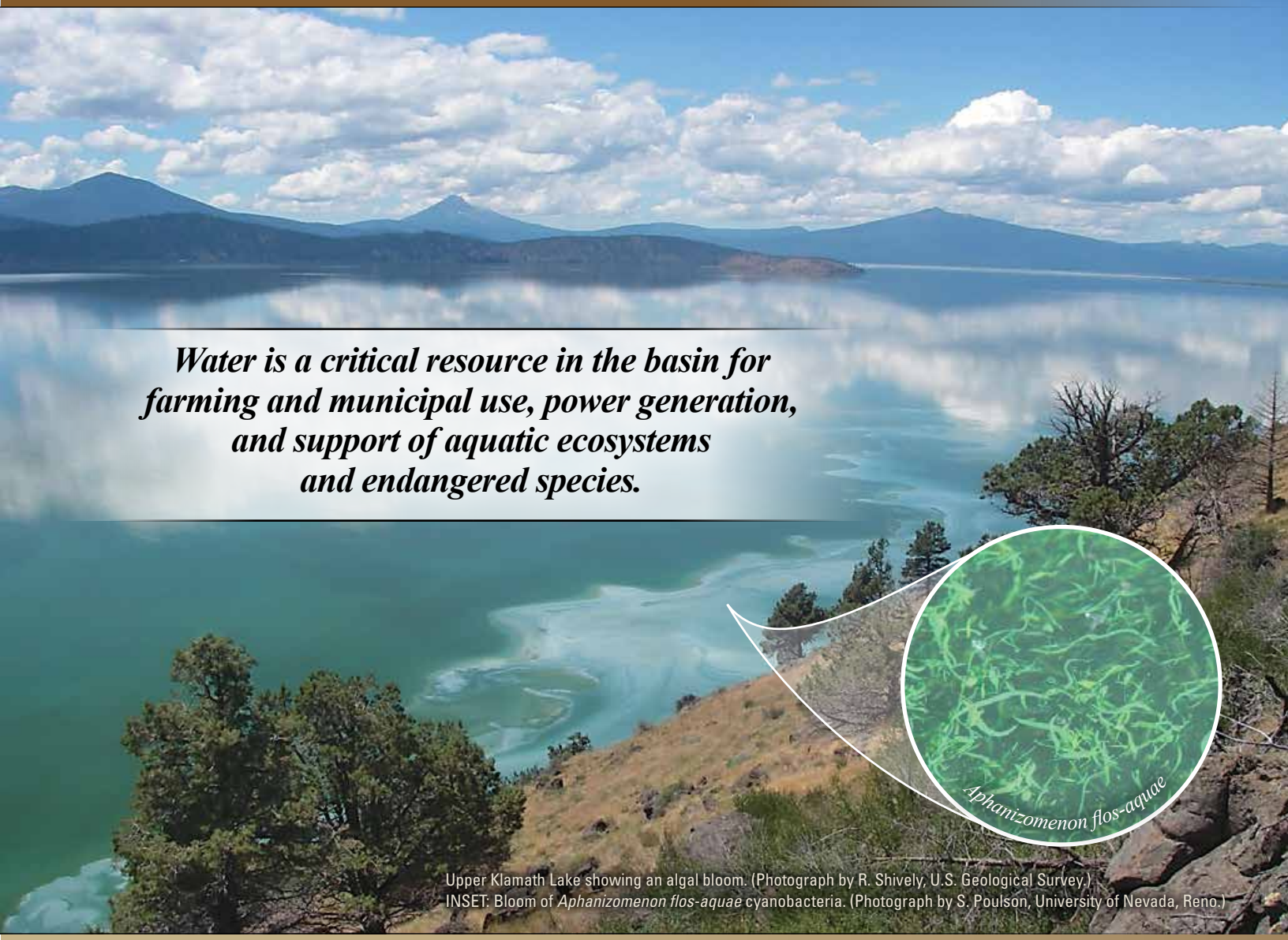
USGS
science for a changing world

Klamath River Basin Water-Quality Data

Water is a critical resource in the basin for farming and municipal use, power generation, and support of aquatic ecosystems and endangered species.



