CRAB-MIT Partnership

DEPTH CHART OF THE LOWER CHARLES RIVER

Sea Grant
Massachusetts Institute of Technology

Charles River Alliance of Boaters

- Mission is to encourage safe and accessible boating by the entire community on the Lower Basin of the Charles.
- This includes power boaters, sailors, rowers, paddlers, and others, working together to keep the Charles River a healthy resource for the enjoyment of boaters and park users alike.
- A cornerstone of our effort is the development of better avenues of communication between and among this diverse community of users.

- www.CharlesRiverAllianceofBoaters.org

MIT Sea Grant College Program

- Mission is to conduct and support research and develop technology to enable scientific investigation into problems surrounding the health and human use of the sea
- Education and outreach efforts disseminate the results of our research, encourage the stewardship and the adoption of sustainable and useful technologies, and support public policy and industry with information that is relevant, evidence-based and scientifically sound.
- Wide variety of activity including the Autonomous Underwater Vehicles (AUV) Lab, the Design Lab for naval architecture and systems, and the MIT Sea Grant Marine Advisory Services group.

- SeaGrant.mit.edu

People

- Carl Zimba
  - Charles River Alliance of Boaters
  - Webmaster for CRAB
  - Principal Race Officer and Coach at Courageous Sailing
  - Former Sailing Coach at Community Boating
  - Former President of Mass Bay Sailing (30 high schools in eastern Mass)
- Michael Sacarny
  - Research Engineer, MIT Sea Grant College Program
  - US Coast Guard Auxiliary
  - Life-long sailor, member at Courageous Sailing

Long-standing Concerns

- Shallow areas affect recreational use of the river
- Sediment is reducing the channel width and depth
- Areas near some docks are getting filled with sediment

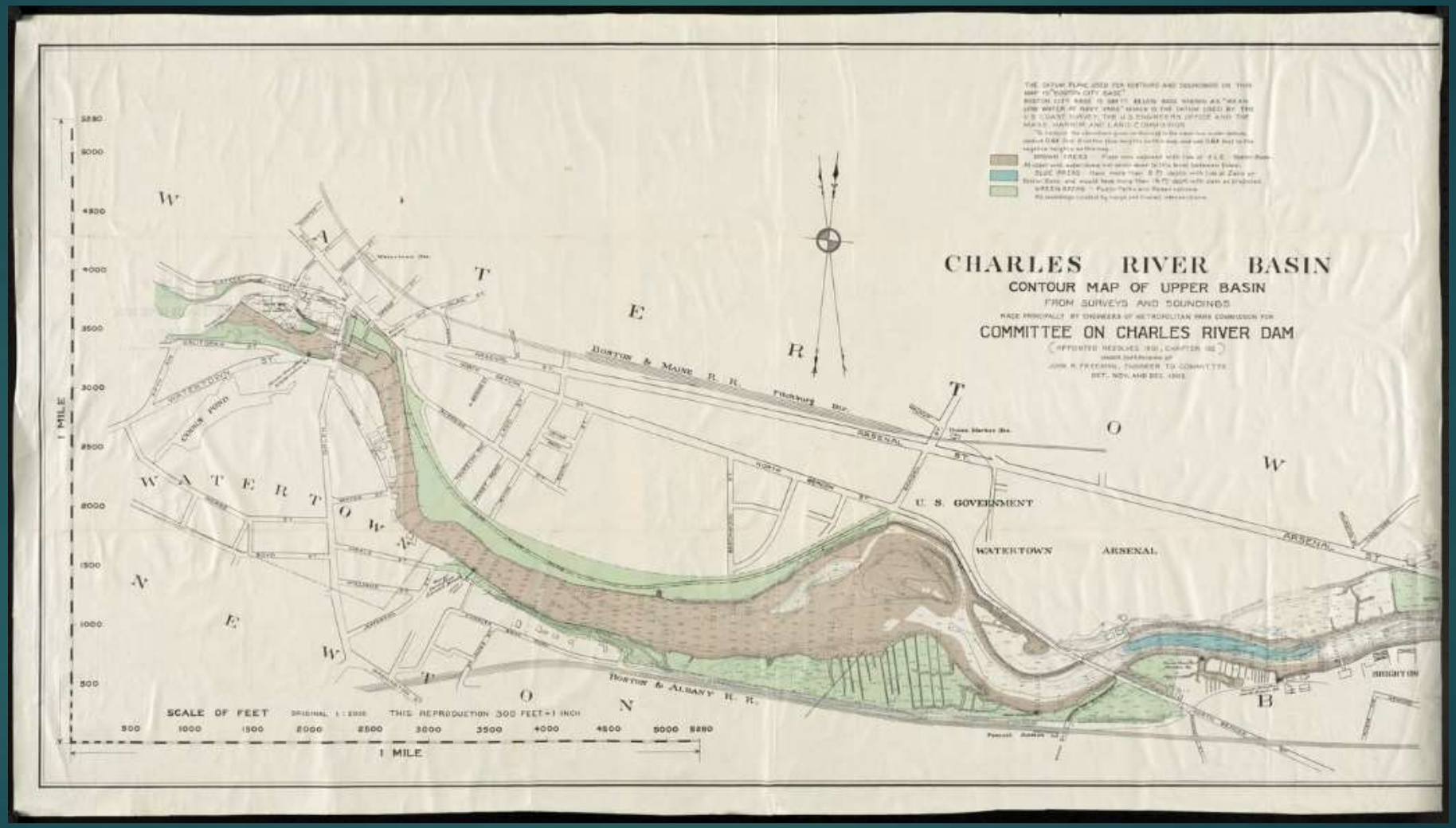
- Lots of anecdotal evidence of problem areas
- No quantitative data

Historical Perspective

- Detailed depth charts of the Charles River Basin
  - Watertown Dam to Boston Harbor
  - 1902 Committee on the Charles River Dam
  - 2000 US Geological Survey

