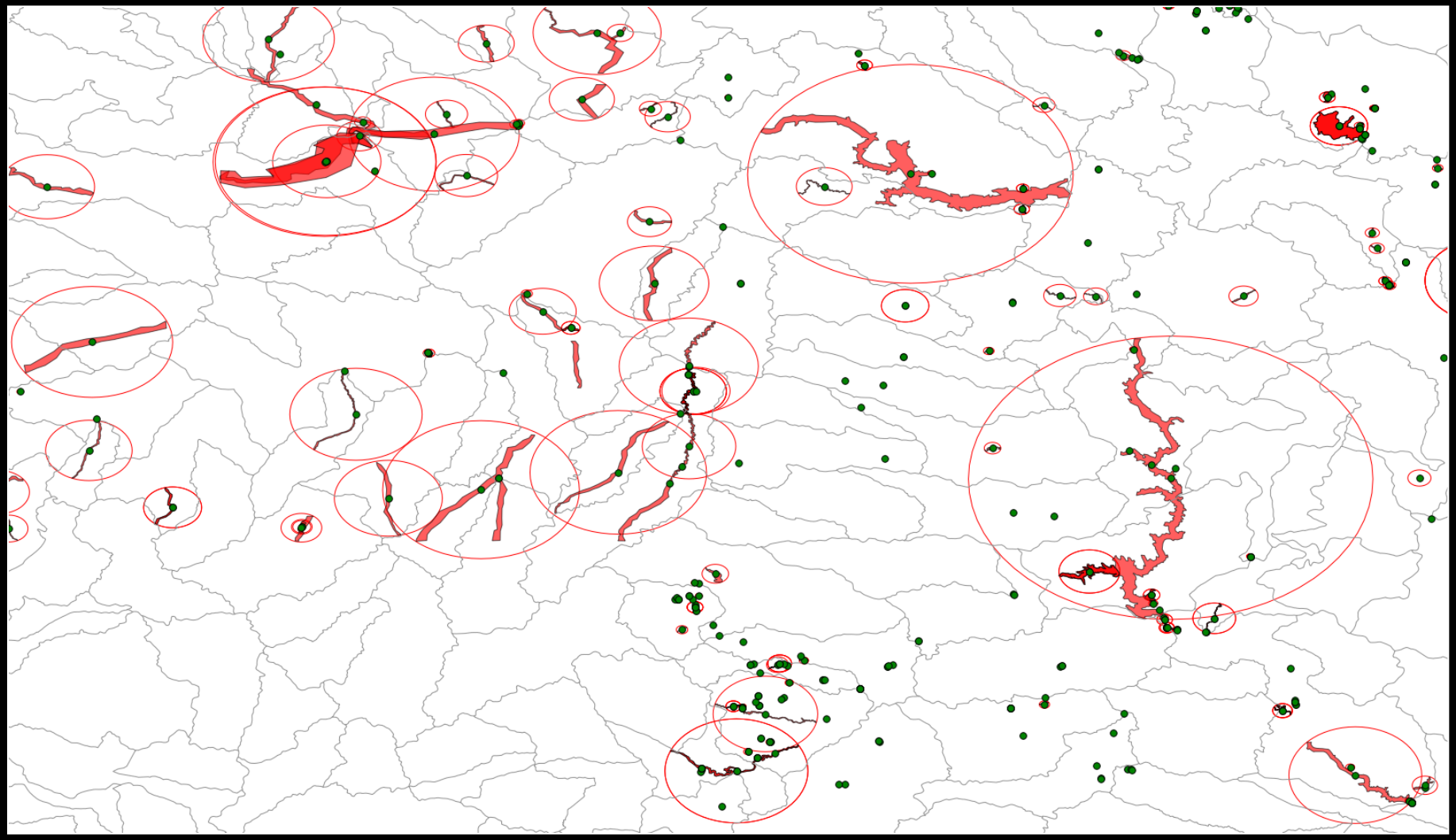

Cumulative Results by Institution
Efficiency of collaborative approach: regional specialization
30000
25000
20000
15000
10000
5000
0
11 January – 14 October 2013

