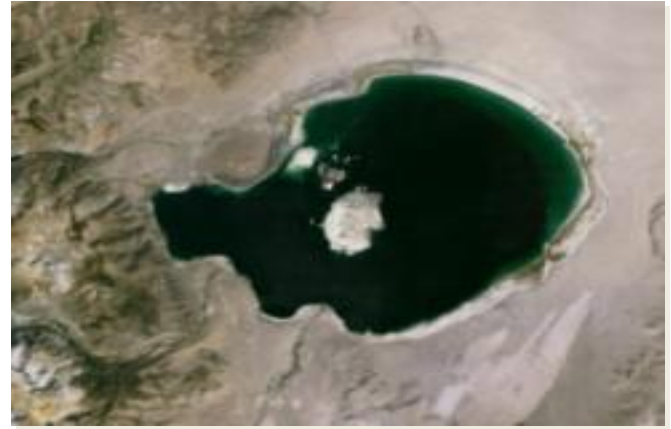


Eared Grebes (*Podiceps nigricollis*): Abundance Patterns at Mono Lake

Dr. W.S. Boyd
Emeritus Scientist
Science & Technology Branch
Environment & Climate Change Canada



Eared Grebes

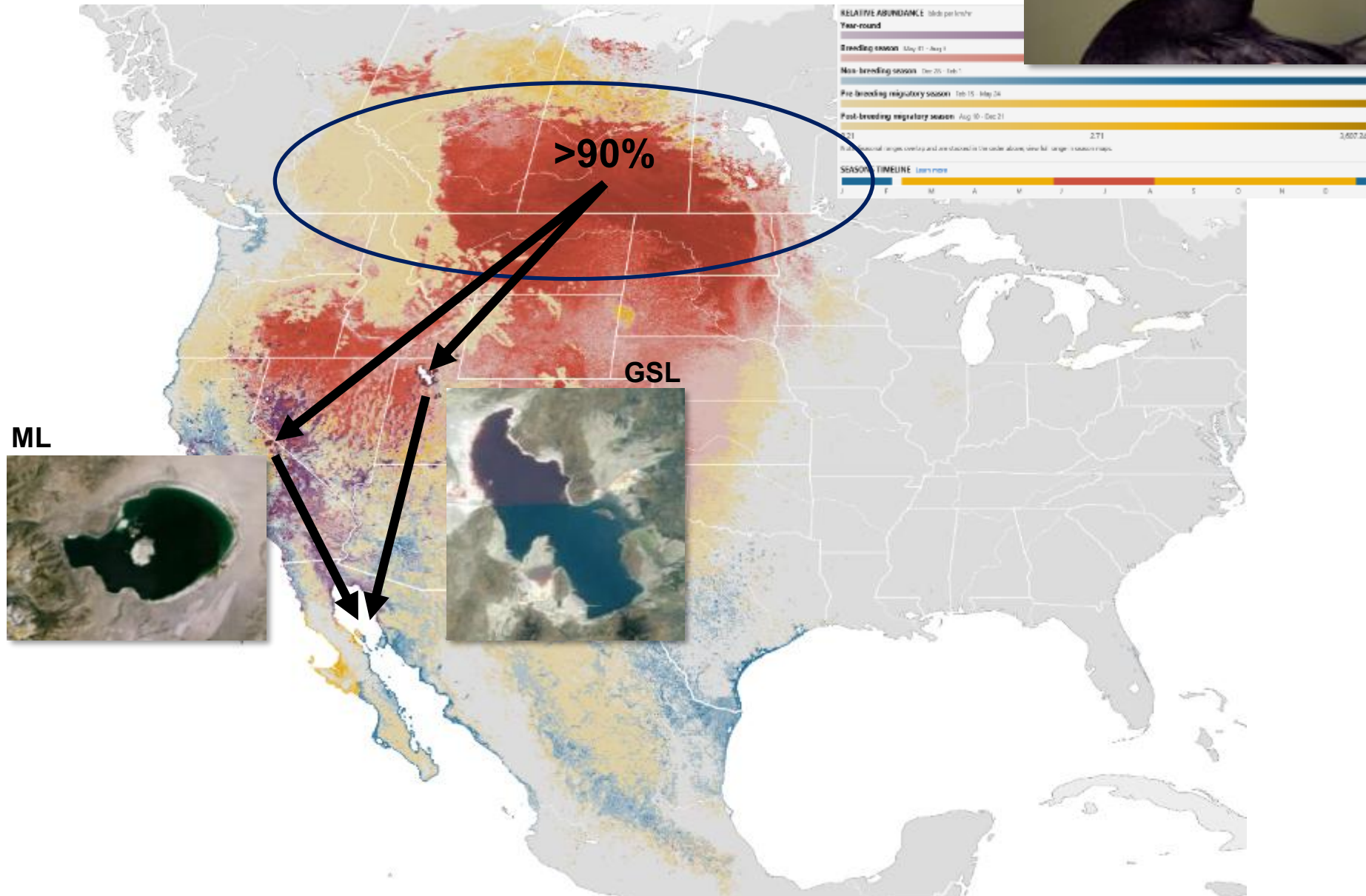
A Few Key Points

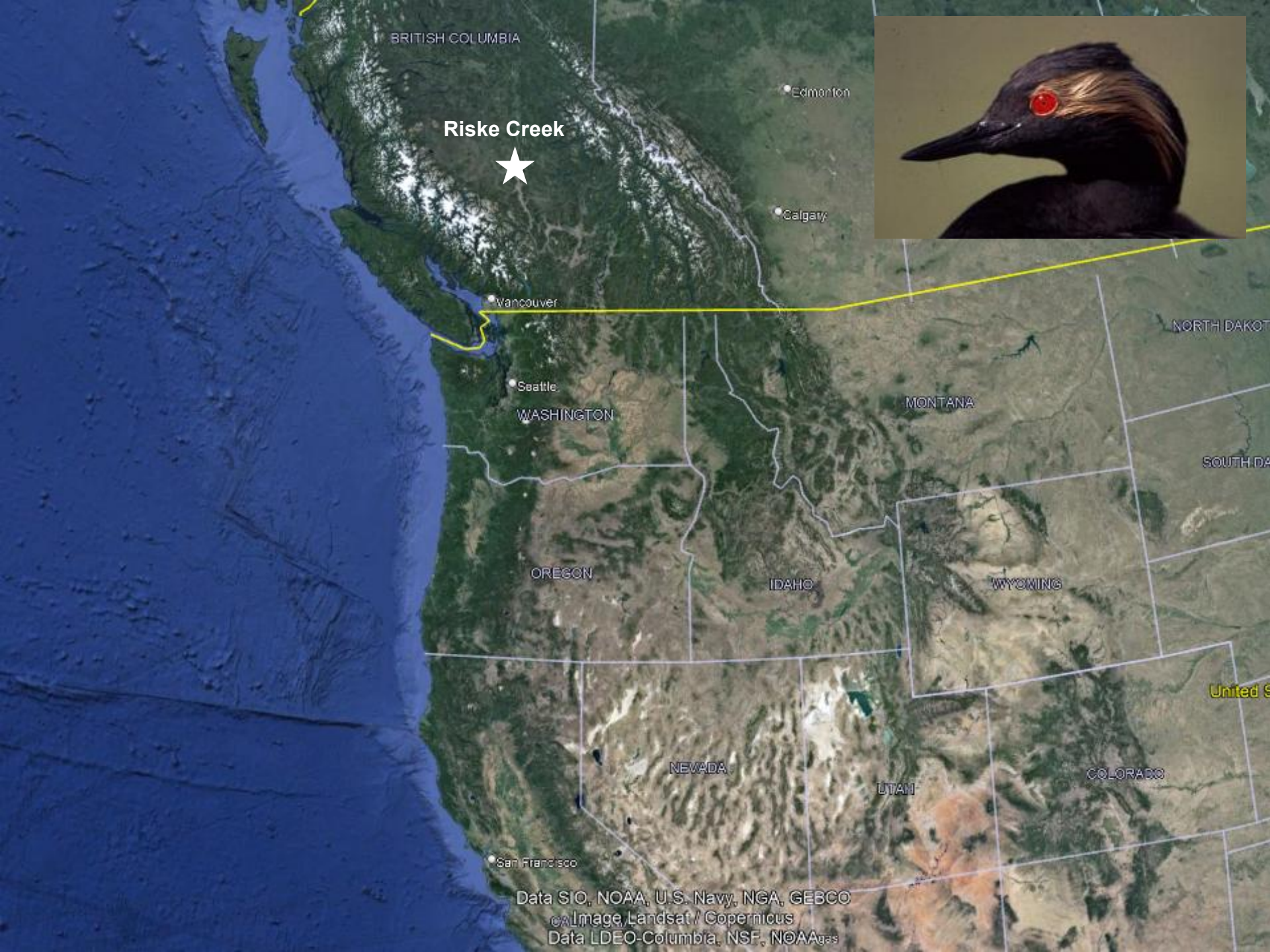


- Unique situation: >90% of NA grebes migrate to two hypersaline lakes (ML and GSL) where the adults molt (renew) body & flight feathers.
- Spend 1/3 of the annual cycle on ML and GSL; ML currently supports 1/4 to 1/3 of NA pop'n (est. 3-5 million?).
- Have a special salt gland to survive hypersaline conditions... other bird species cannot survive such conditions (hence, 99% of birds on ML).
- Forage on brine shrimp primarily; adults accumulate fat/protein reserves needed to grow new feathers and fuel migration to wintering areas.

Eared Grebe *Podiceps nigricollis*

Seasonally-averaged estimated relative abundance (Birds of NA).