Upper Klamath Lake showing an algal bloom. (Photograph by R. Shively, U.S. Geological Survey.)
INSET: Bloom of *Aphanizomenon flos-aquae* cyanobacteria. (Photograph by S. Poulson, University of Nevada, Reno.)

The U.S. Geological Survey, Bureau of Reclamation, and others continue to monitor and assess water-quality conditions in Upper Klamath Lake and the surrounding watershed. These collaborative efforts provide incredibly valuable information for those managing, working in, or living in the area.

The Klamath River Basin stretches from the mountains and inland basins of south-central Oregon and northern California to the Pacific Ocean, spanning multiple climatic regions and encompassing a variety of ecosystems. Water quantity and water quality are important topics in the basin, because water is a critical resource for farming and municipal use, power generation, and for the support of wildlife, aquatic ecosystems, and endangered species. Upper Klamath Lake is the largest freshwater lake in Oregon (112 square miles) and is known for its seasonal algal blooms. The Klamath River has dams for hydropower and the upper basin requires irrigation water to support agriculture and grazing. Multiple species of endangered fish inhabit the rivers and lakes, and the marshes are key stops on the Pacific flyway for migrating birds. For these and other reasons, the water resources in this basin have been studied and monitored to support their management and distribution.

U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2018-3031
May 2018

History of Excellence

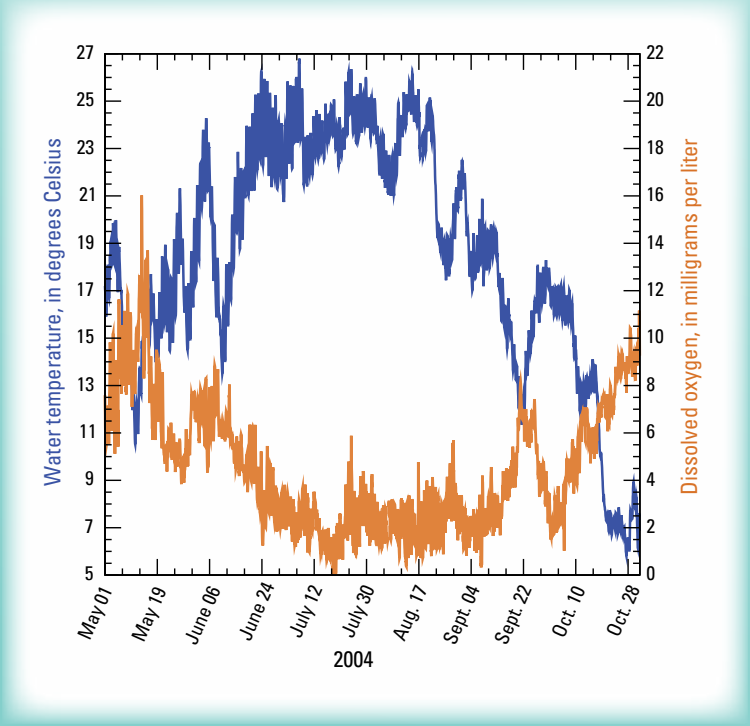
In 2012, the U.S. Geological Survey (USGS) and the Bureau of Reclamation (Reclamation) began a multi-year partnership to evaluate more than 20 years of Klamath River Basin water-quality data collected by Reclamation. The datasets consisted of time-series data and laboratory results from discrete water-quality samples. The goal was to assess the quality of the data, make appropriate corrections, and archive the results in the USGS National Water Information System (NWIS), where the data will be available to the public for exploration and analysis.

An aerial view of irrigated fields in the upper Klamath River Basin, Oregon. (Photograph by C. Anderson, U.S. Geological Survey.)