Efficiencies of the Collaborative System: Simultaneous Correction of Multiple Georeferences

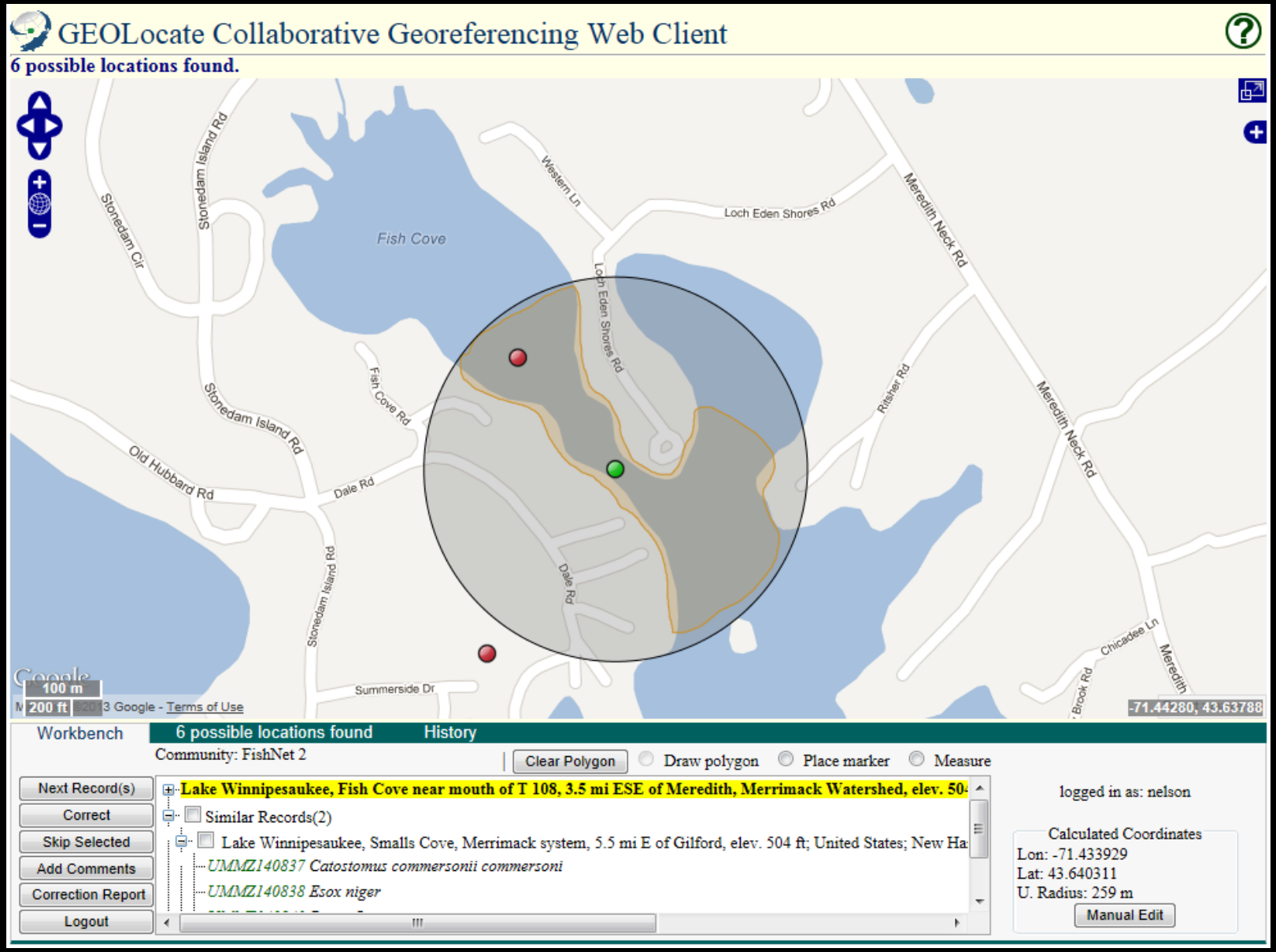
High percentage **(19.6%)** of "*verification events*" involved multiple georeferences corrected at same time.



