

# STREAM TEMPERATURE IN THE CHESAPEAKE BAY WATERSHED

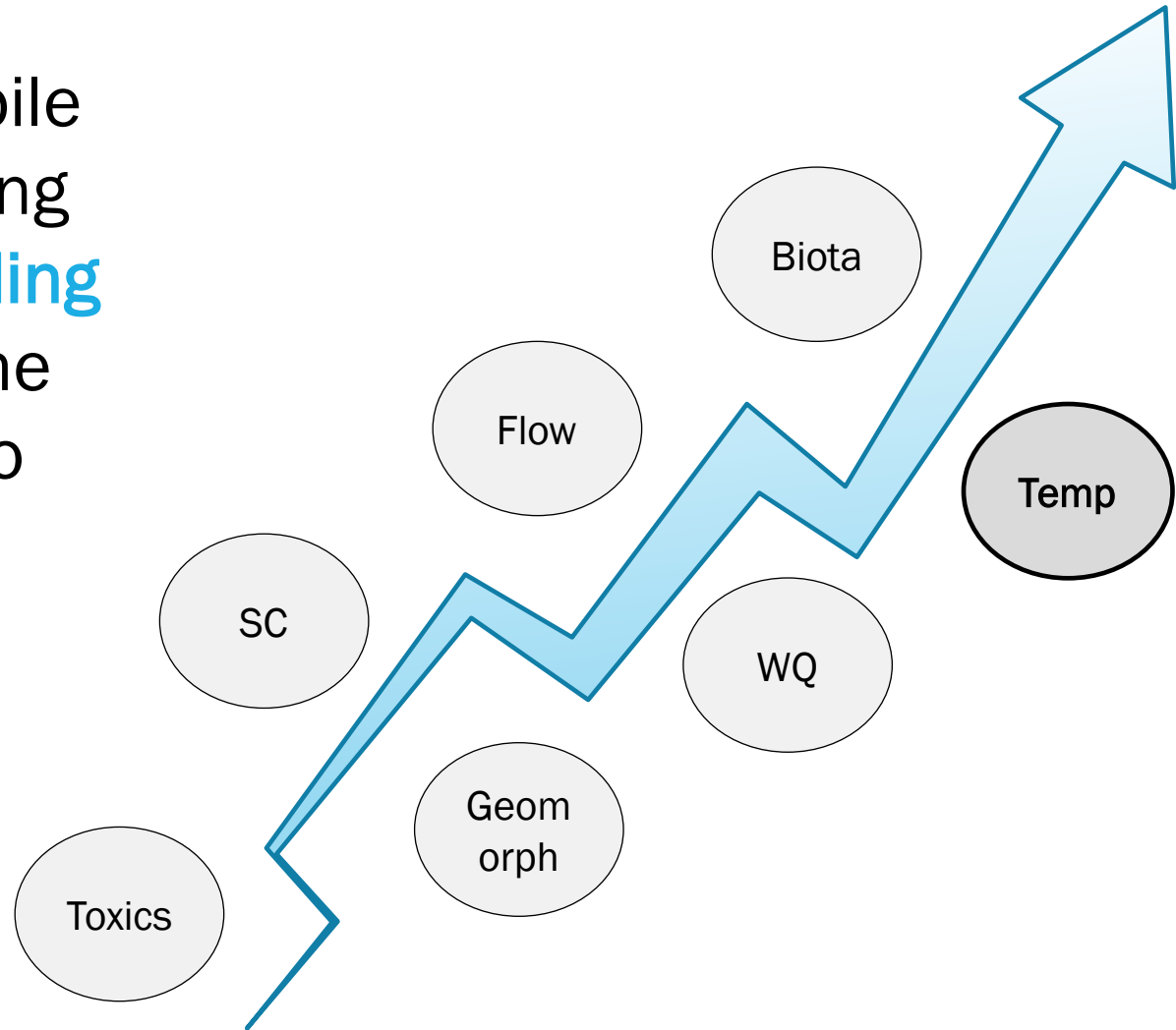


JOHN CLUNE, TAMMY ZIMMERMAN, JAMES COLGIN AND CHARLES SANDUSKY

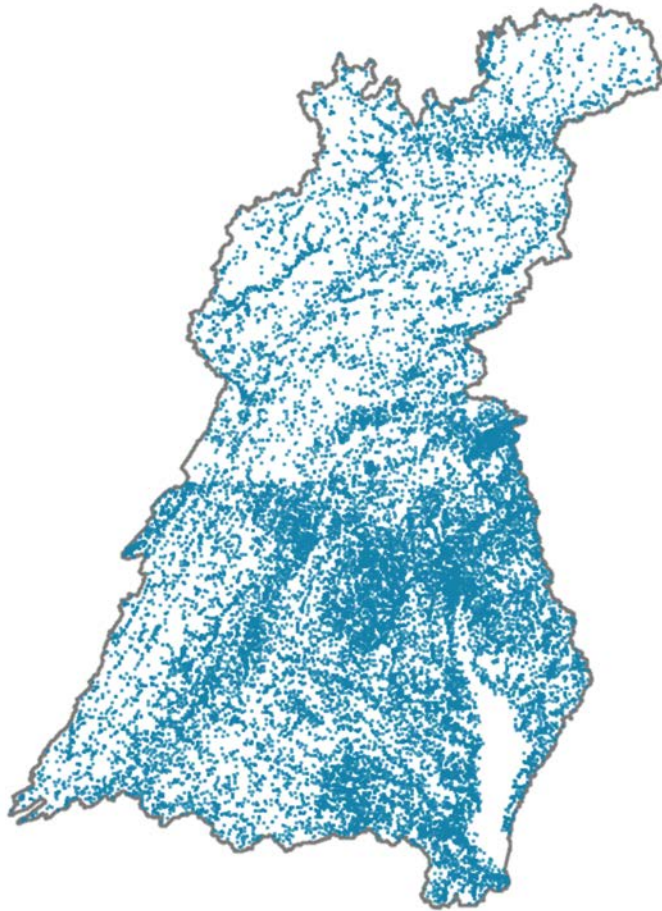
This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information