Water-Quality Parameters

Water quality often is measured through parameters such as water temperature, dissolved oxygen, pH, nitrate (NO_3^-), total suspended solids, alkalinity, and total phosphorus, among others. An individual measurement of nitrate or dissolved-oxygen concentration provides valuable information, but long-term datasets can reveal trends, seasonal patterns, and extreme events, and can improve the confidence of such measurements. These long-term, continuous data and repeated discrete sampling data may allow the exploration of questions such as:

- How has the water temperature in the Klamath River changed over time?
- What concentrations of ammonia have occurred during the spawning period of a particular fish species?
- During the 2001 drought, did dissolved-oxygen concentrations reach levels that could be harmful to aquatic life?



Hourly water-temperature and dissolved-oxygen data collected by the Bureau of Reclamation at Klamath Straits Drain near Hwy 97 (420451121510000) from May 1 to November 1, 2004, reveal an inverse relation. The USGS Data Grapher allows users to explore time-series data and create customized graphs and tables of the data.

Water appears green near this railroad trestle in Lake Ewauna, Oregon, because of an algal bloom. (Photograph by C. Anderson, U.S. Geological Survey.)

Data Compilation

In addition to evaluating and importing hundreds of time-series datasets and thousands of discrete sample results into NWIS, USGS staff created a new map-based website as an interface to the Klamath River Basin data. With the launch of this map-based website, users can explore the data more easily and find answers to questions of interest. Read more to find out how the data were evaluated and how the new website can be accessed and used.

Continuous Water-Quality Data

Reclamation began collecting hourly water-quality data throughout the Klamath River Basin in 1990. The locations where data were collected ranged from sites in the Klamath River to sites in diversion channels and canals that were affected by irrigation water pumping. A few of the sites that were established in 1990 are still active and are collecting continuous data today (2018). Water temperature, pH, dissolved oxygen, specific conductance, and sometimes sensor-depth data are collected at most sites. Water-quality monitoring technology has progressed over the past few decades, and multiple types of instruments were used to collect these data.

At the time of data collection, Reclamation staff did not have access to a public database to archive the data, so data were stored in local files. USGS and Reclamation staff worked together to find and analyze all the available documentation, including site-visit notes and data, instrument calibration notes, and other associated information. For data to be accepted into the USGS NWIS database, all protocols, equipment, and data values had to be evaluated and checked to assure their quality. Data were methodically analyzed, and decisions about the need to correct or delete poor data were made on a case-by-case basis. Corrections were made using published USGS protocols.