- More recent surveys have been done in selected areas
  - MDC / Cortell Associates, 1997, 20 transits at various locations between Newton YC and Science Park
  - Mirant-Kendall Station Outfall, 2010 ?
  - MIT Pierce Boathouse, 2013
  - Longfellow Bridge Rehabilitation

1902 Watertown to Beacon St



1902 Arsenal St to River St

1902 River St to Craigie St

2000 USGS Survey

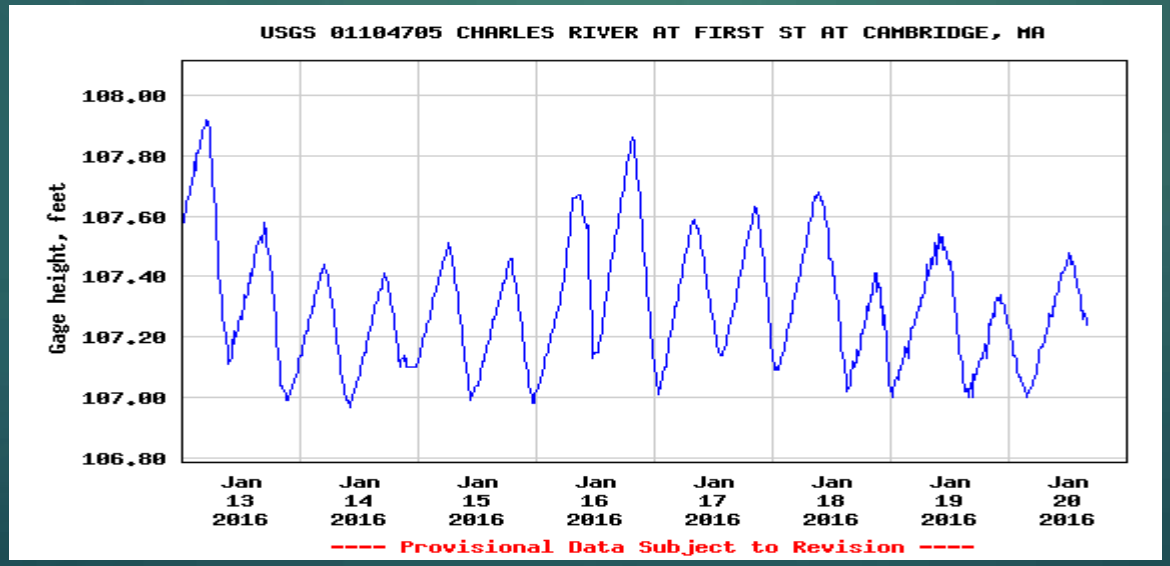
- Data currently available has depth contours of 2 meters
  - Limited detail about underwater features
  - Working to get original data from primary investigator
- http://pubs.usgs.gov/wri/wri004124/wholereport.pdf

CRAB-MIT Partnership

- Goal is to obtain high quality quantitative data
  - Baseline for future measurements
  - Disclaimer : Not for navigational use
- Crowd-sourcing of depth data collection
  - Using inexpensive fish-finder sonar units
- Characterize the influence of daily water releases
  - Use stream gauges or pressure gauges over several months
  - Correlate magnitude and temporal variations to USGS gauge
- Develop charts
  - Web, navigational instruments, printable
- MIT participation is restricted to science and technology role
  - No legislative testimony, litigation, or politics

Data Measurements

- Depth using sonar fish-finders
  - Depth with GPS location and time
- Height of water sheet using stream gauge data loggers
  - Measures change in water height with time
  - Develop and apply a correction to Sonar Depth data



Questions ??