Photo by [Max Andrey](#) from [Pexels](#)

The USGS has begun to compile **multi-agency data** for assessing **status and trends**, and **modeling** stream temperature across the Chesapeake Bay watershed to better understand the drivers and stressors of fish health

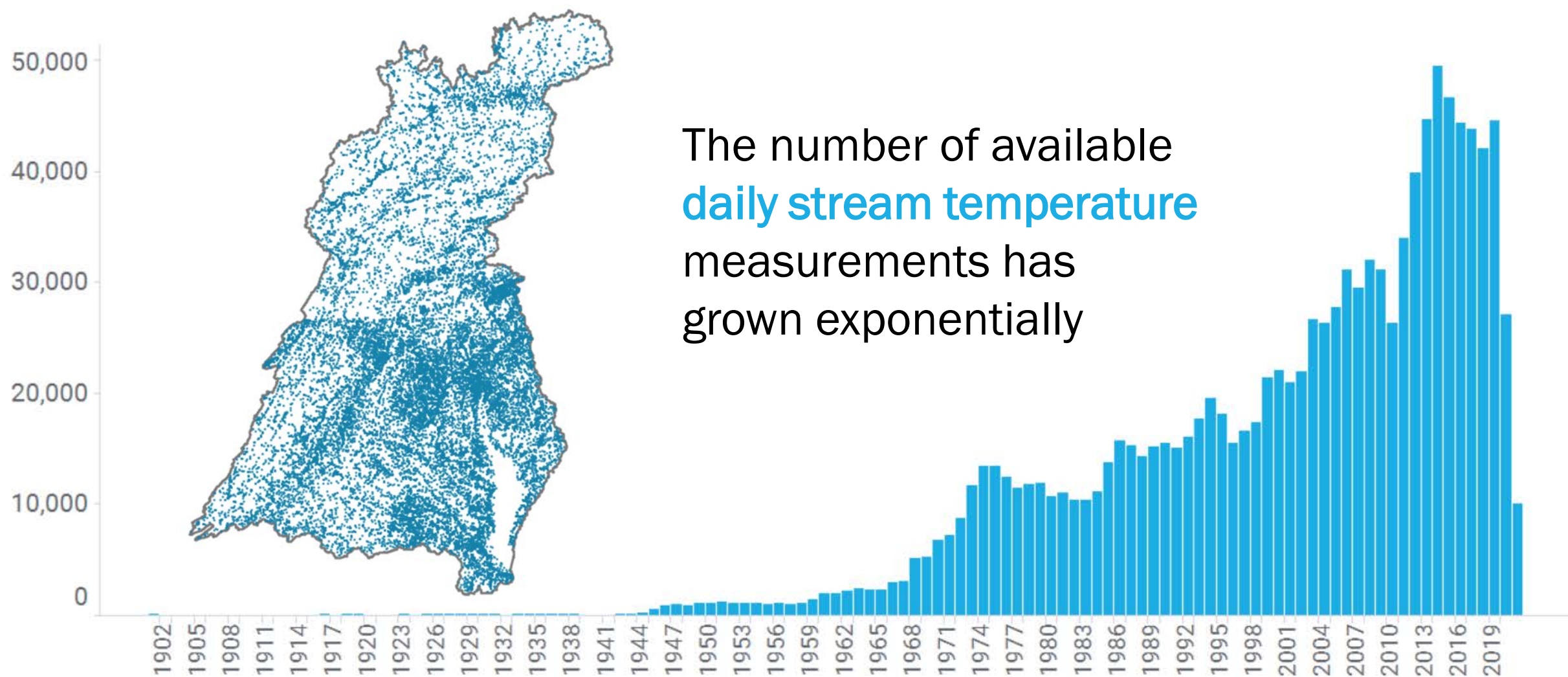






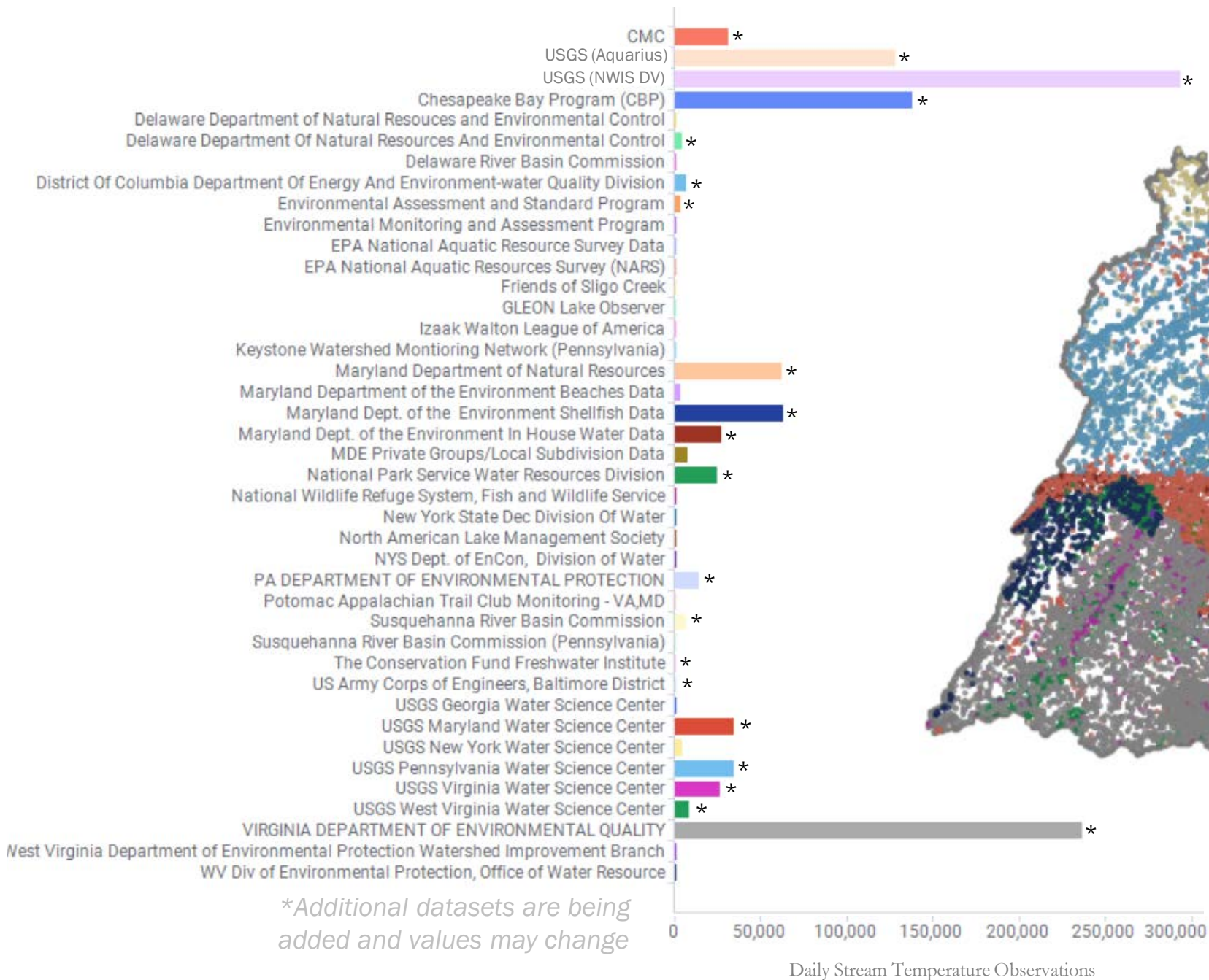
In the past 70 years,  
**stream temperature data**  
has been collected at  
**31,142 sites** by multiple  
agencies across the  
Chesapeake Bay Watershed

*\*Additional datasets are being added and values may change*



The number of available  