Georeferencing Output



Base Map - 1:2M 8-Digit HUCs



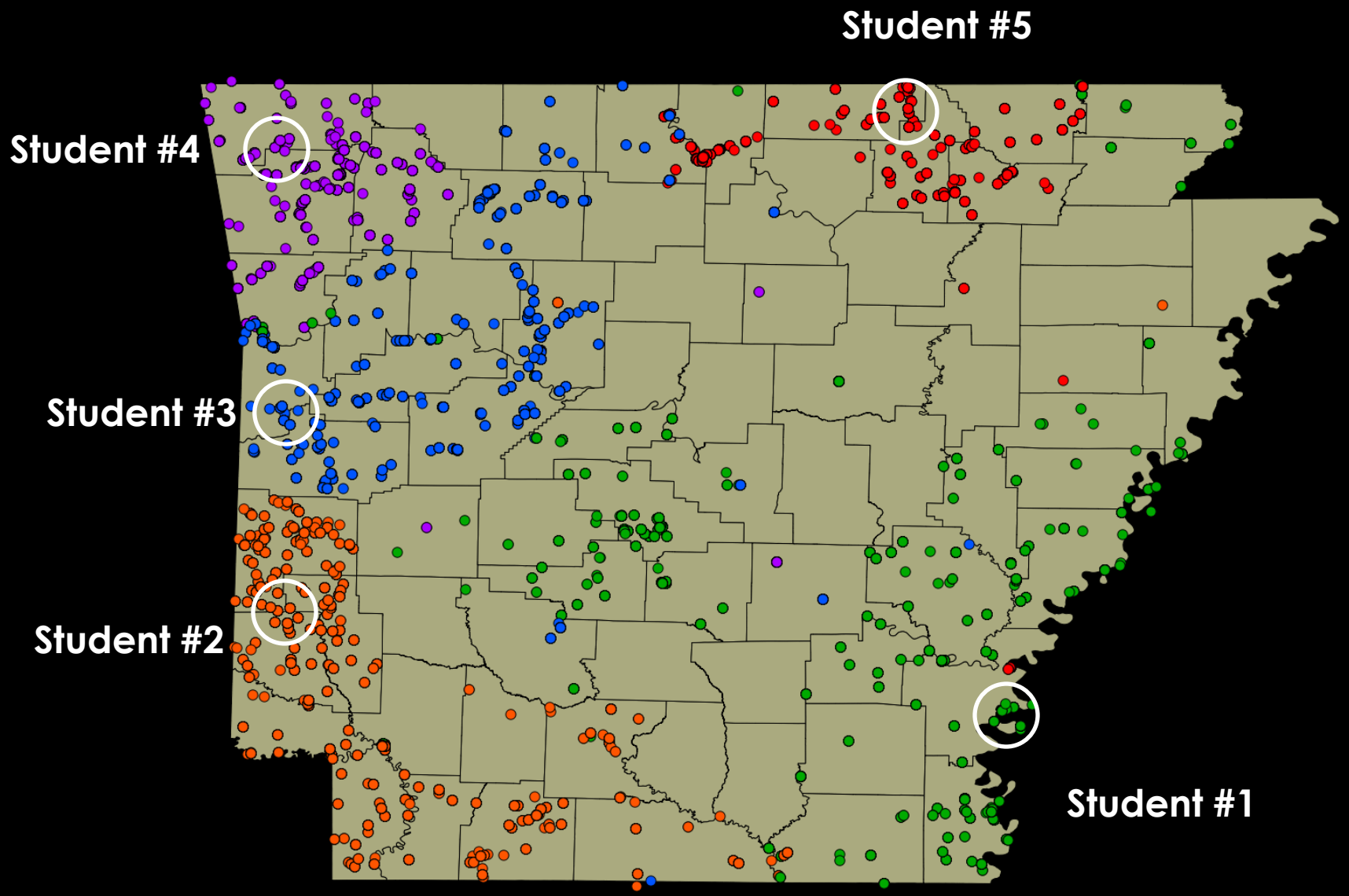
Current tools targeted at "experts"

How Do Non-Experts Perform?