BRITISH COLUMBIA

Riske Creek



Edmonton

Calgary

Vancouver

Seattle

WASHINGTON

MONTANA

NORTH DAKOTA

SOUTH DAKOTA

OREGON

IDAHO

WYOMING

United States

NEVADA

UTAH

COLORADO

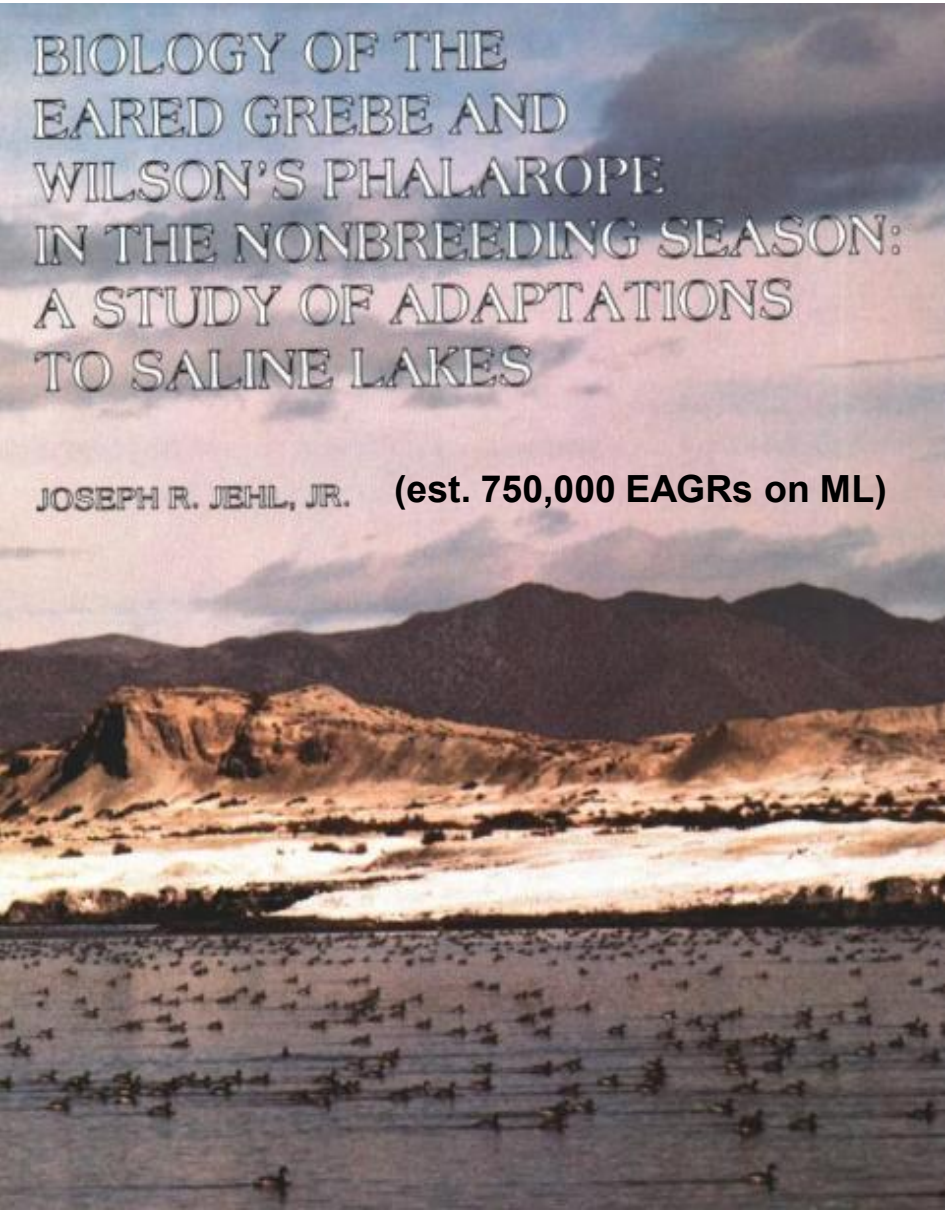
San Francisco

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image Landsat / Copernicus

Data LDEO-Columbia, NSF, NOAAgas





BIOLOGY OF THE
EARED GREBE AND
WILSON'S PHALAROPE
IN THE NONBREEDING SEASON:
A STUDY OF ADAPTATIONS
TO SALINE LAKES

JOSEPH R. JEHL, JR. (est. 750,000 EAGRs on ML)



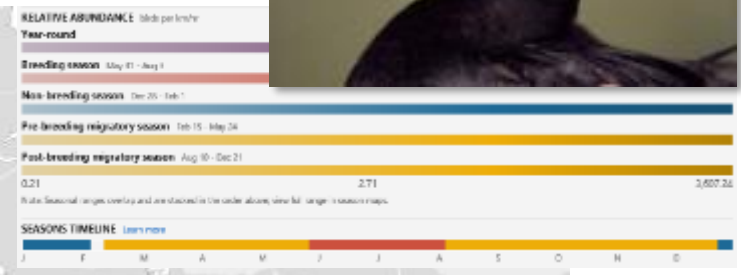
STORM
OVER MONO

THE MONO LAKE BATTLE AND
THE CALIFORNIA WATER FUTURE

JOHN HART

Eared Grebe *Podiceps nigricollis*

Seasonally-averaged estimated relative abundance (Birds of NA).



RC

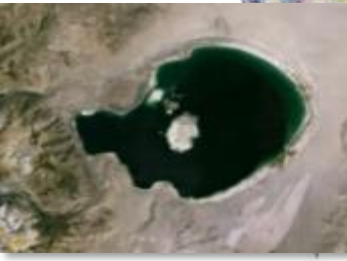
1996 VHF's

50-60%

10-20%

GSL

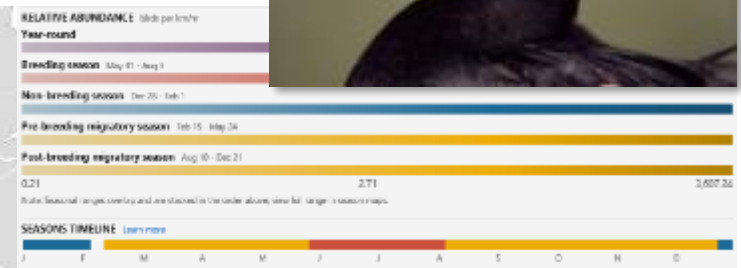
ML



Boyd, W.S., S.D. Schneider, and S.A. Cullen. 2000. Using radio telemetry to describe the fall migration of Eared Grebes. Journal of Field Ornithology 71(4): 702-707.

Eared Grebe *Podiceps nigricollis*

Seasonally-averaged estimated relative abundance (Birds of NA).