**daily stream temperature**  
measurements has  
grown exponentially

*\*Additional datasets are being added and values may change*



\* Networks currently in use  
(recent data since 2019)

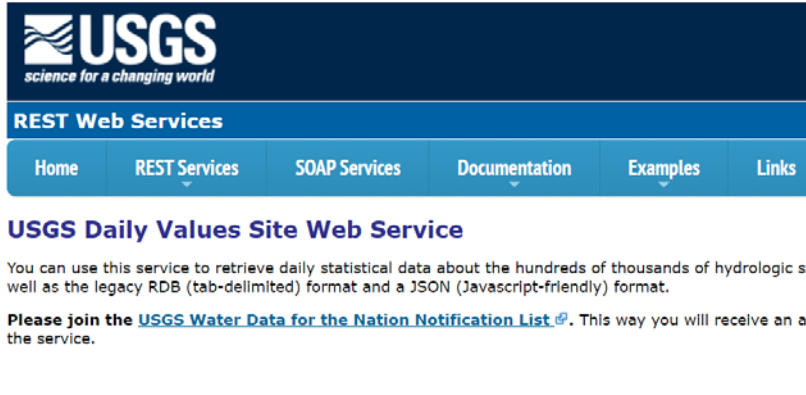
Some **sites**  
and **agencies**  
have more  
observations  
than others

Note: USGS (NWIS DV) refers to aggregate data statistics (i.e. mean, max, min) provided by the readNWISdata dv function call in the USGS R dataRetrieval package. USGS (Aquarius) data refers to temperature routine check measurements made during streamflow measurements acquired from the USGS Aquarius database.