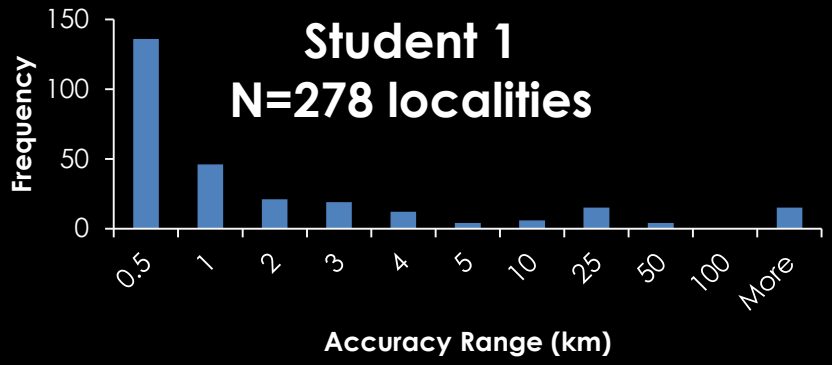
Crowdsourcing Experiment

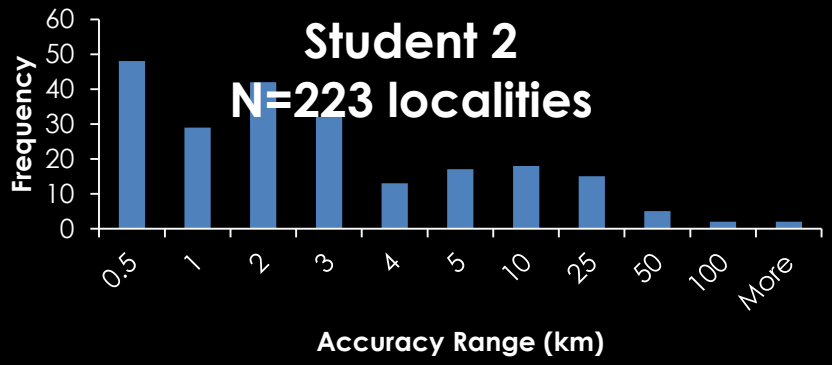
- 7,463 lots (916 localities) ***with coordinates already determined*** randomly selected from the state of Arkansas.
  - Data provided by KU, MMNS, NCSM, OKMNH, OSUM, ROM, TU, USNM, YPM via FishNet
- Group into 5 regional datasets
- Each region assigned to a Tulane student for georeferencing
- Evaluated accuracy of student results