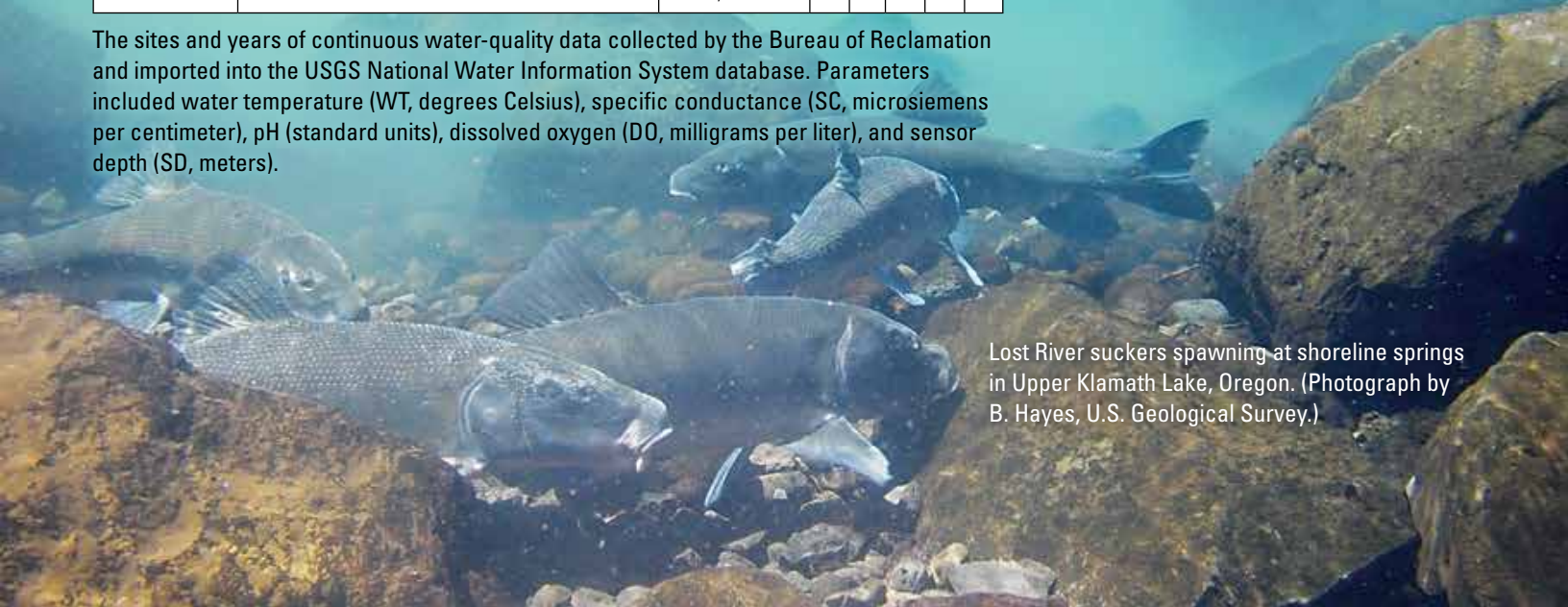
Site No.	Site name	Years	Parameters				
			WT	SC	pH	DO	SD
11507501	Link River below Keno Canal, near Klamath Falls, OR	2001-06, 2010-13	x	x	x	x	x
11509370	Klamath River above Keno Dam, at Keno, OR [top]	1991-2006, 2010-13	x	x	x	x	x
11510990	Klamath River above Shovel Creek near Copco, CA	1996-98, 2000	x	x	x	x	
11517500	Shasta River near Yreka, CA	1998-2000	x	x	x	x	
11519500	Scott River near Fort Jones, CA	1998-2000	x	x	x	x	
11520500	Klamath River near Seiad Valley, CA	1998-2000	x	x	x	x	
11522500	Salmon River at Somes Bar, CA	1999-2000	x	x	x	x	
11530000	Trinity River at Hoopa, CA	1999-2000	x	x	x	x	
411448123462401	Klamath River at Youngs Bar near Weitchpec, CA	1999-2000	x	x	x	x	
412051123523401	Klamath River at Johnsons Point near Orick, CA	1999	x	x	x	x	
415548121360101	P Canal at Tule Lake Tunnel Outlet near Tulelake, CA	1999-2000	x	x	x	x	
415552122263101	Klamath River below Iron Gate Res. near Copco, CA	1996-2000	x	x	x	x	
415950121463701	Klamath Straits Drain at Hwy 161 near Dorris, CA	1999-2000	x	x	x	x	
420219121474500	Klamath Straits Drain at Township Rd	1999-2000	x	x	x	x	
420451121510000	Klamath Straits Drain near Hwy 97, OR	1990-2006, 2010-13	x	x	x	x	x
420523122042000	Klamath River at RM 220.1, near Keno, OR	1996-97	x	x	x	x	
420524121515200	Ady Canal 0.25 mi below Klamath River, near Worden, OR	2009-2010	x	x	x	x	x