50-60%

GSL



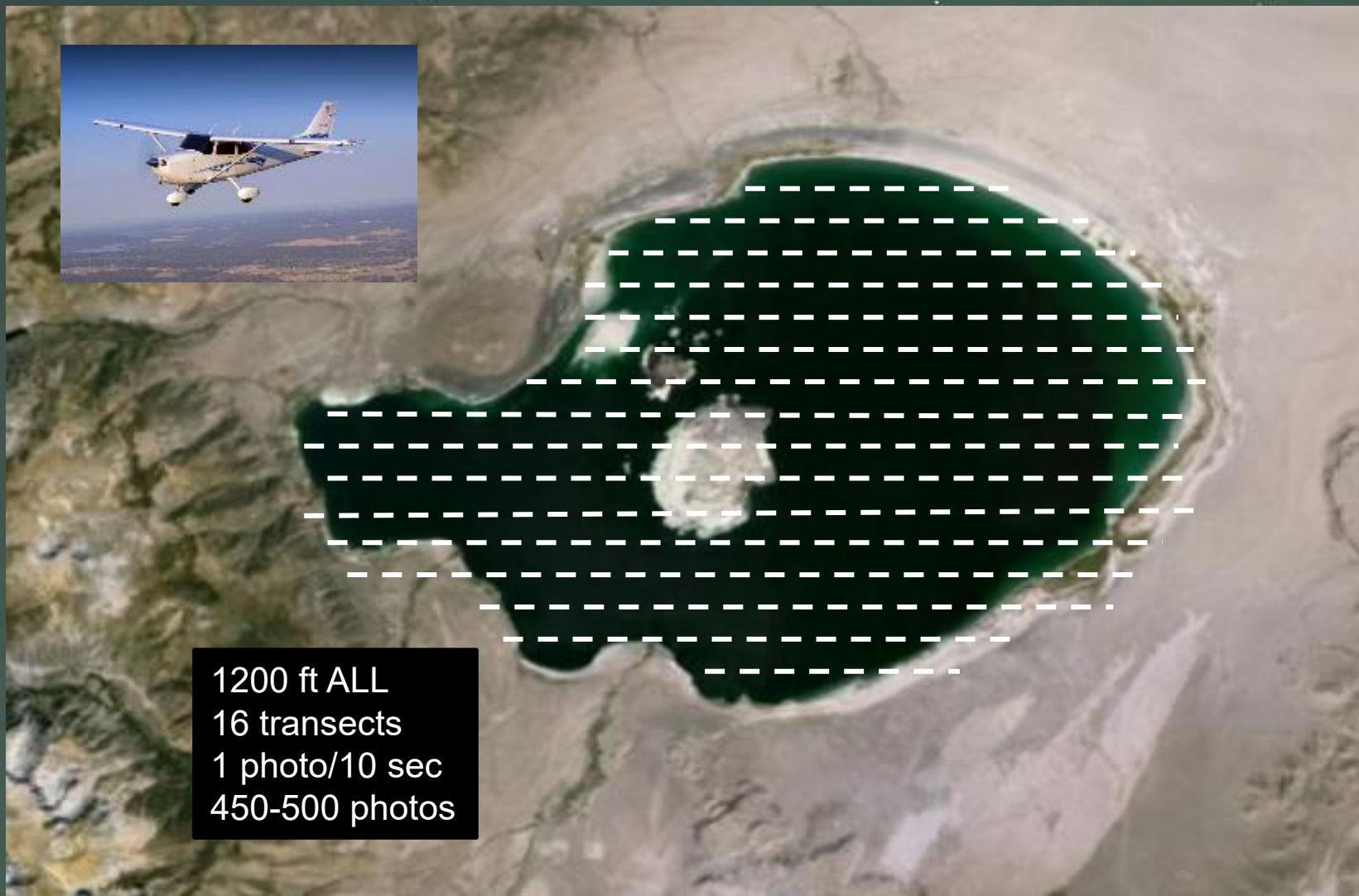
10-20%

ML



2017 VHFs

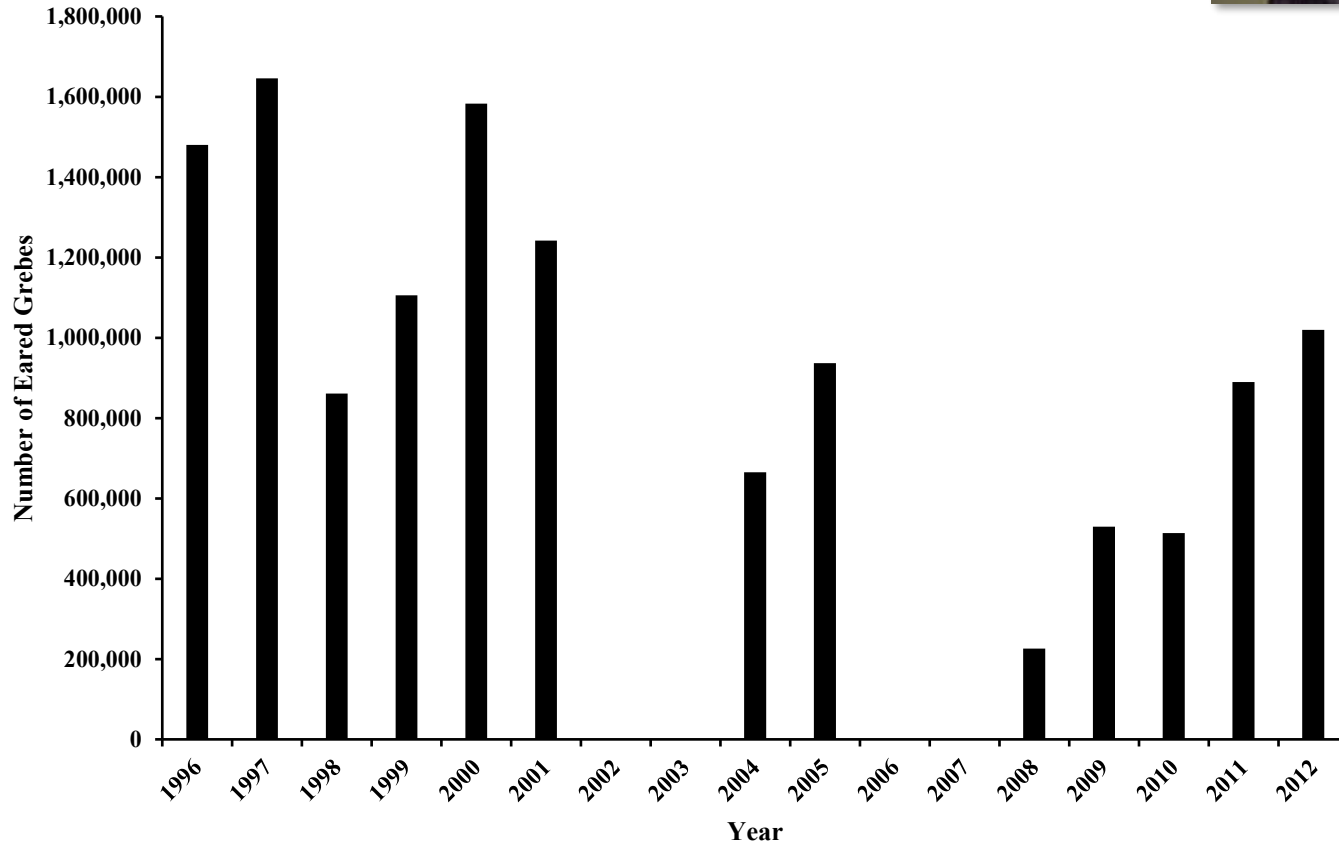




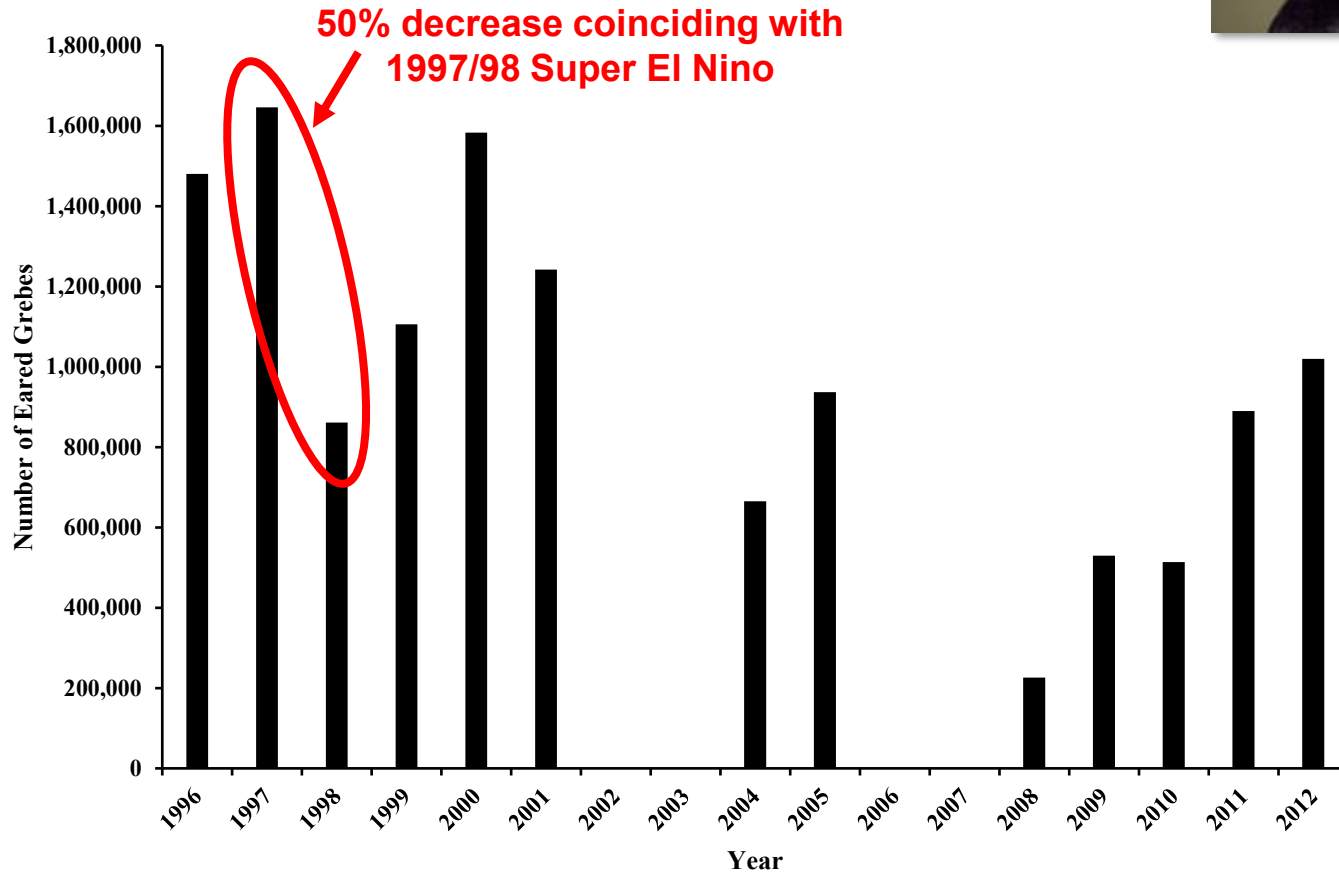
1200 ft ALL
16 transects
1 photo/10 sec
450-500 photos

Boyd, W.S. and J.R. Jehl, Jr. 1998. Estimating the abundance of Eared Grebes on Mono Lake, California, by aerial photography. Colonial Waterbirds 21(2): 236-241. DOI:10.2307/1521912

Mono Lk Eared Grebes Mid-October Photo Counts (Surface Birds Only)