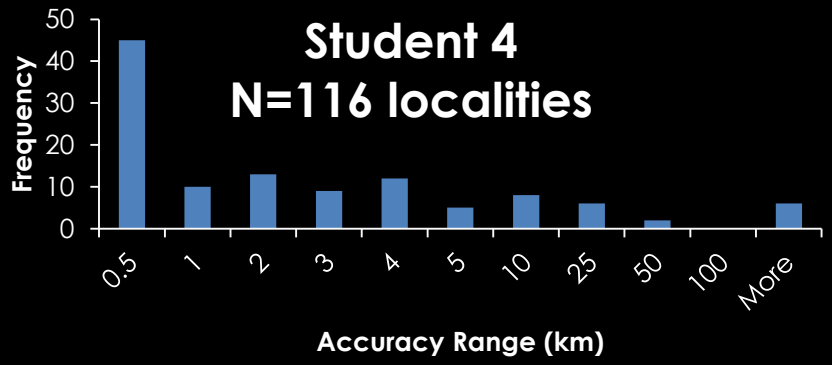
Student Results

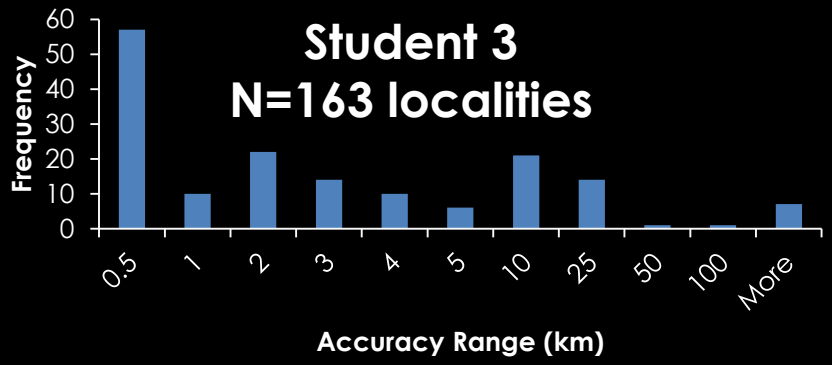


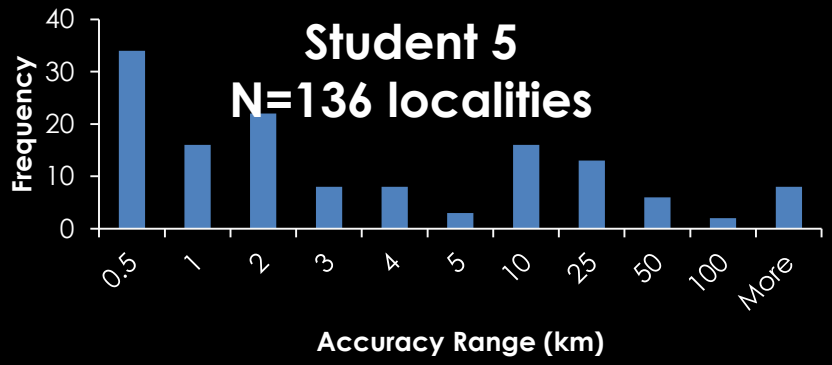
Georeferencing Profiles











Expert vs. Volunteer Comparison

Experts:

- 163,586 locality verifications
  - 143,108 corrected
  - 20,478 skipped (12.5% rate)
- 703,794 specimen records
  - 635,251 corrected
  - 68,543 skipped (9.7% rate)
- **10 localities per hour; high accuracy**

Volunteers:

- 4,558 locality verifications
  - 4,125 corrected
  - 433 skipped (9.5% rate)
- 23,026 specimen records
  - 21,541 corrected
  - 1,485 skipped (6.9% rate)
- **22 localities per hour; low accuracy**