420615121533600	Klamath River at Site 12a, near Rock Quarry, OR [top]	2005, 2010-11	x	x	x	x	x
420615121533601	Klamath River at Site 12a, near Rock Quarry, OR [bottom]	2005, 2010-11	x	x	x	x	x
420732121501100	North Canal 0.9 mi below Klamath River, near Worden, OR	1990-91, 2009-10	x	x	x	x	x
420741121554001	Klamath River above Keno Dam, at Keno, OR - Bottom	2003-06, 2010-13	x	x	x	x	x
420743121565400	Klamath River below Keno Dam, at Keno, OR	2006	x	x	x	x	
420853121505500	Klamath River at Miller Island Boat Ramp, OR [top]	1999-2006, 2010-13	x	x	x	x	x
420853121505501	Klamath River at Miller Island Boat Ramp - Bottom	2003-2006, 2010-13	x	x	x	x	x
420903122010900	Klamath River at RM 228.2, near Keno, OR	1992, 2006	x	x	x	x	
421015121471800	Lost River Diversion Channel near Klamath River, OR	2010-13	x	x	x	x	x
421131121465900	Klamath River above OR 140, near Altamont, OR	2002	x	x	x	x	
421209121463000	Klamath River at Railroad Bridge, OR [top]	2003-06, 2010-11	x	x	x	x	x
421209121463001	Klamath River at Railroad Bridge - Bottom	2003-05, 2010-11	x	x	x	x	x
421258121465800	Lake Ewauna near Altamont, OR - Top	1992-93	x	x	x	x	
421258121465801	Lake Ewauna near Altamont, OR - Bottom	2002-03	x	x	x	x	
421330121474700	Link River above Eastside Powerhouse	2003-07	x	x	x	x	
421401121480900	Link River Dam	2001-06, 2010-13	x	x	x	x	x