# Compiling data is a **challenge** and needs a future coordinated framework



**USGS**  
science for a changing world

**REST Web Services**

Home REST Services SOAP Services Documentation Examples Links

**USGS Daily Values Site Web Service**

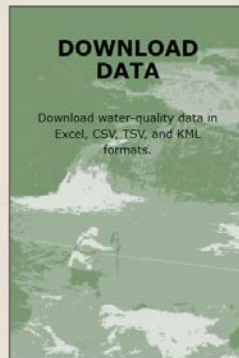
You can use this service to retrieve daily statistical data about the hundreds of thousands of hydrologic sites as the legacy RDB (tab-delimited) format and a JSON (Javascript-friendly) format.

Please join the [USGS Water Data for the Nation Notification List](#). This way you will receive an email when the service is updated.



## Water Quality Portal

The Water Quality Portal (WQP) is a cooperative service sponsored by the United States Geological Survey (USGS), the Environmental Protection Agency (EPA), and the National Water Quality Monitoring Council (NWQMC). It serves data collected by over 400 state, federal, tribal, and local agencies.

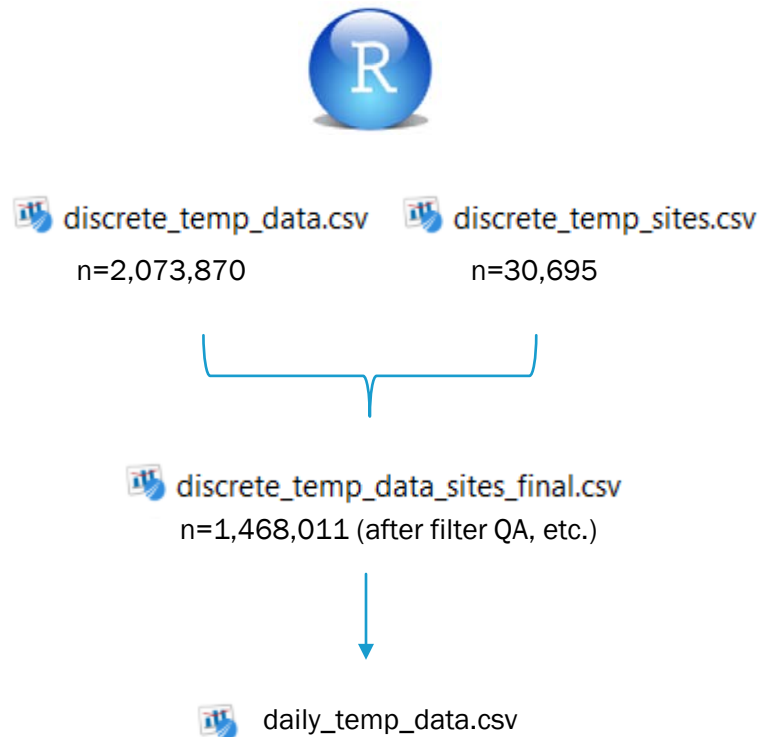


CMC  
PA DEP  
SRBC  
NY DEC  
VIMS  
DOEE  
ICPRB

MD DNR  
MD Baltimore  
County  
NPS  
UVA  
VEROS  
WV DNR



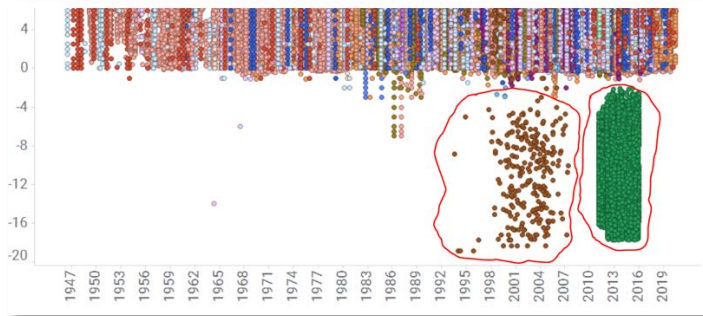
Currently developing **methods** that can be used for routine data compilation cycles (every 2 years, etc.)



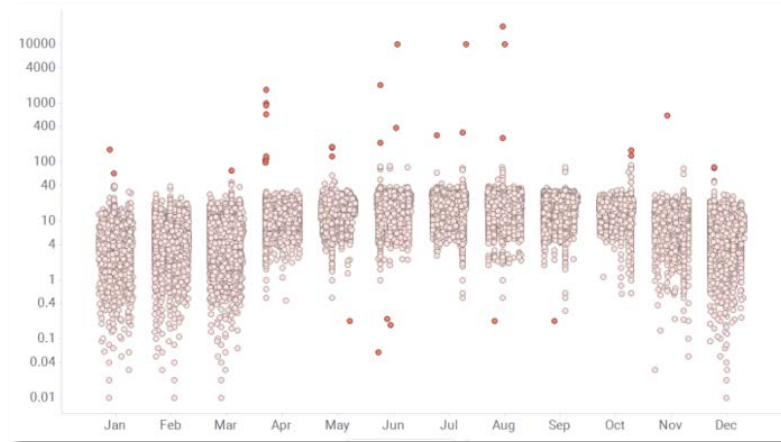
```
DiscreteData_WaterTemp_WQP.R x
1 setwd("C:
2
3 install.packages("dataRetrieval")
4 library (dataRetrieval)
5
6 # Pulls and saves site information for discrete sites in Bay watershed
7 discrete_temp_sites_pull <- whatWQPsites(huc=c("0205*", "0206*", "0207*
8
9 # Pulls and saves temperature data for sites in Bay watershed
10 discrete_temp_data_pull <- readWQPdata(huc=c("0205*", "0206*", "0207*",
11
12 # Removes unwanted columns (see Methods - Appendix I for notes on col
13 discrete_temp_sites <- discrete_temp_sites_pull[which(names(discrete_
14 discrete_temp_data <- discrete_temp_data_pull[which(names(discrete_te
15
16 # Merge discrete_temp_sites & discrete_temp_data
17 discrete_temp_data_sites <- merge(discrete_temp_sites, discrete_temp_
18
```