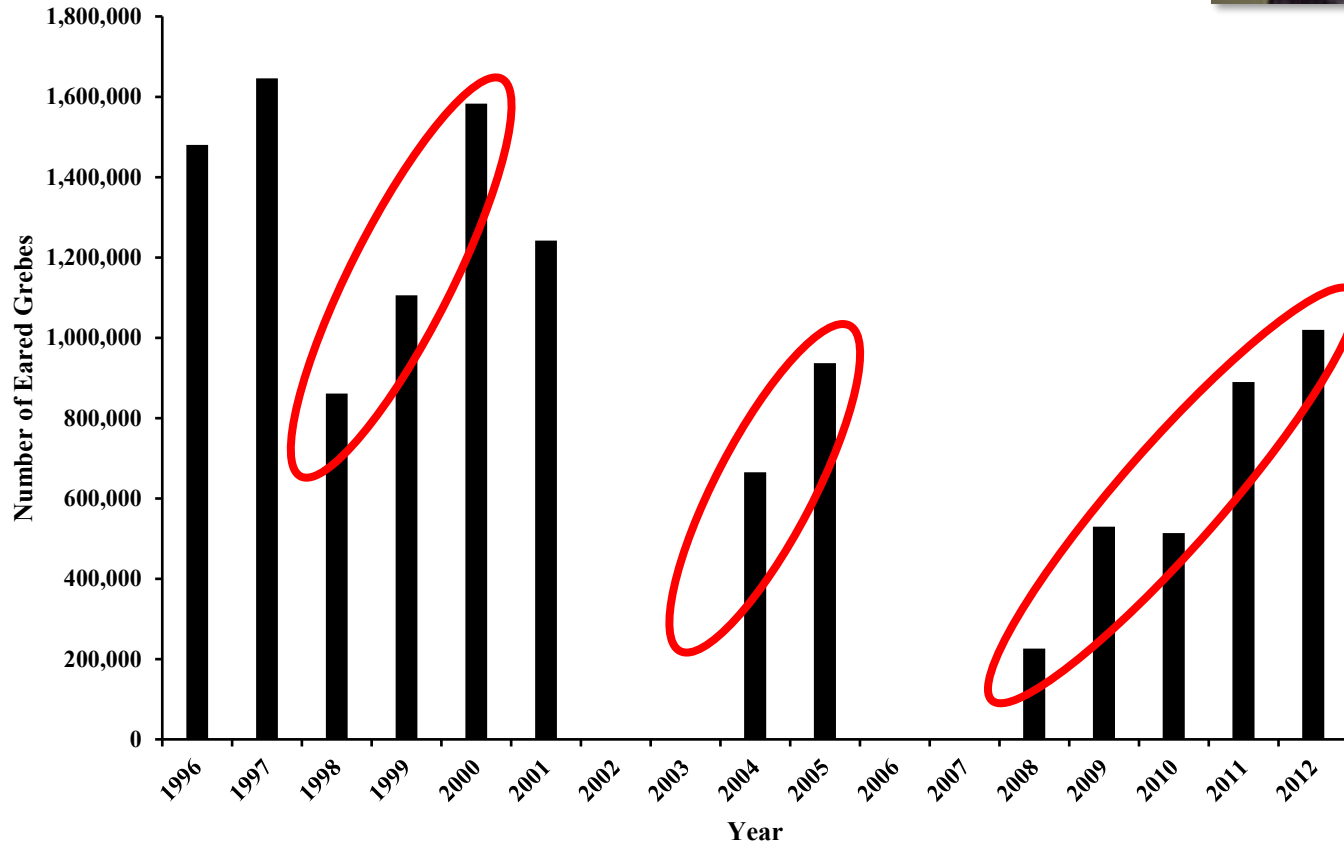


Mono Lk Eared Grebes Mid-October Photo Counts (Surface Birds Only)

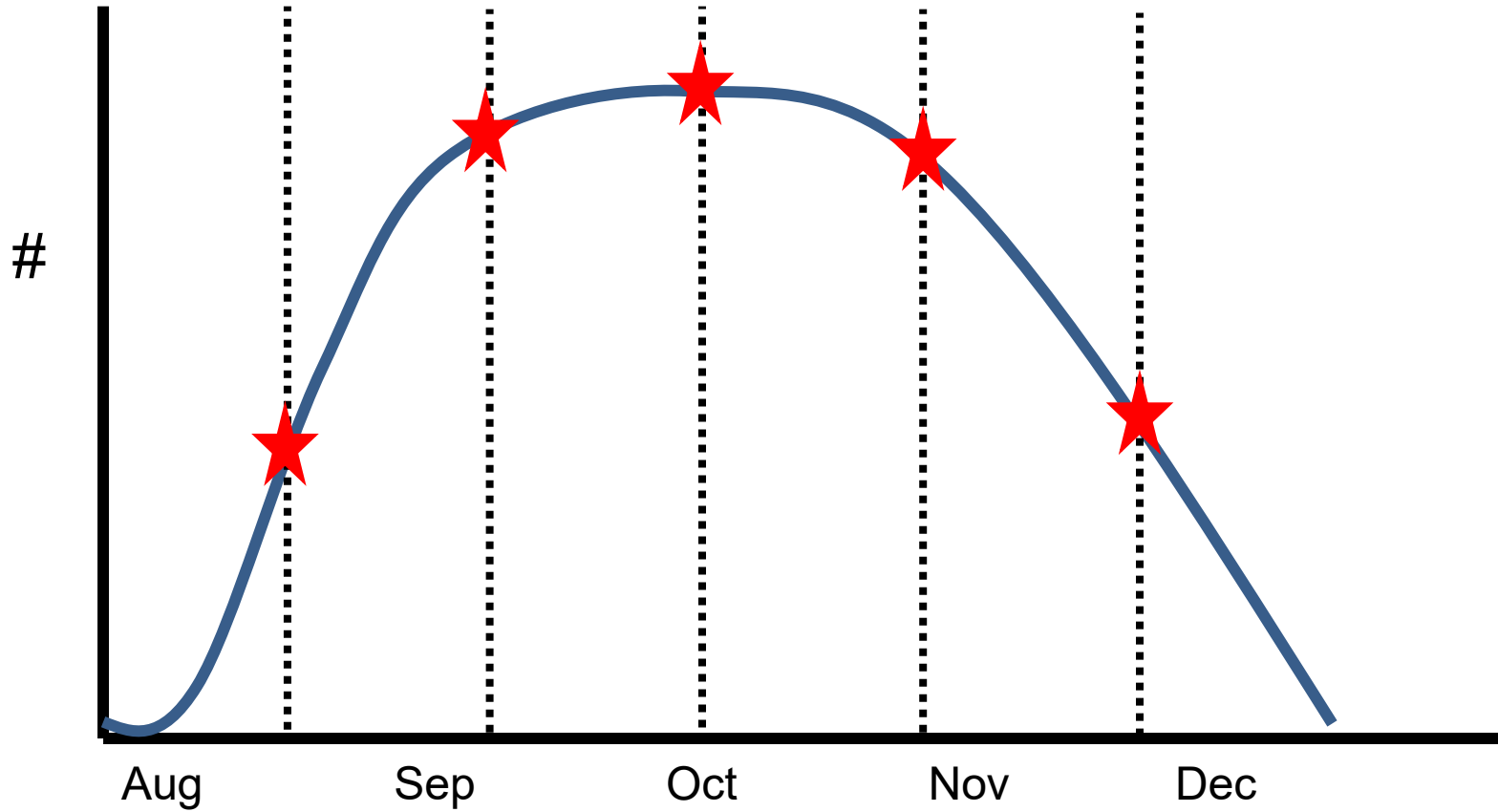


Jehl, J. R., Jr, W.S. Boyd, D.S. Paul and D.W. Anderson. 2002. Massive collapse and rapid rebound: population dynamics of Eared Grebes *Podiceps nigricollis* during an ENSO event. *Auk* 119(4): 1162-1166. DOI:10.1642/0004-8038(2002)119[1162:MCARRP]2.0.CO;2.

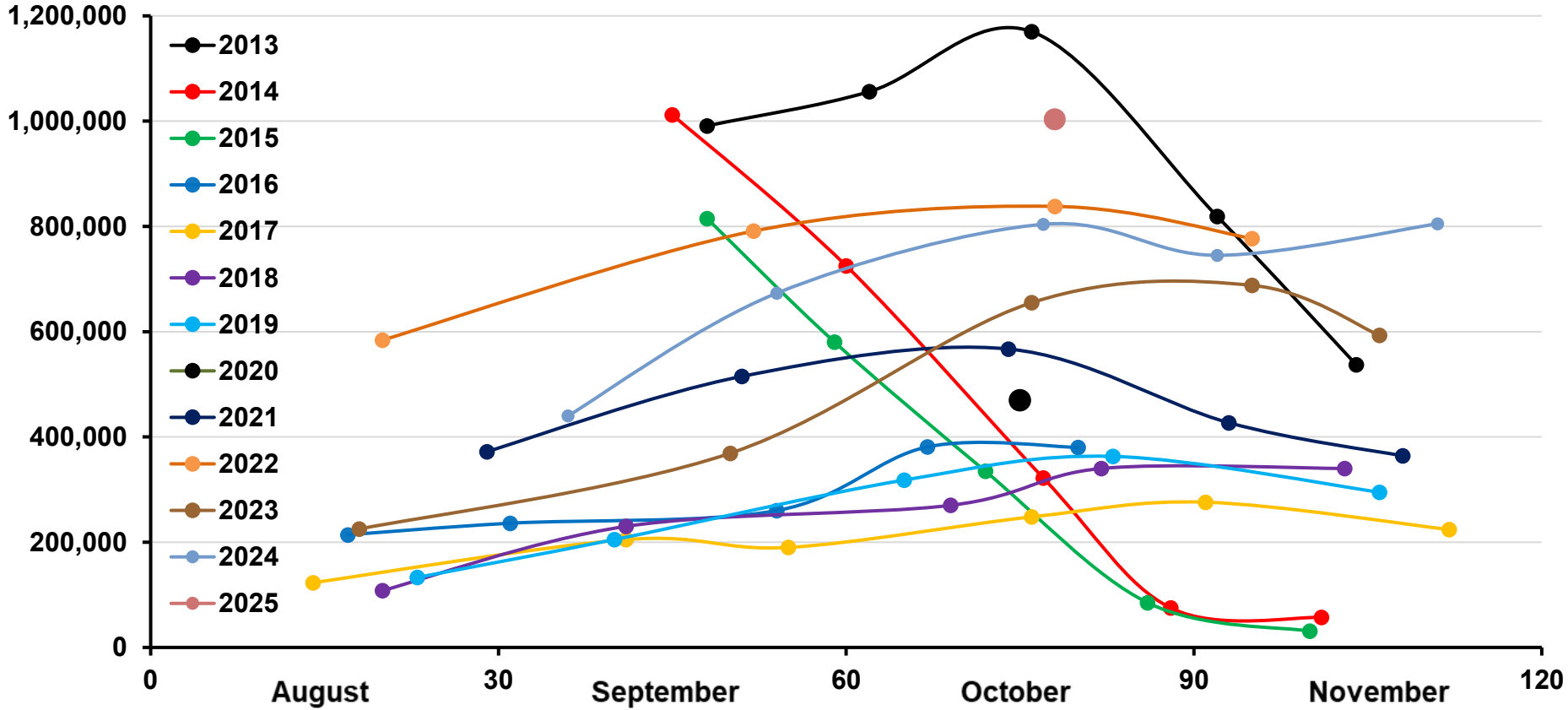
Mono Lk Eared Grebes Mid-October Photo Counts (Surface Birds Only)