The sites and years of continuous water-quality data collected by the Bureau of Reclamation and imported into the USGS National Water Information System database. Parameters included water temperature (WT, degrees Celsius), specific conductance (SC, microsiemens per centimeter), pH (standard units), dissolved oxygen (DO, milligrams per liter), and sensor depth (SD, meters).

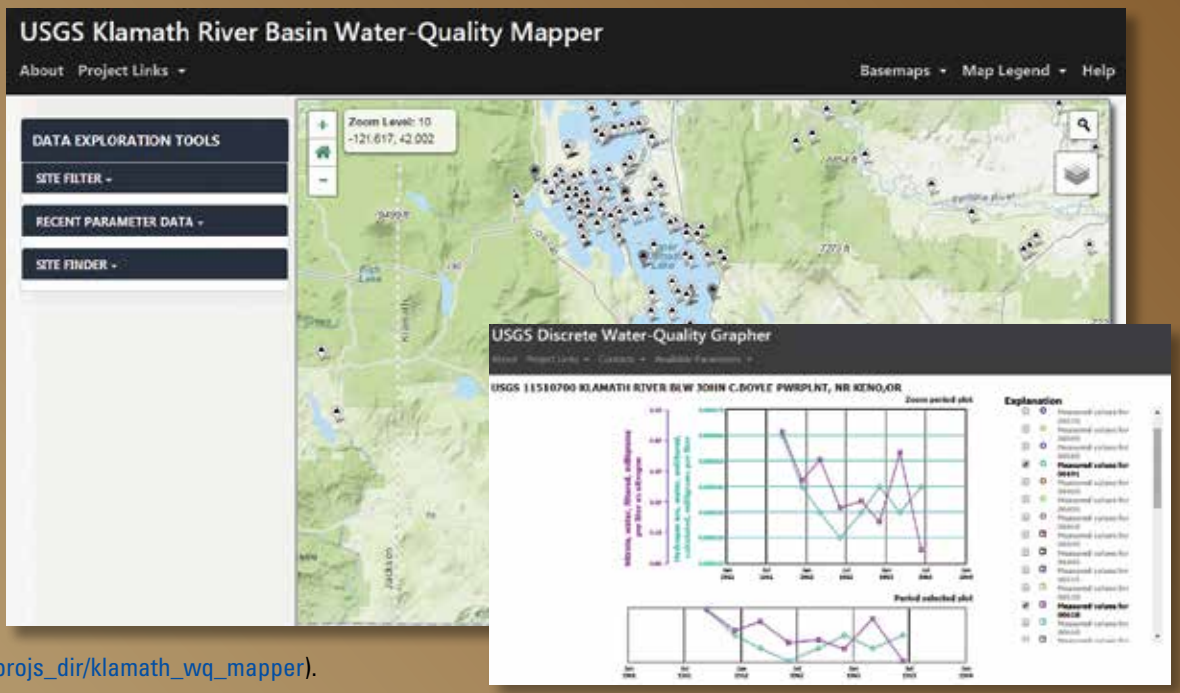
Discrete Water-Quality Samples

From 1998 through 2012, Reclamation staff collected more than 2,700 discrete water samples from sites in the Klamath River Basin. Water samples were collected from reservoirs, Upper Klamath Lake, groundwater wells, and rivers in both Oregon and California. Samples were analyzed for various constituents such as nutrients, chlorophyll-*a*, biochemical oxygen demand, alkalinity, metals, and others.

USGS staff reviewed the data-collection and quality-assurance protocols used by Reclamation to collect these discrete data, and evaluated the laboratory analytical methods and protocols used to generate the sample results. The data were reviewed for typographical input errors and statistical outliers. The quality-assurance data were used to eliminate unreliable results or qualify some data. The data that passed the review tests were loaded into NWIS and double-checked. The data in NWIS are accessible to the public and archived. The results of more than 20,000 laboratory analyses are contained in this dataset from the Reclamation discrete water samples.



Lost River suckers spawning at shoreline springs in Upper Klamath Lake, Oregon. (Photograph by B. Hayes, U.S. Geological Survey.)



Screen captures from online data exploration tools: Klamath River Basin Water-Quality Mapper and Discrete Water-Quality Grapher (https://or.water.usgs.gov/projs_dir/klamath_wq_mapper).

Water-Quality Mapper

A custom-built, map-based website was developed to allow users to explore and access the newly imported datasets from Reclamation, as well as any other Klamath River Basin data in NWIS. The "Klamath River Basin Water-Quality Mapper" is a powerful and user-friendly website with many capabilities. When first navigating to the site, users can visit the "About" link on the navigation bar to learn how to use the website, and peruse the Project Links provided.

Data Exploration Tools

The Mapper website contains two ways to search for data. The Data Exploration Tools, in the upper left corner of the screen, were designed for users to search for specific sites or data types, or for the most recent measurements. The map allows users to zoom and pan to discover the breadth of locations where data have been collected.

Markers on the map show locations of data-collection sites and the color of the marker indicates the site type and whether the site is currently active. To get started, when users select a site marker of interest, an information box about the site will open. Several links may be present at the bottom of that information box. A link to NWIS will always be present. The NWIS link allows users to access the continuous or discrete data as well as available statistics for any continuous water-quality data. When continuous time-series data are available, a link to the Data Grapher tool may be present. The Data Grapher allows users to explore the time-series data in more detail, through graphs and tables of various types that are generated in response to user inputs. A third selectable link (Interactive Plot) is available if the site contains discrete water-quality data. Selecting the Interactive Plot link will open a new window and load the Discrete Water-Quality Grapher tool that allows the user to create graphs of the available discrete water-quality data for that site. Hovering the mouse cursor over the icons in the Explanation box will show definitions for each parameter, and any combination of parameters can be added or removed from the graphs. The tool allows users to selectively zoom to different time periods, and information on each data point can be viewed by hovering the mouse cursor over that point.

Have fun exploring the data!

American white pelicans resting on an island in the Tule Lake National Wildlife Refuge, California. (Photograph by U.S. Geological Survey.)

Authors: Cassandra D. Smith, Stewart A. Rounds, and Leonard L. Orzol

Compiled by Steven Sobieszczyk

For more information contact:

Director, Oregon Water Science Center
U.S. Geological Survey
2130 SW 5th Avenue
Portland, Oregon 97201
https://www.usgs.gov/centers/or-water
https://twitter.com/USGS_OR

ISSN 2327-6932 (online)
https://doi.org/10.3133/fs20183031