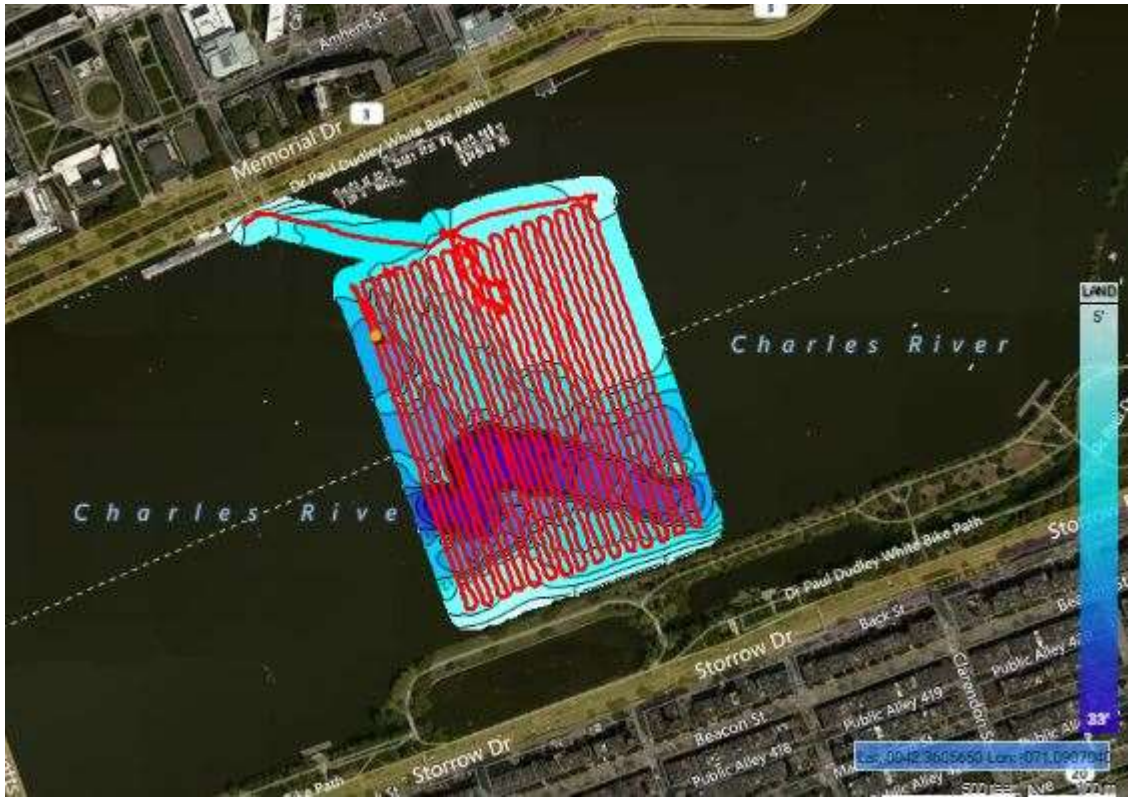
- MIT data presentation

The CRAB-MIT Chart Project

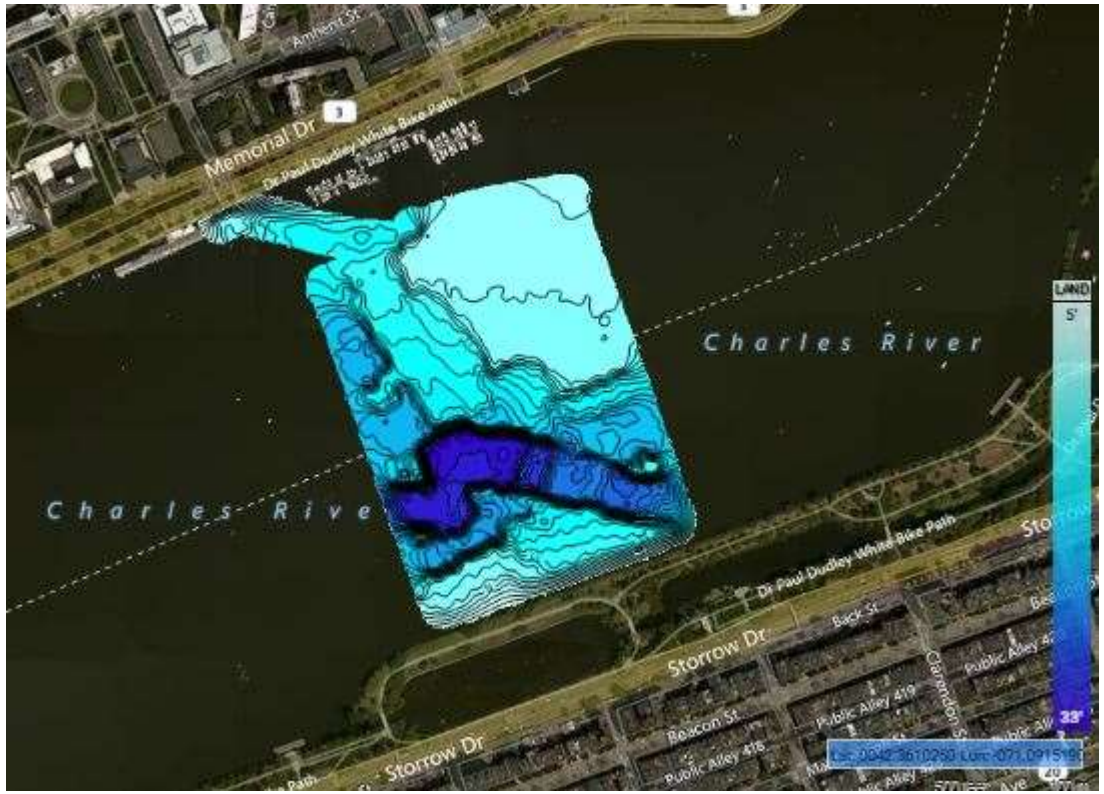
A survey of the lower Charles River developed by and for the boating community