# Implementing **quality control (QC) procedures** that can improve multi-agency datasets

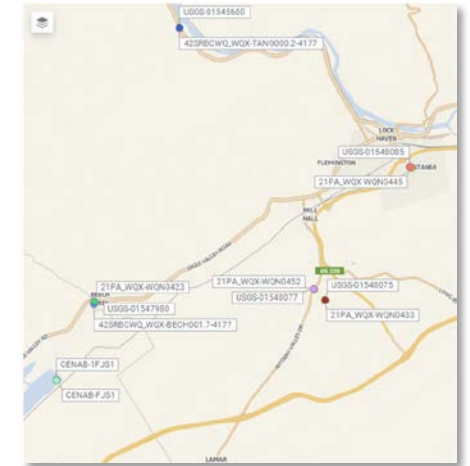
## Wrong Units



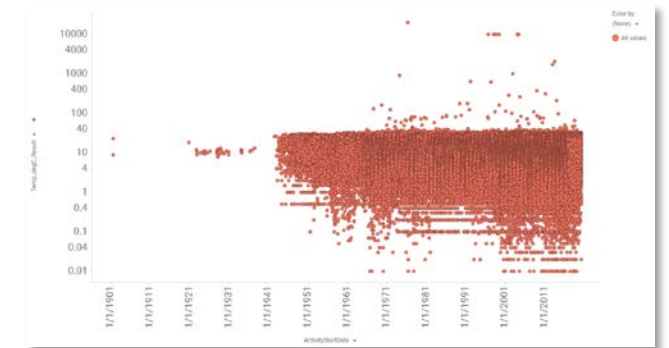
## Outliers



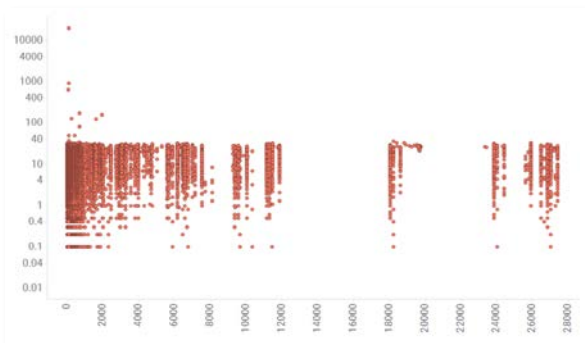
## Site Duplication



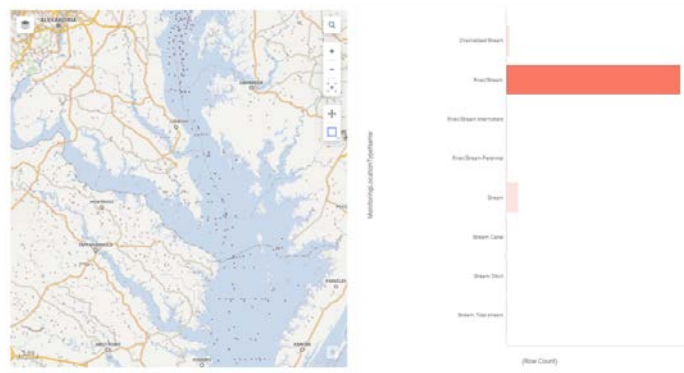
## Detection Limits



## Incomplete Metadata

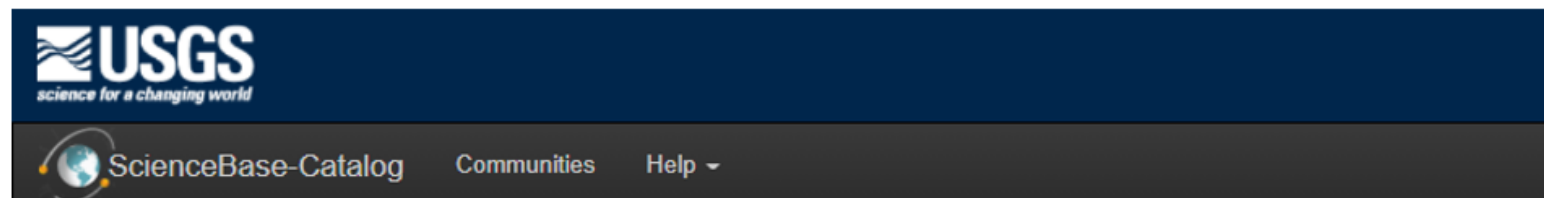


## Coding Issues





Preparing a  
USGS **data  
release** that  
can be used as  
a foundation  
for a future  
framework