Contributors to Volunteer Georeferencing Inaccuracy

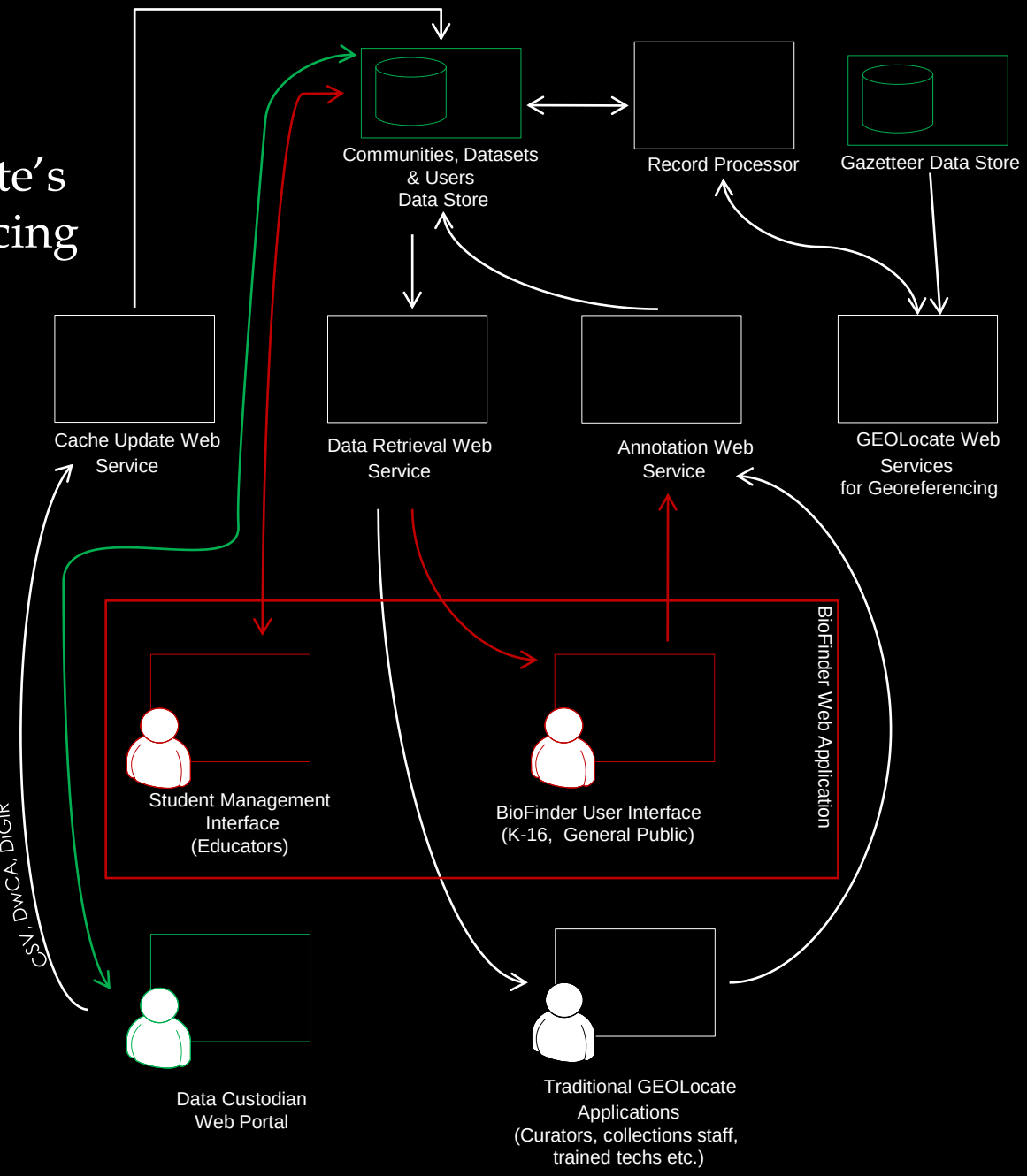
- **Inexperience** in Georeferencing
- **Lack of geographic familiarity** with regions
- No access to **supporting data** (catalogs, field notes, ship logs, etc.)
- Specificity assessments
  - 6 miles west of Dierks
- **Errors in original data**
  - Original data still need to be double checked (likely reason for large inaccuracies)
- Student **motivation varies** over time

Crowdsourcing: Conceptual Requirements

- Data Quality
  - Multiple verifications per locality
  - Periodic skills assessments using known controls
  - Reputation-based scoring
  - Validation against higher geography & taxon distributions
  - Spatial clustering & outlier removal
  - Batch Review & refinement by experts or promoted citizen scientists

- Engaging K-16, General Public
  - Allow georeferencers to select projects or regions
  - User promotion and reward system
  - Client software must present a low barrier of entry
  - Rich educational experience beyond moving points on a map

Adding Crowdsourcing Components to GEOLocate's Collaborative Georeferencing Architecture (pending *Biofinder* proposal).



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FishNet 2

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