REx 4 ASV and "fish finder" sonar

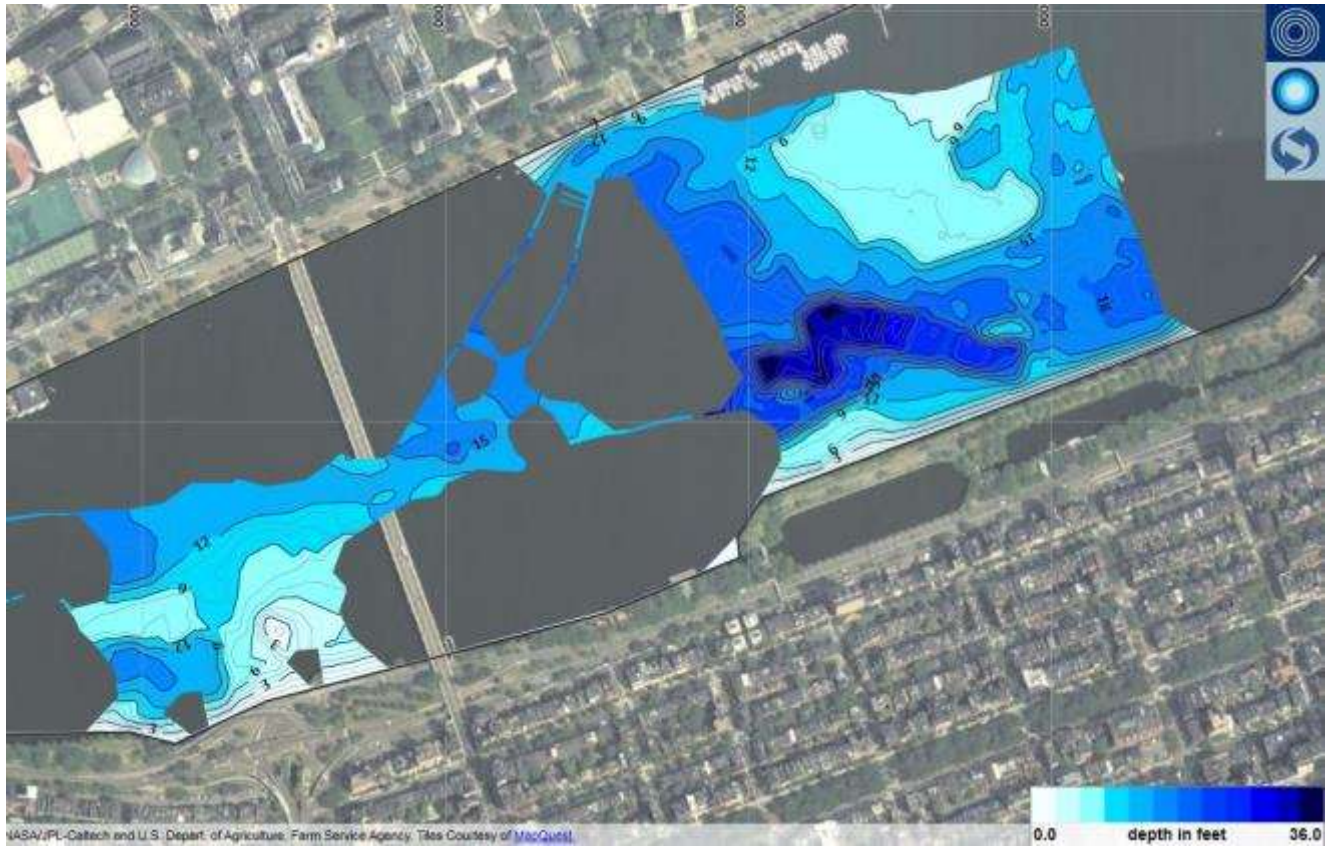
Boat basin survey



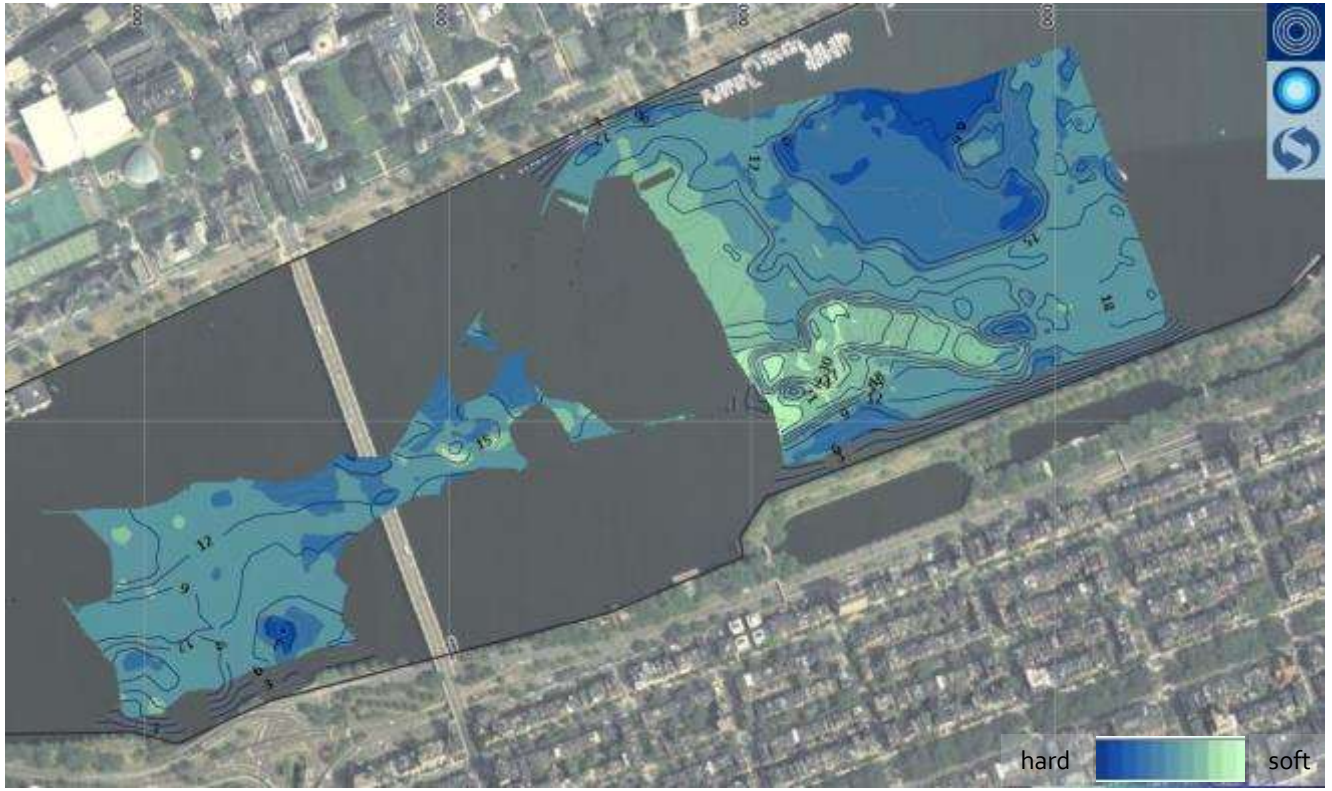
Boat basin - bathymetry



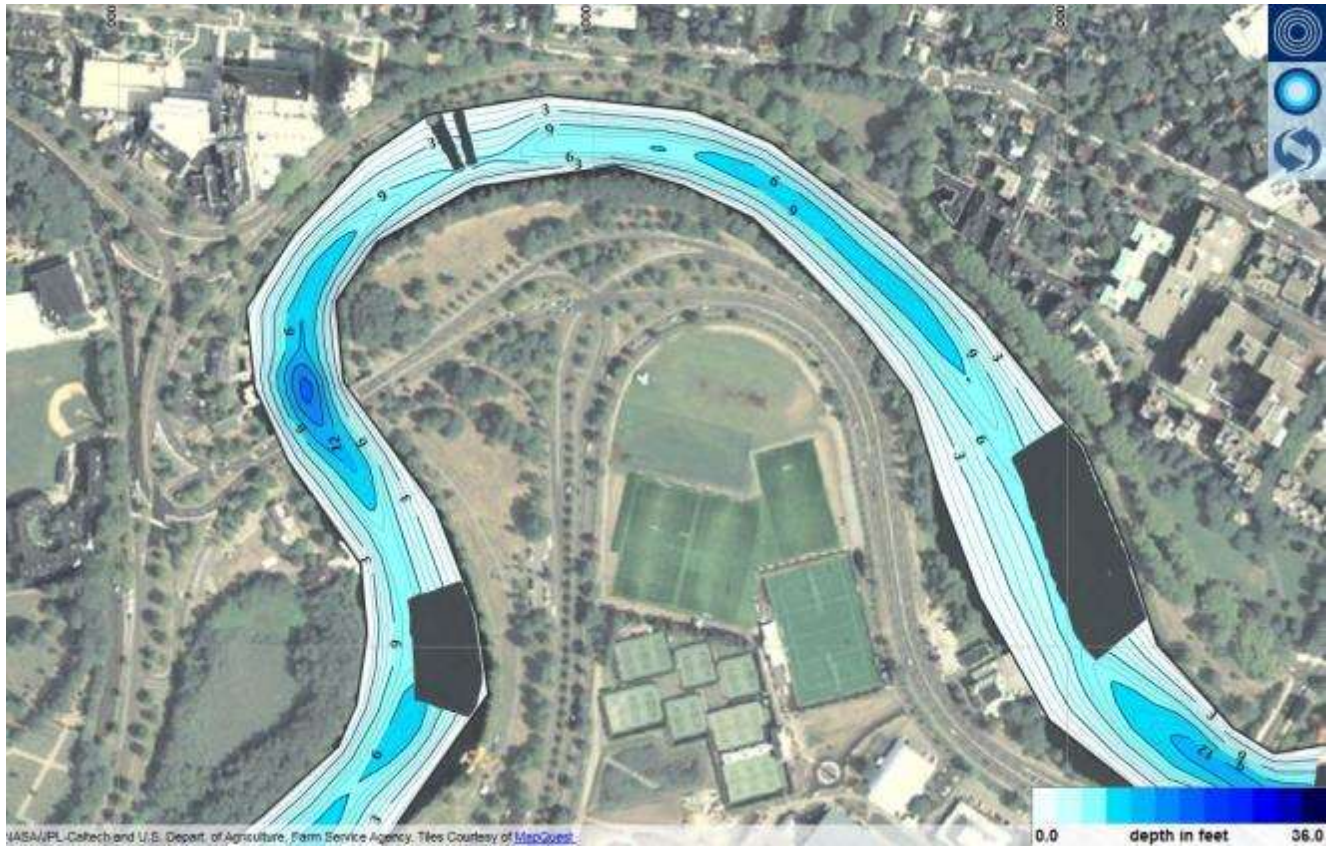
Charles, boat basin - bathymetry



Charles, boat basin - composition

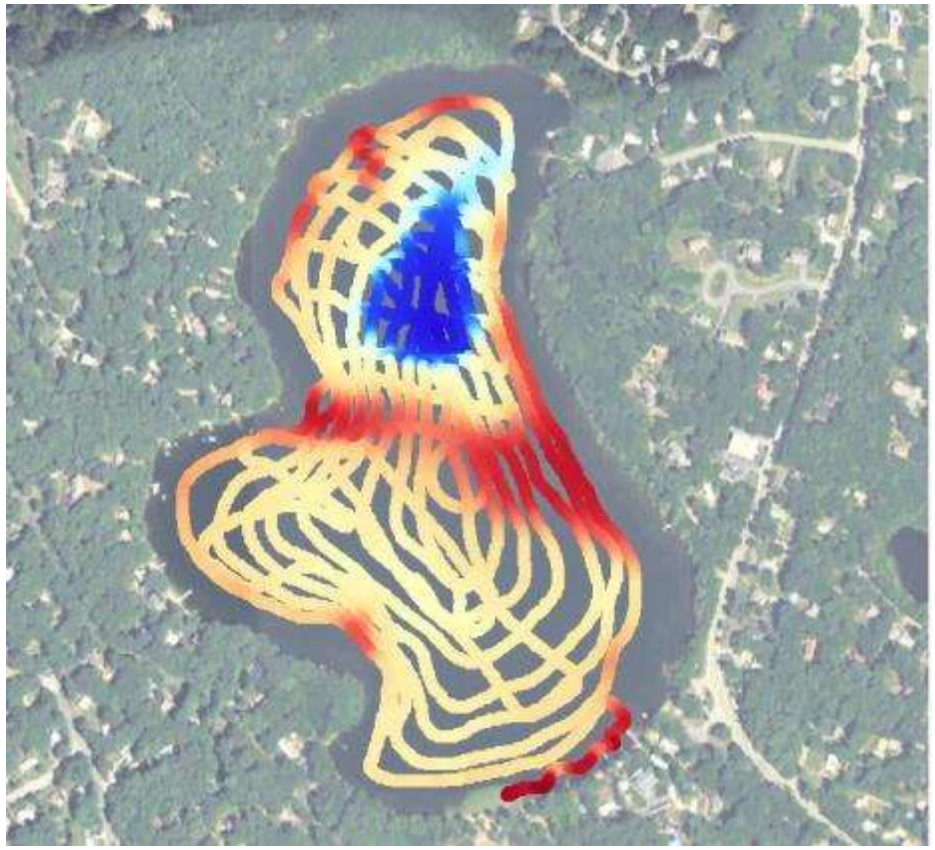


Charles, Eliot Br. – bathymetry

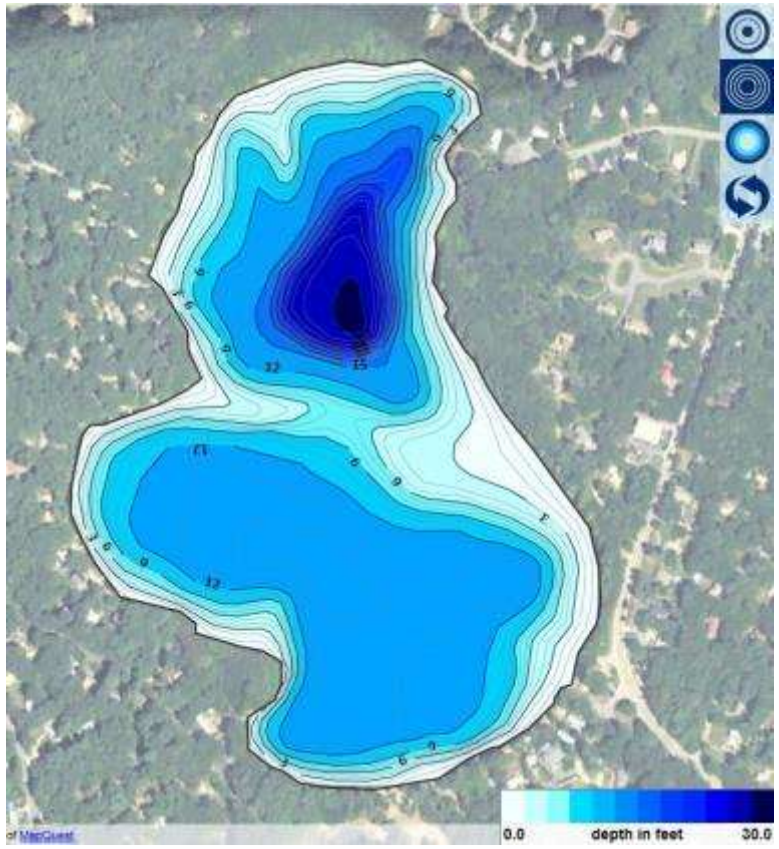


Charles, N. Beacon St. - bathymetry

Fresh Pond, Plymouth - survey



Fresh Pond, Plymouth - bathymetry

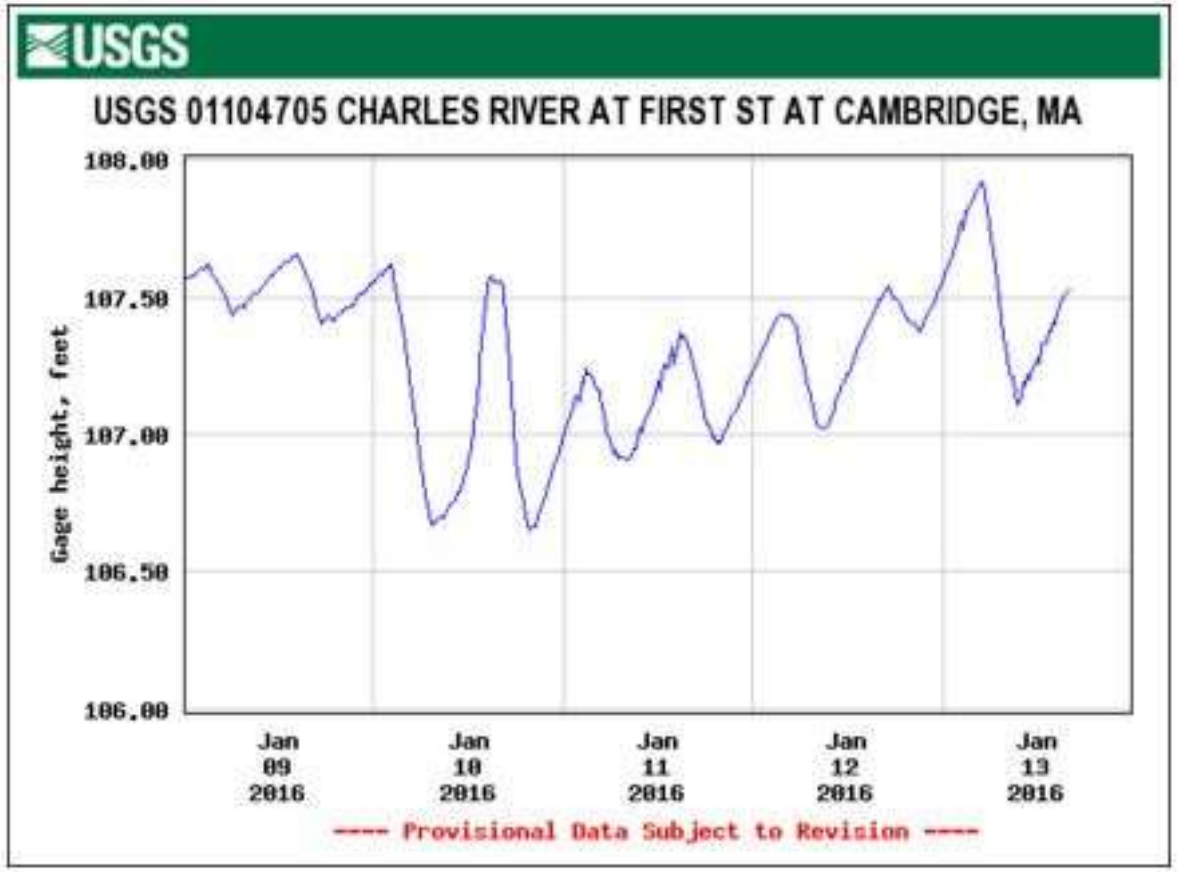


Fresh Pond, Plymouth - composition