## Data release: Compilation of multi-agency water temperature observations for streams in the Chesapeake Bay Watershed, 1894 -2021

### Dates

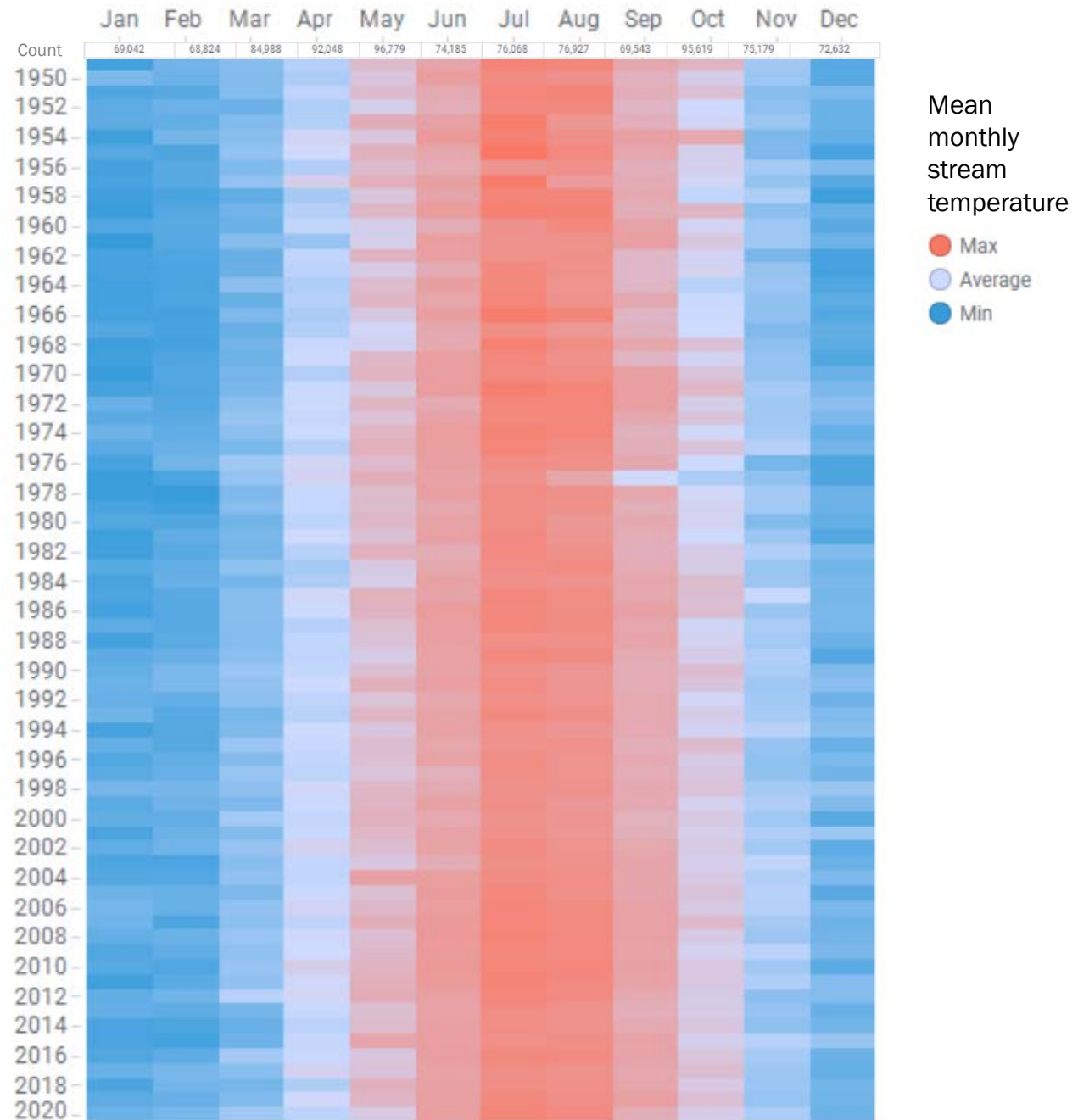
**Publication Date:** 2021  
**Start Date:** 1894-08-30  
**End Date:** 2021-12-01