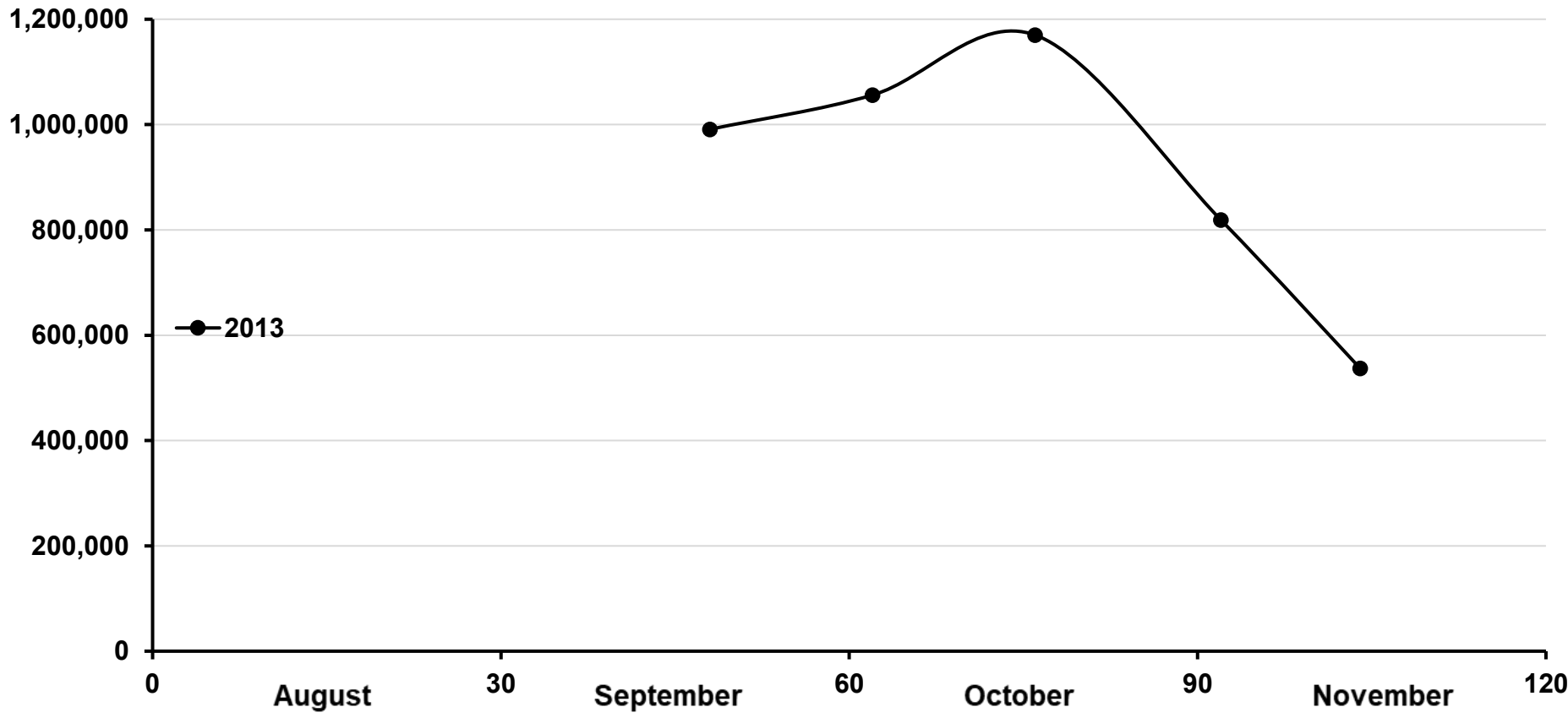
Mono Lk Eared Grebes Assumed Abundance Curve



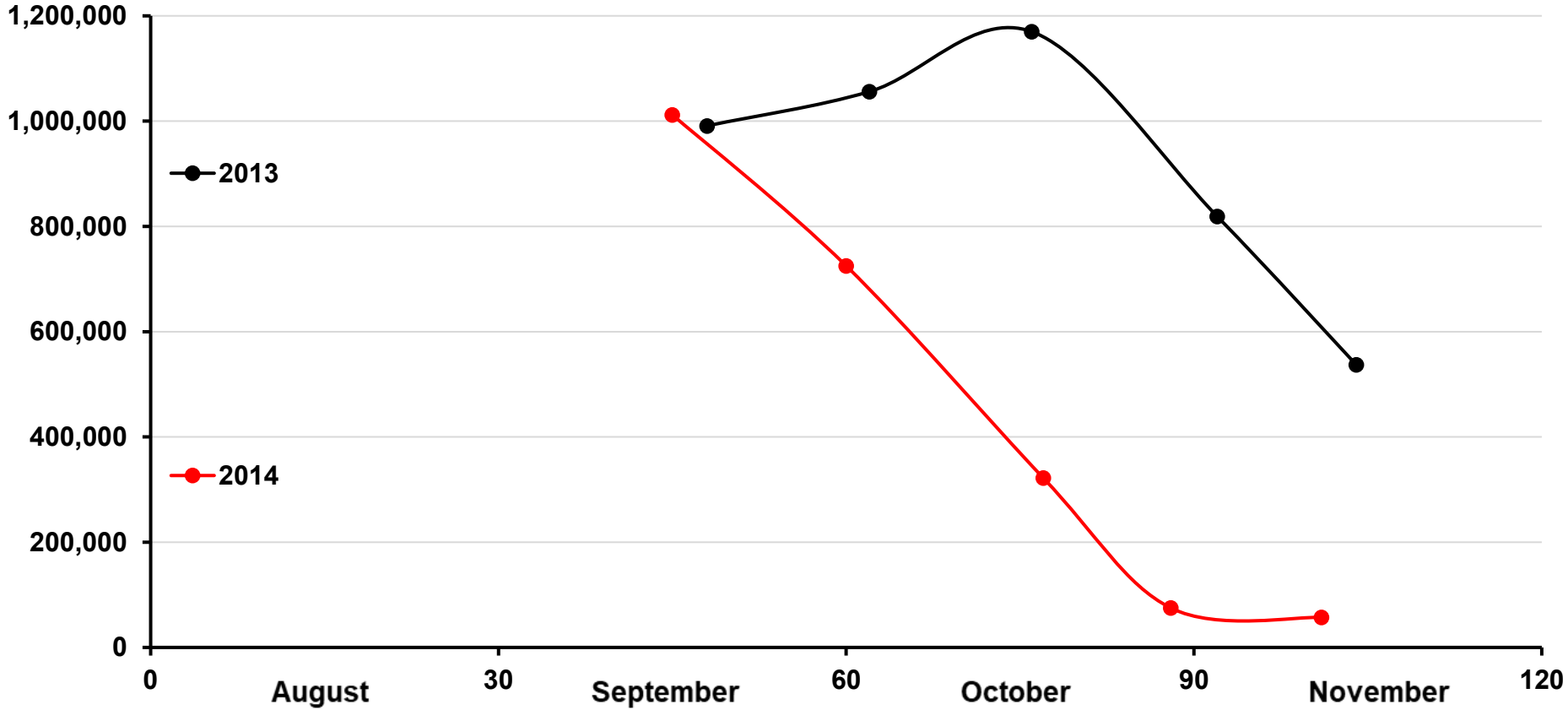
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



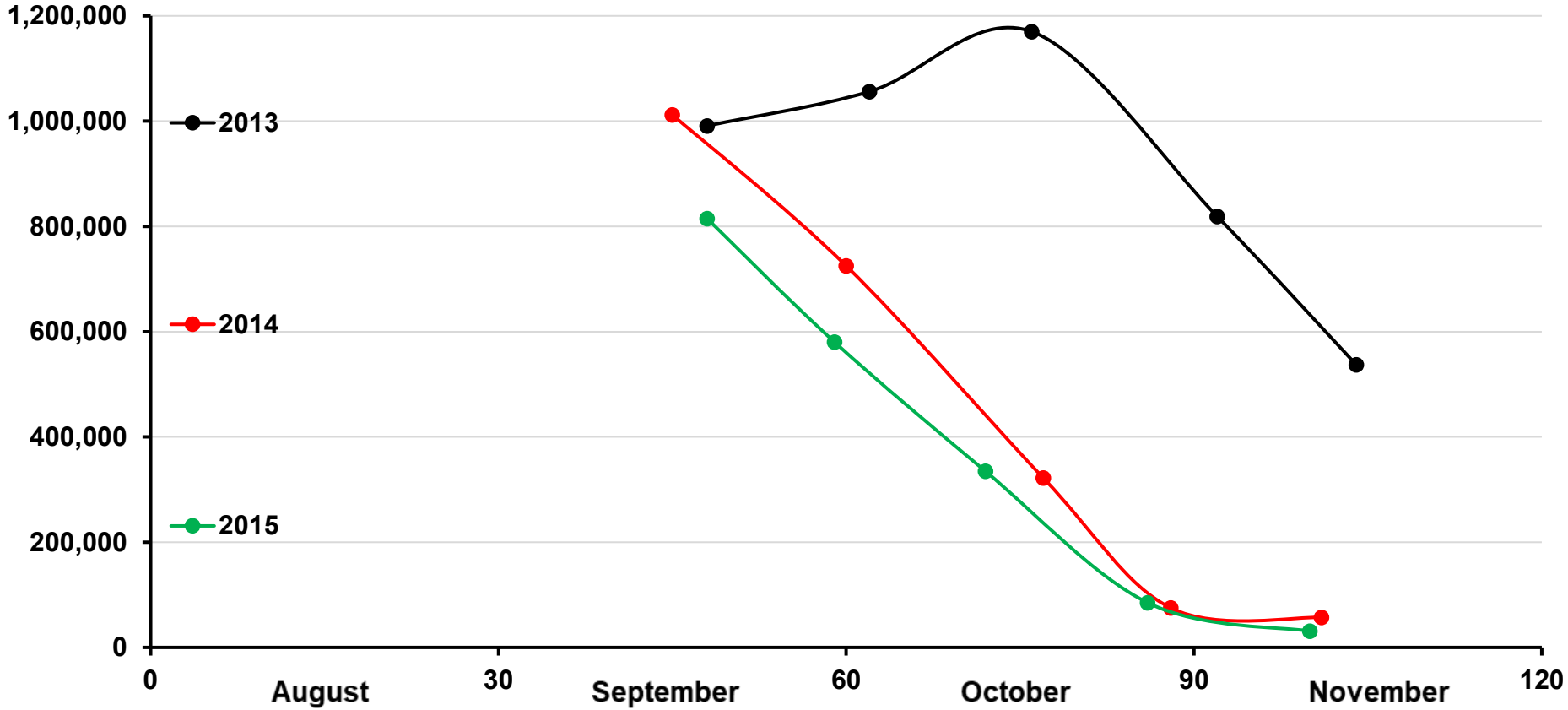
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