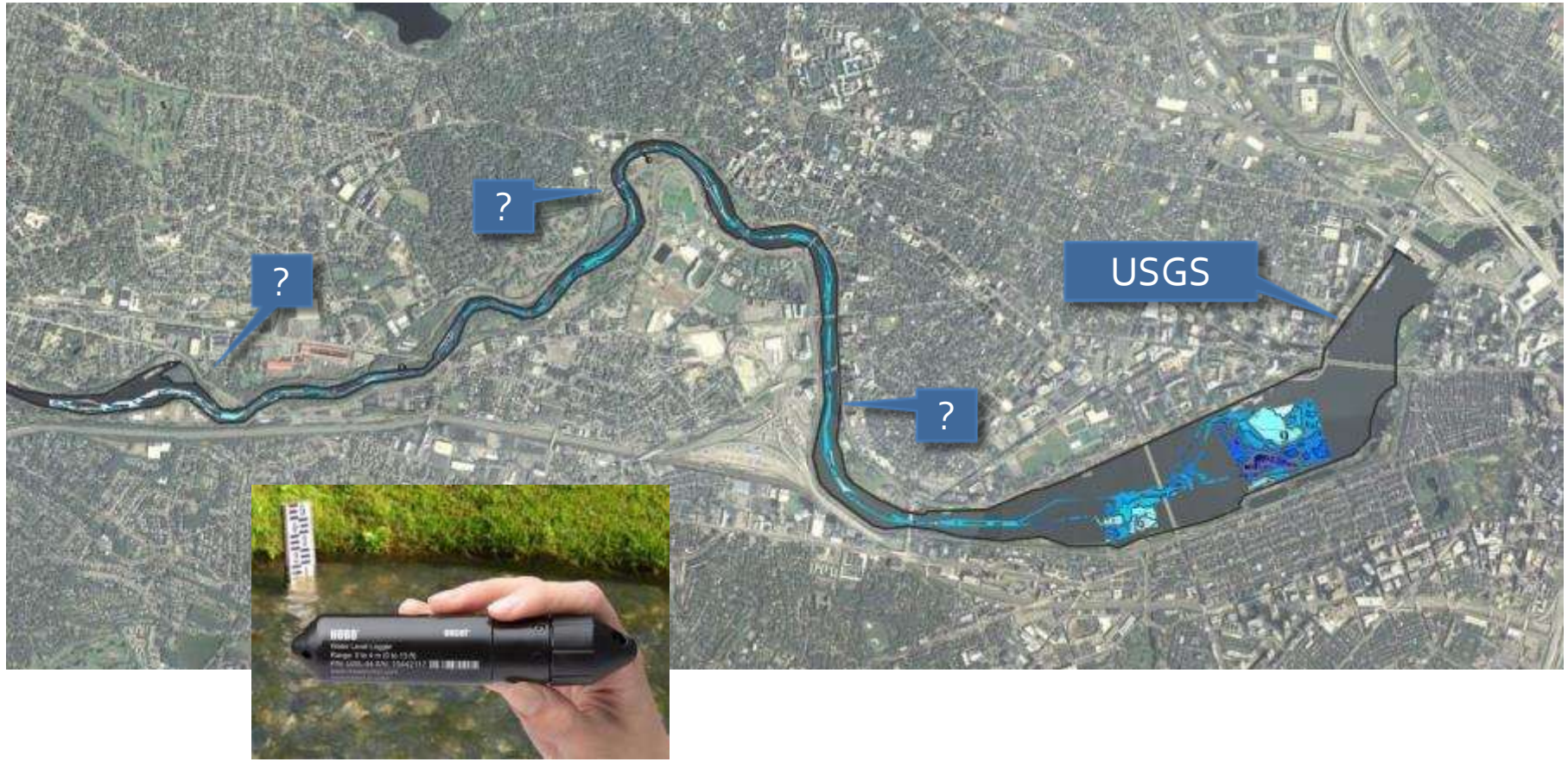
ReefMaster – lower Charles River

- Muddy River delta: bathy and composition
- Single trip up river

Water level: First St. gauge

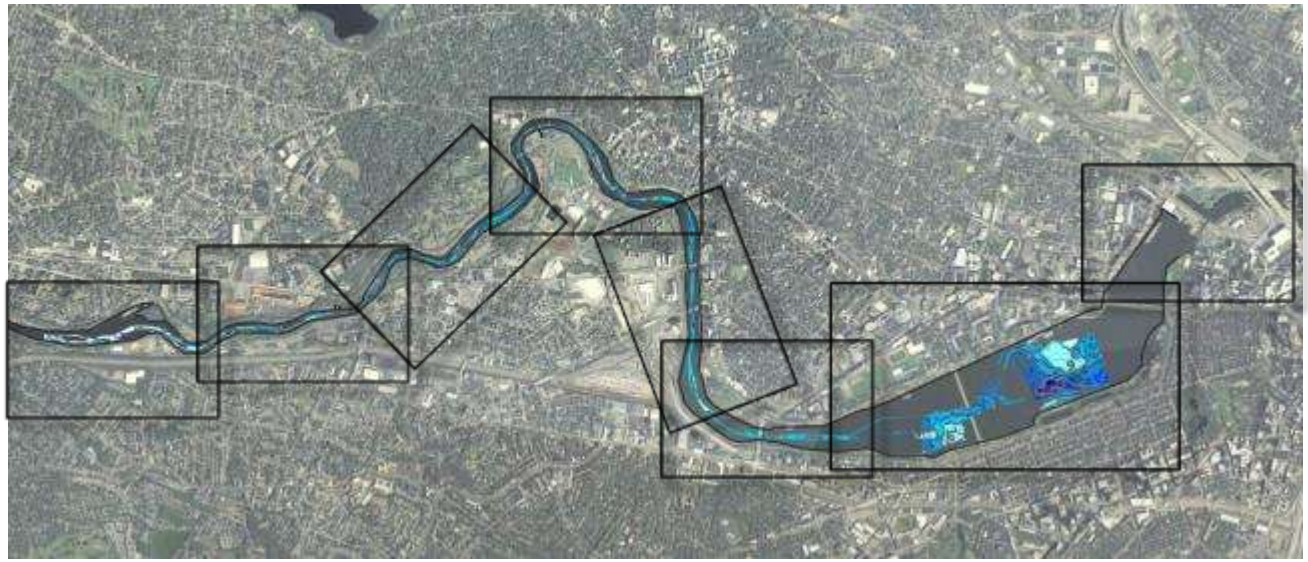


Water level loggers

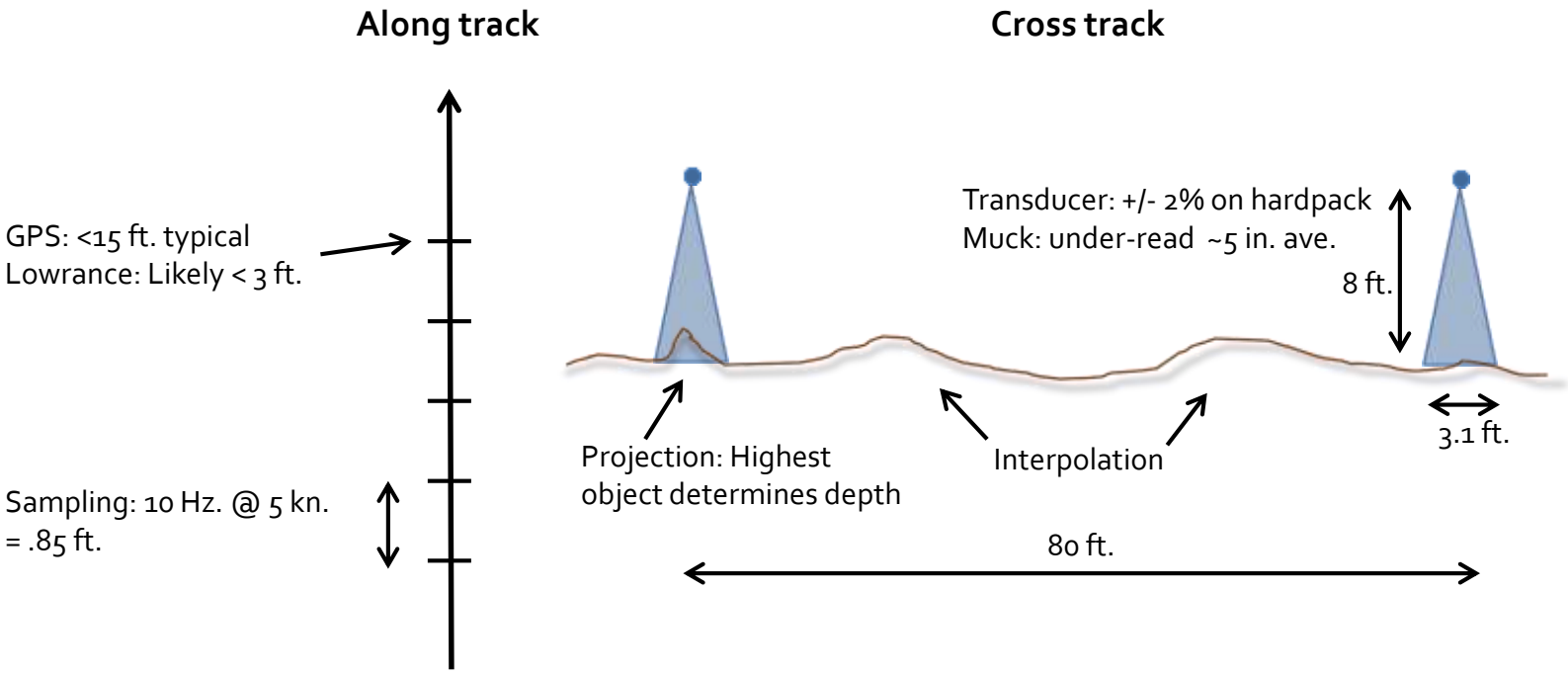


Deliverables

- Google Earth files of bathymetry and composition
- Chartplotter files in Lowrance (AT5) format
- PDF compilation of sections



Sources of error



Uncertainty in Data

- Spatial position is determined by GPS
  - ±5 feet
- Depth determined by sonar echo