### Citation

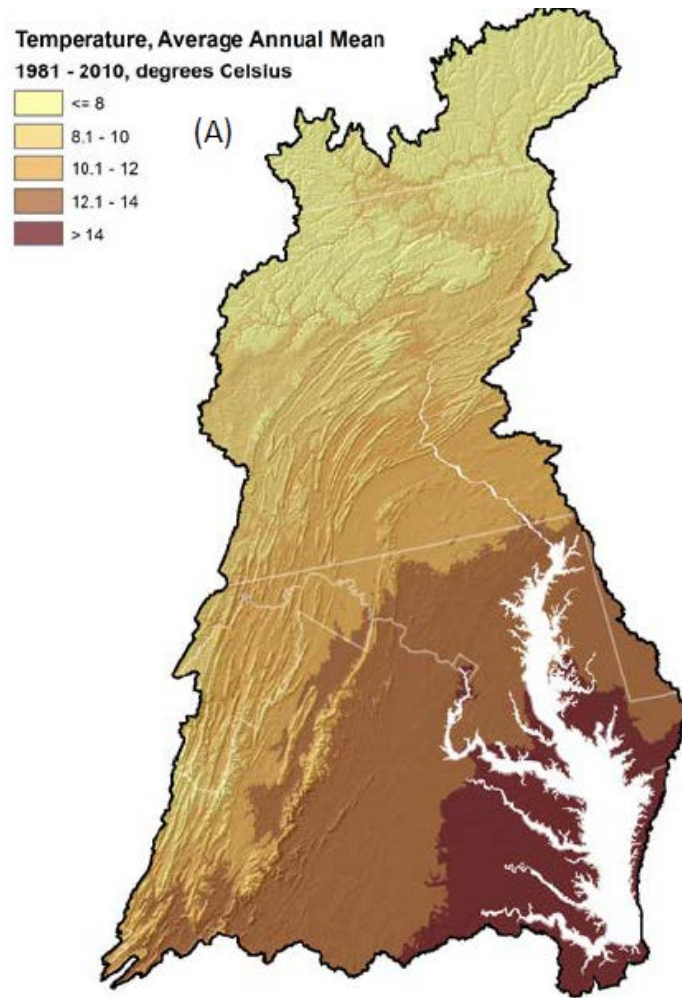
John W. Clune, James Colgin, Charles Sandusky, and Tammy Zimmerman, 2021, Compilation of multi-agency water temperature observations for streams in the Chesapeake Bay Watershed, 1894 -2021 1: U.S. Geological Survey, <https://doi.org/10.XXXX/XXXXX>

site_id	date	mean_temp_degC	min_temp_degC	max_temp_degC	n_obs	source	flag	date_
USGS-01434025	2020-07-12T00:00:00Z	15.96	15.50	16.80	96	nwis_uv	P	7/12/2020
USGS-01434025	2020-07-13T00:00:00Z	15.91	15.20	16.80	96	nwis_uv	P	7/13/2020
USGS-01434025	2020-07-14T00:00:00Z	15.74	15.10	16.50	96	nwis_uv	P	7/14/2020
USGS-01434025	2020-07-15T00:00:00Z	15.42	14.80	16.10	96	nwis_uv	P	7/15/2020
USGS-01434025	2020-07-16T00:00:00Z	15.32	15.10	15.80	96	nwis_uv	P	7/16/2020
USGS-01434025	2020-07-17T00:00:00Z	15.09	14.60	16.10	96	nwis_uv	P	7/17/2020
USGS-01434025	2020-07-18T00:00:00Z	15.22	14.20	16.50	96	nwis_uv	P	7/18/2020
USGS-01434025	2020-07-19T00:00:00Z	15.82	15.00	17.00	96	nwis_uv	P	7/19/2020

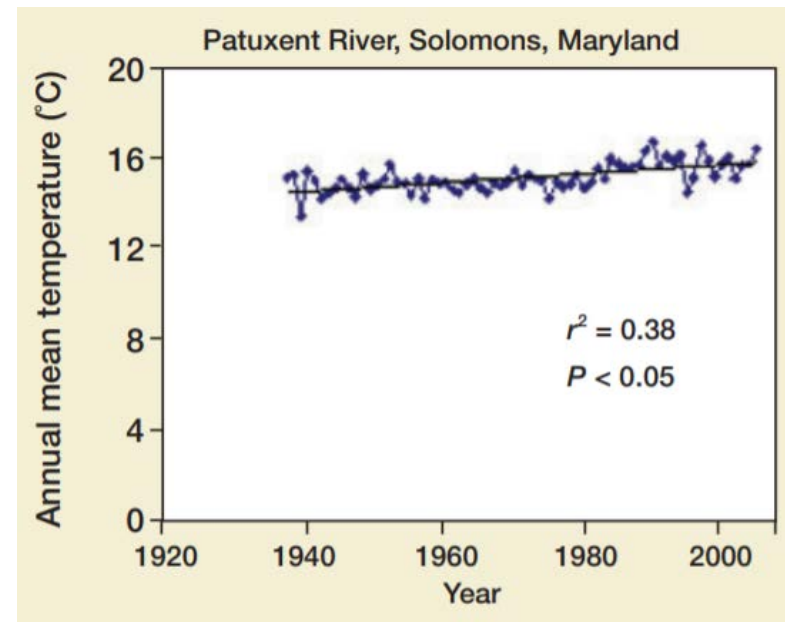
Abundant daily  
stream temperature  
measurements will  
be available for  
**data exploration**  
(seasonal, monthly  
and annual)



*\*Additional datasets are being added and values may change*



Publishing methods that will use daily observations to develop **status and trends** at sites with long term records



(<https://doi.org/10.1890/090037>)

*Kaushal and others, 2010*  
*Rice and Jastram,*  
*Ashizawa and Cole, 1994*  
*Webb and Nobilis, 1995*  
*Durance and Ormerod, 2007*  
*Wagner and others, 2017*  
*Hirsh and others, 2010*  
*Oliver and others, 2022*