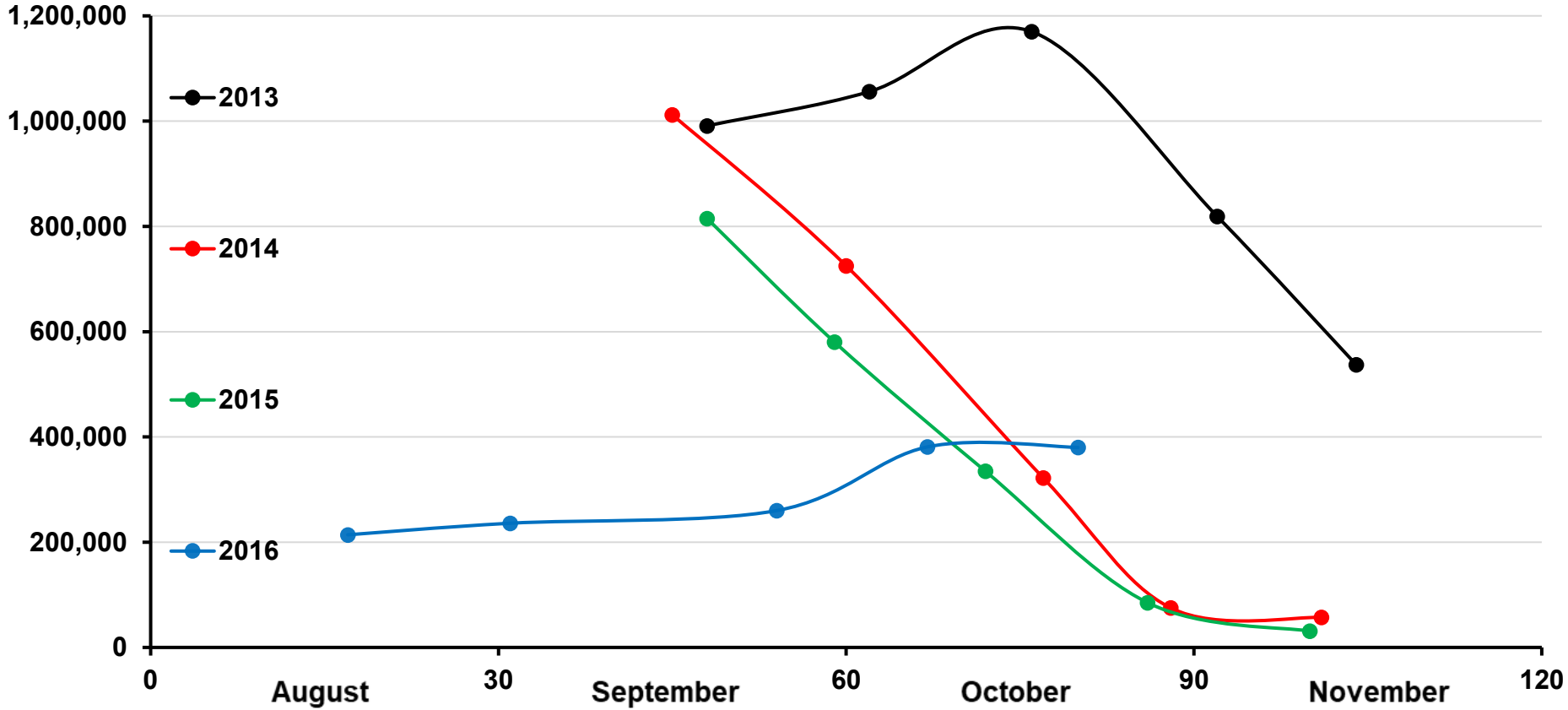
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



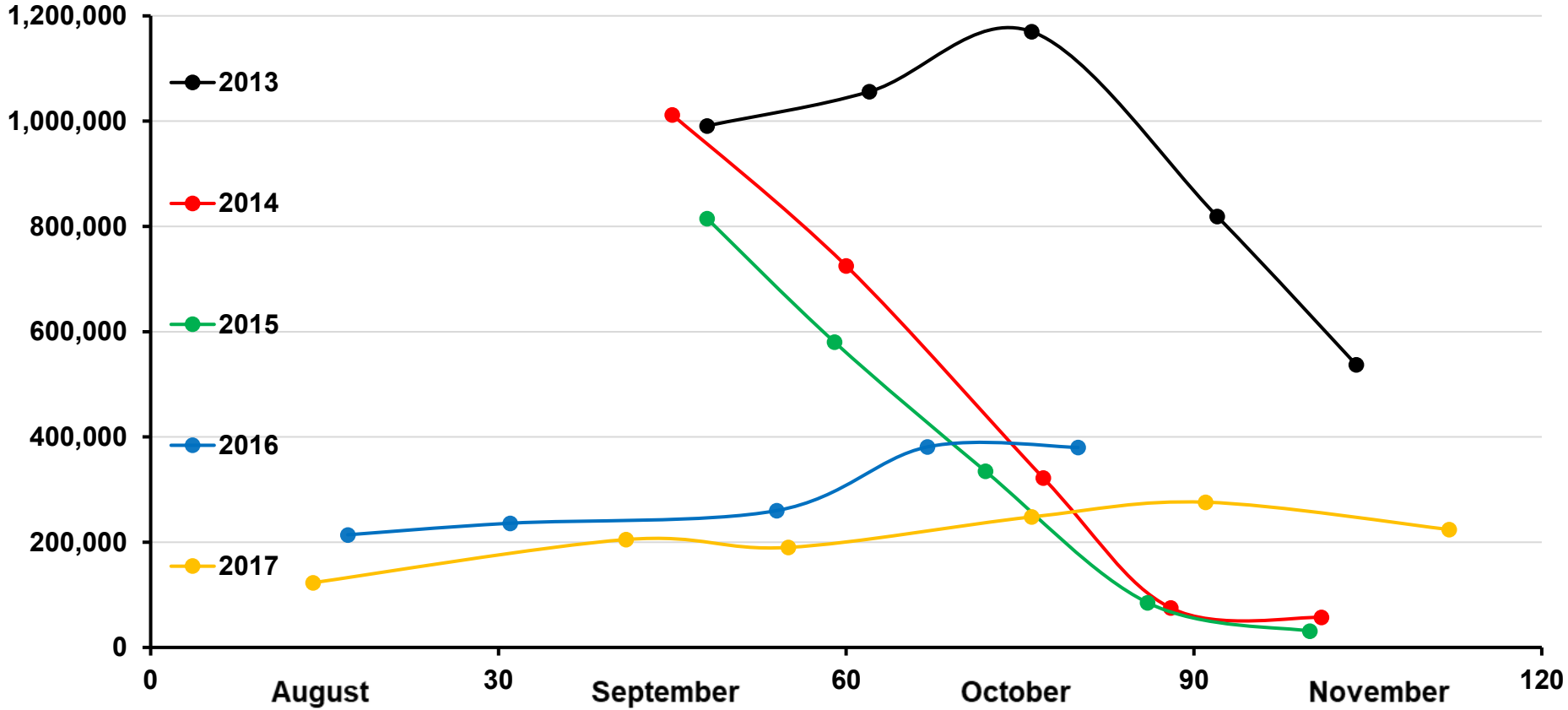
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