  - 2% on a hard bottom, 5% on soft bottom
  - Depth is normalized to the height of the water sheet
    - Height of water sheet varies with a 12-13 hour period
  - Depth error: ± 6 inches
- Difference between track path and width of track
  - Data measured at ?? Hz,
    - every 4.4 ft at 3 mph along the track path
  - Depth perpendicular to the track (width) is extrapolated by the software
    - Caution with over-extrapolating the width
    - Insight Genesis plots are pretty, but seem over-extrapolated

Meeting with DCR

- Bill Gode
  Director
  Flood Control Management and Navigational Operations
  Department of Conservation and Recreation
  Charles River Dam

- Agreed that our methodology was sound and should produce quality data
- Made some helpful suggestions about measuring height of the water sheet

How can you help ?

- Volunteer
  - Stream gauge locations
    - Near Magazine Beach, Eliot Bridge, Nonantum
  - Passive sonar measurements
    - Select team of trained volunteers
    - Cover area above BU Bridge and along shoreline
- Financial support

Project Budget

	Quantity	Cost
Fishfinder for passive data collection	3	$1,200
Fishfinder for strategic data collection	1	$1,100
Depth Calibration Rods	4	$200
Water Level Data Loggers	3	$2,300
Mapping Software	2	$500
Workstation	1	$1,500
MIT Sea Grant Personnel		$5,000
Contingency		$500
Total		**$12,300**
Optional Side Scan Sonar	1	$2,000

What's Next ?

- Project updates via CRAB web site
- Installation of stream gauges in Spring 2016
- Passive depth measurements in Spring and Summer 2016
- Targeted depth measurements in 2016
- Depth calibration in October 2016
- Final calibrated chart in Winter 2016
- Plans for future years ?