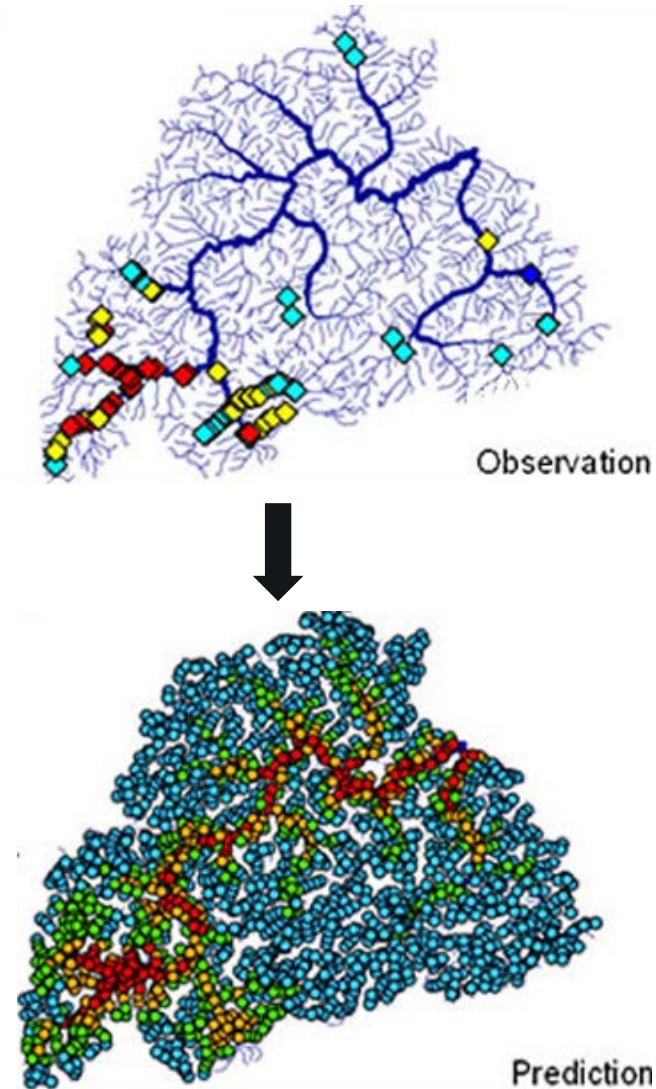
Evaluating **models** that will use these data to better **predict stream temperature** spatially across the Chesapeake Bay watershed (100k, 24k scale)

*USGS SPARROW*

*Ecosheds*

*Bay Model*

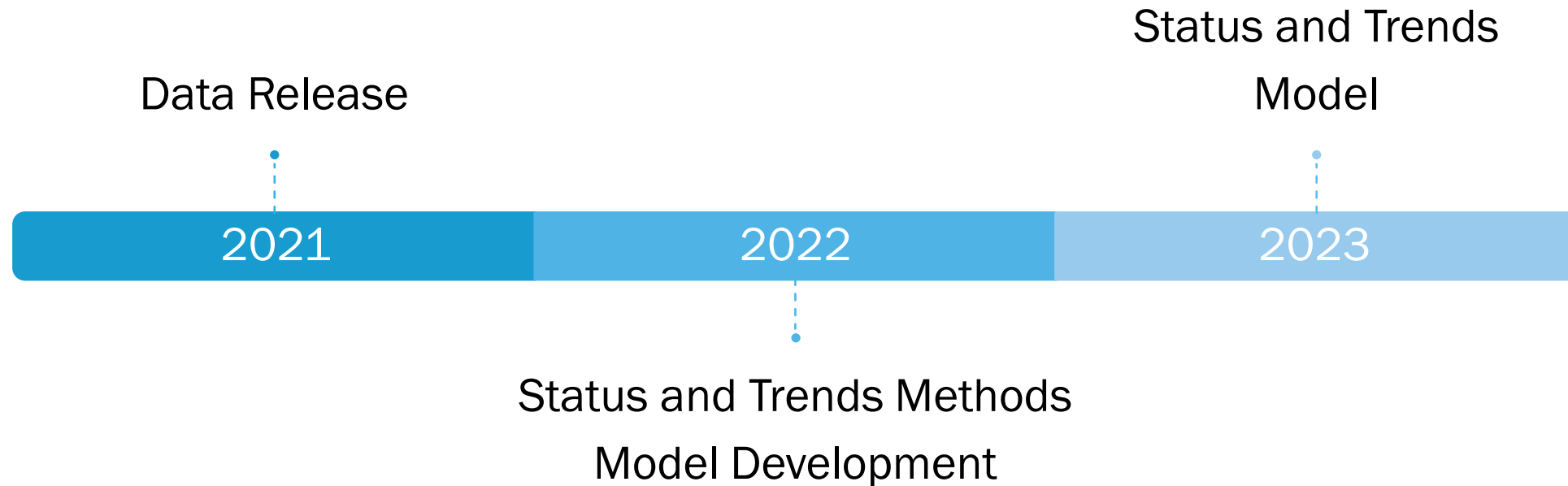
*EPA SSN Models*



Courtesy  
Naomi Detenbeck (US EPA)



The next few years will bring new  
**advances in understanding stream temperature**  
across the Chesapeake Bay watershed.



# THANK YOU



Photo by [Max Andrey](#) from [Pexels](#)

For more information:

John Clune, PhD

U.S. Geological Survey

(717) 317-7226

[jclune@usgs.gov](mailto:jclune@usgs.gov)