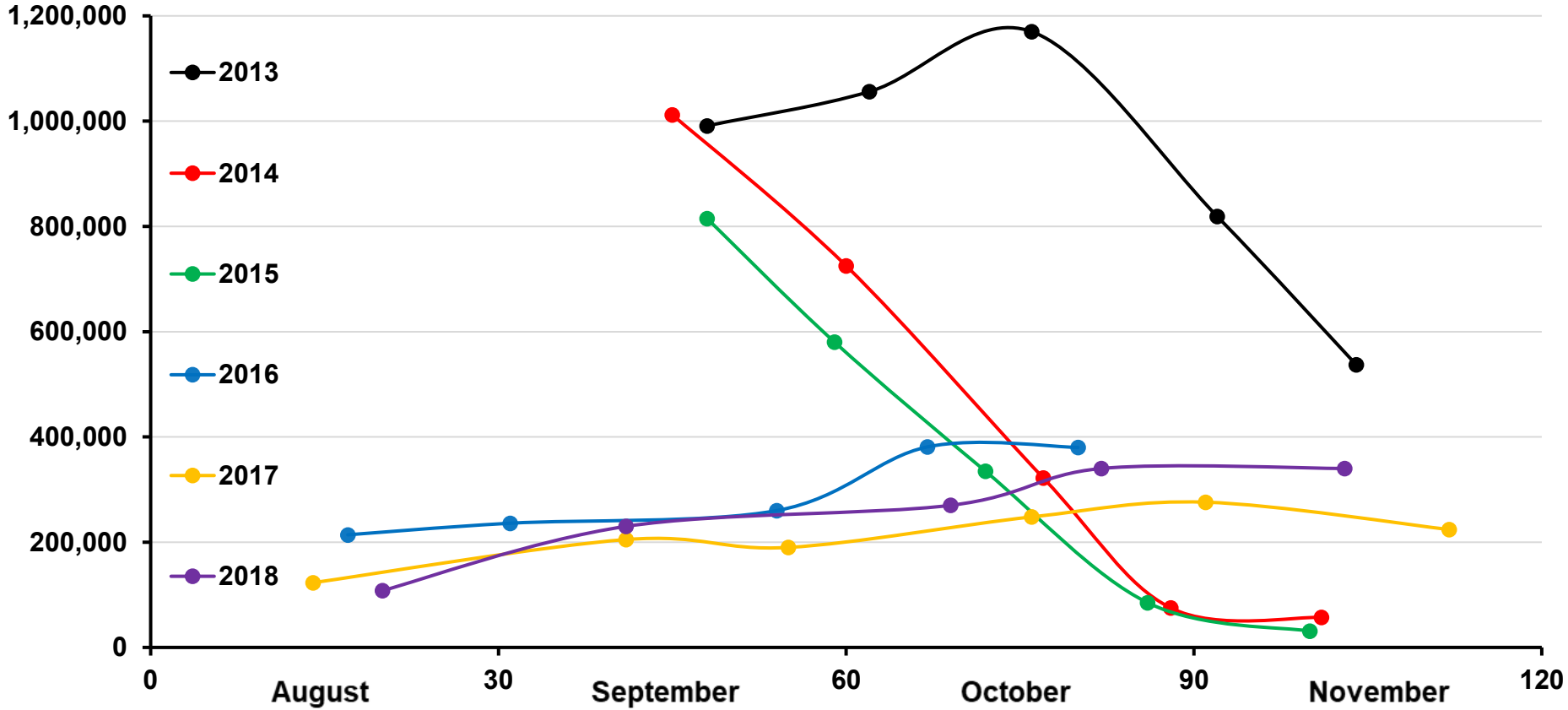
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



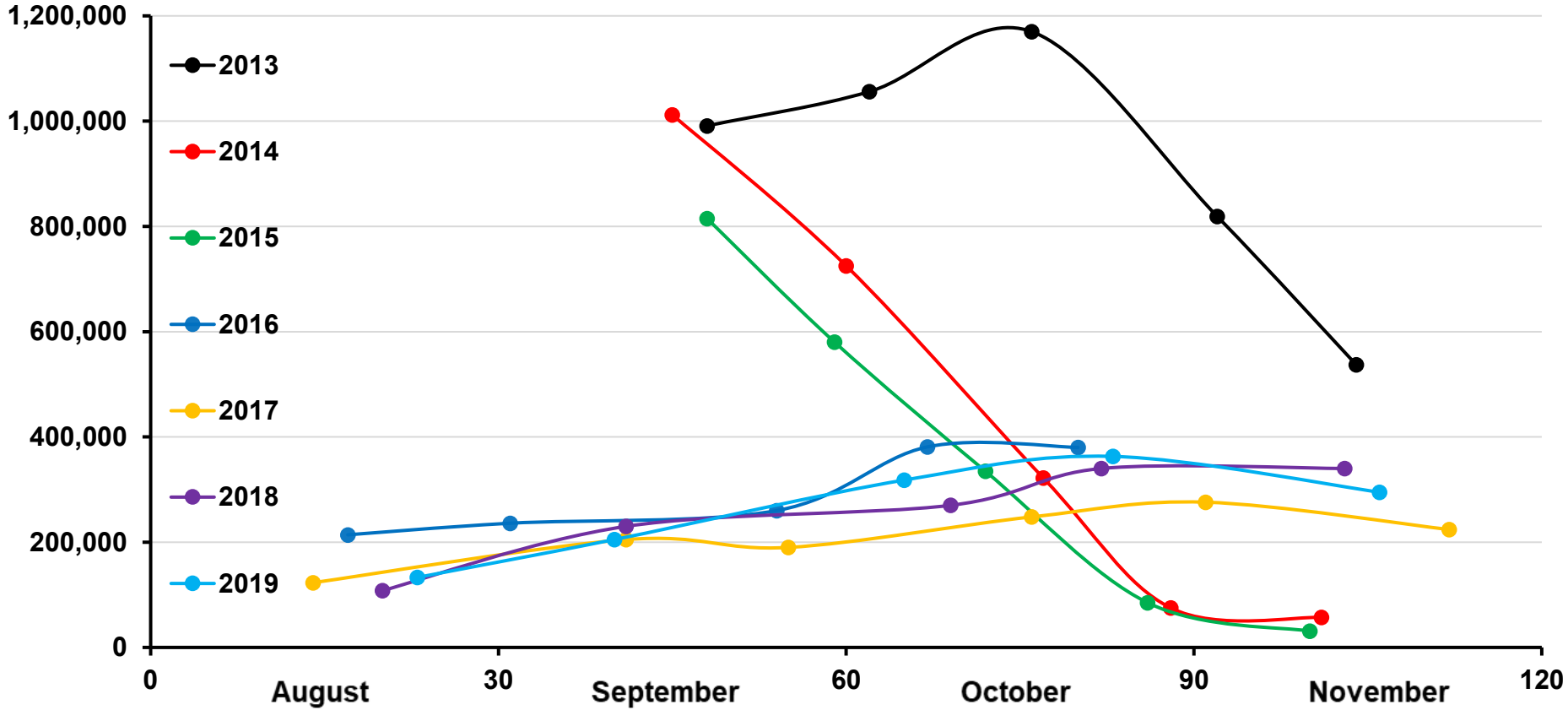
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



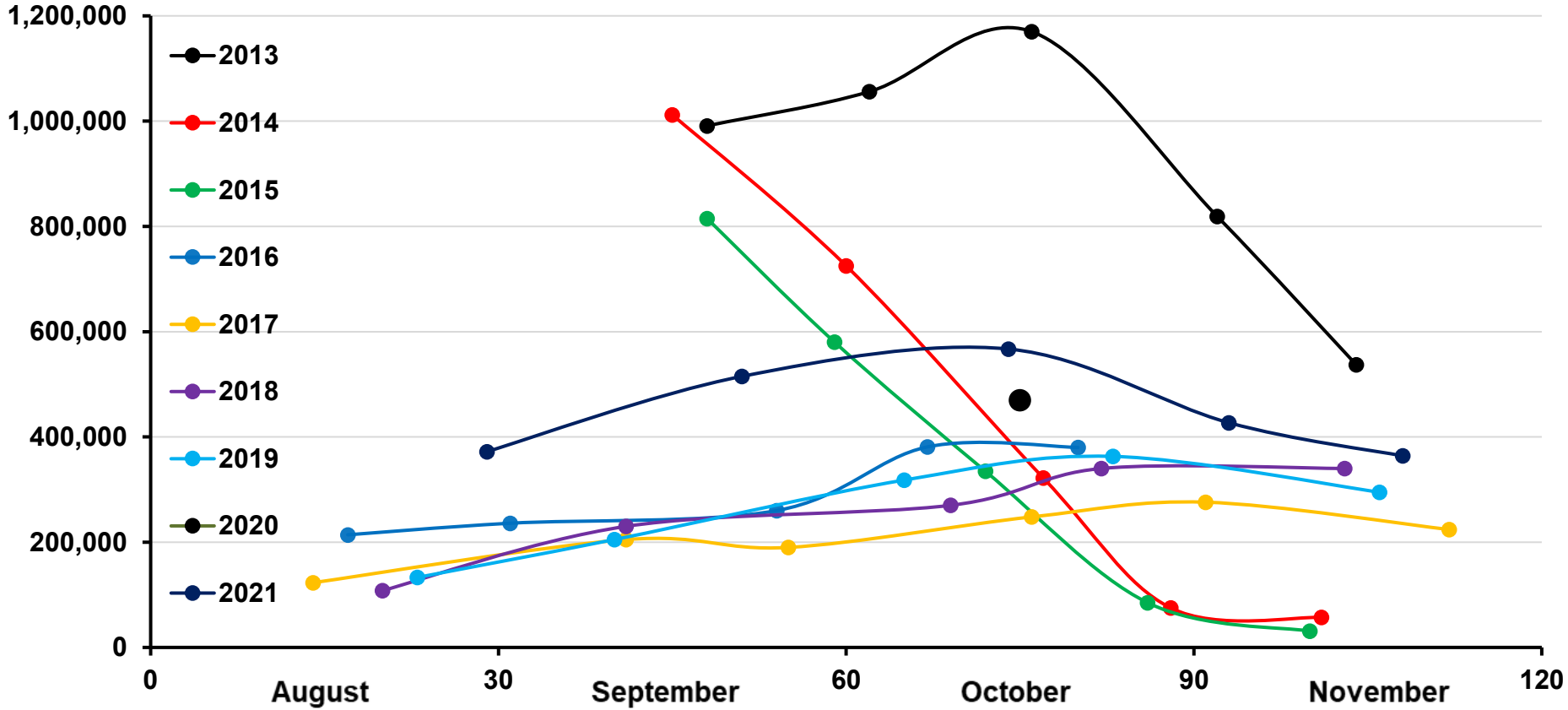
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



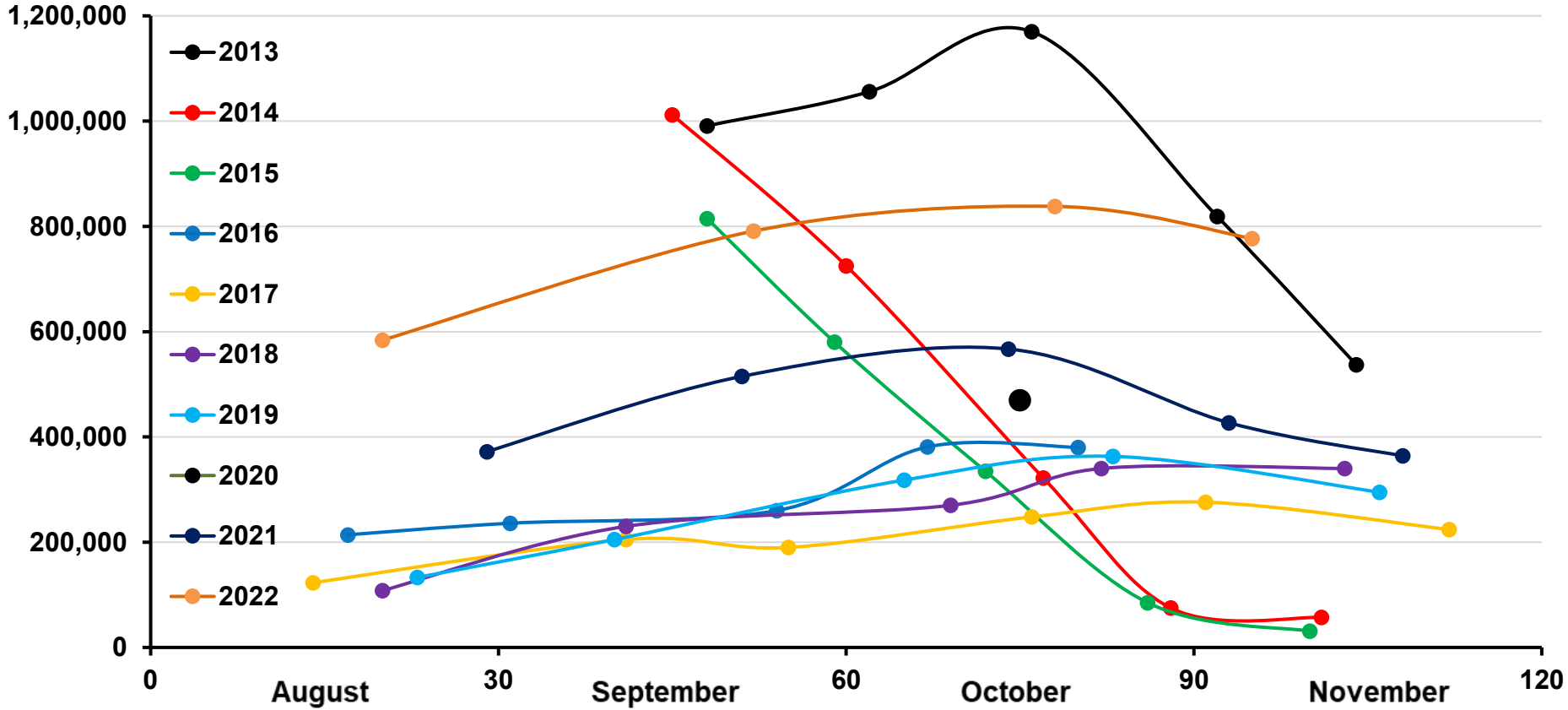
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



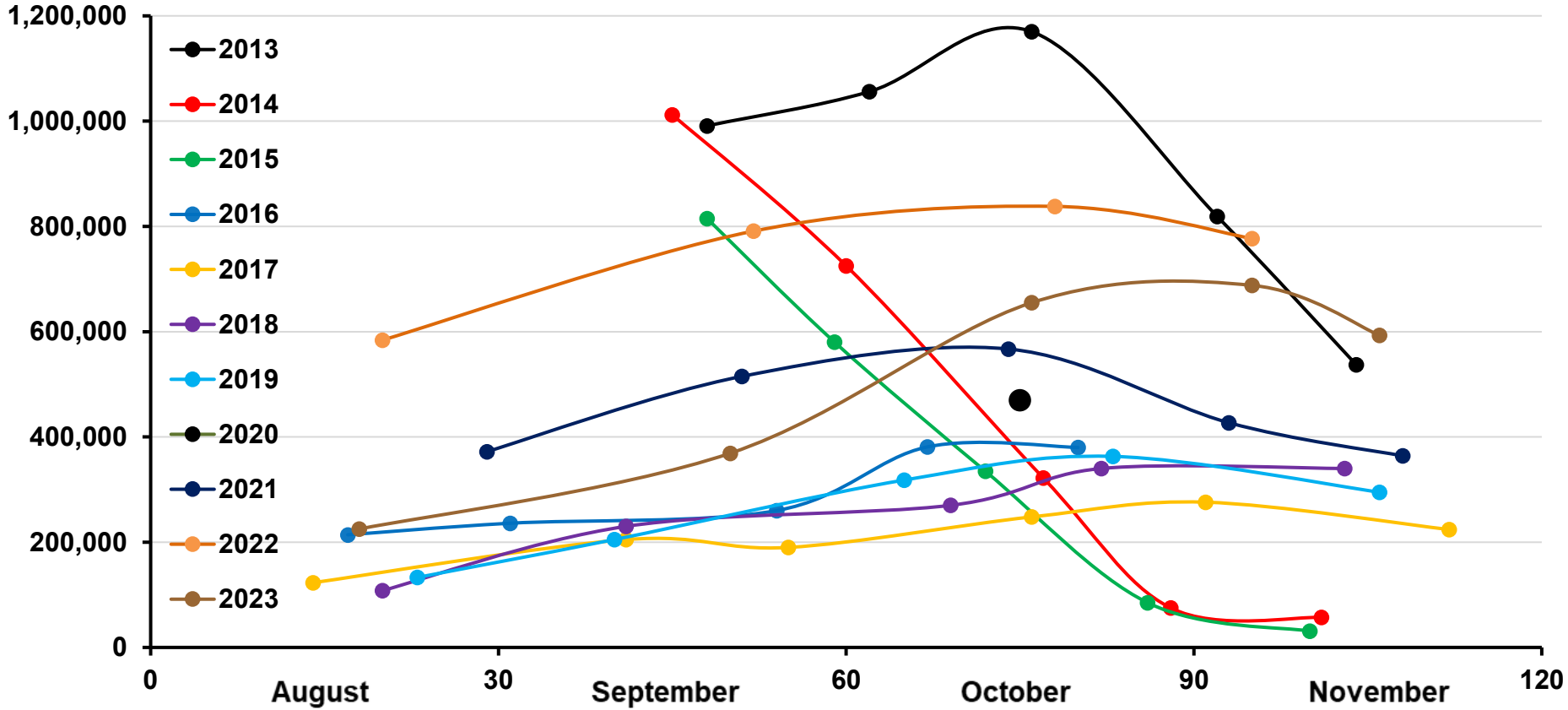
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



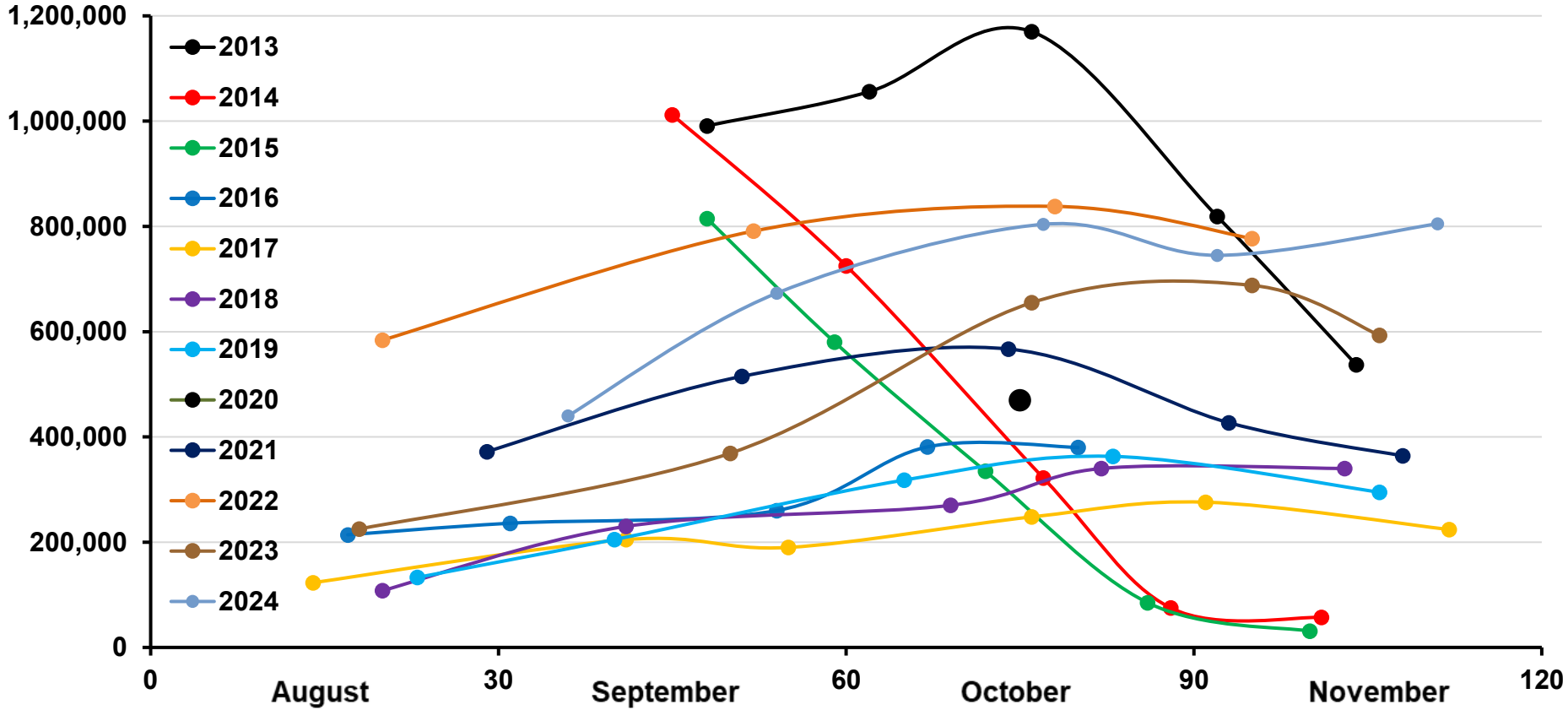
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)



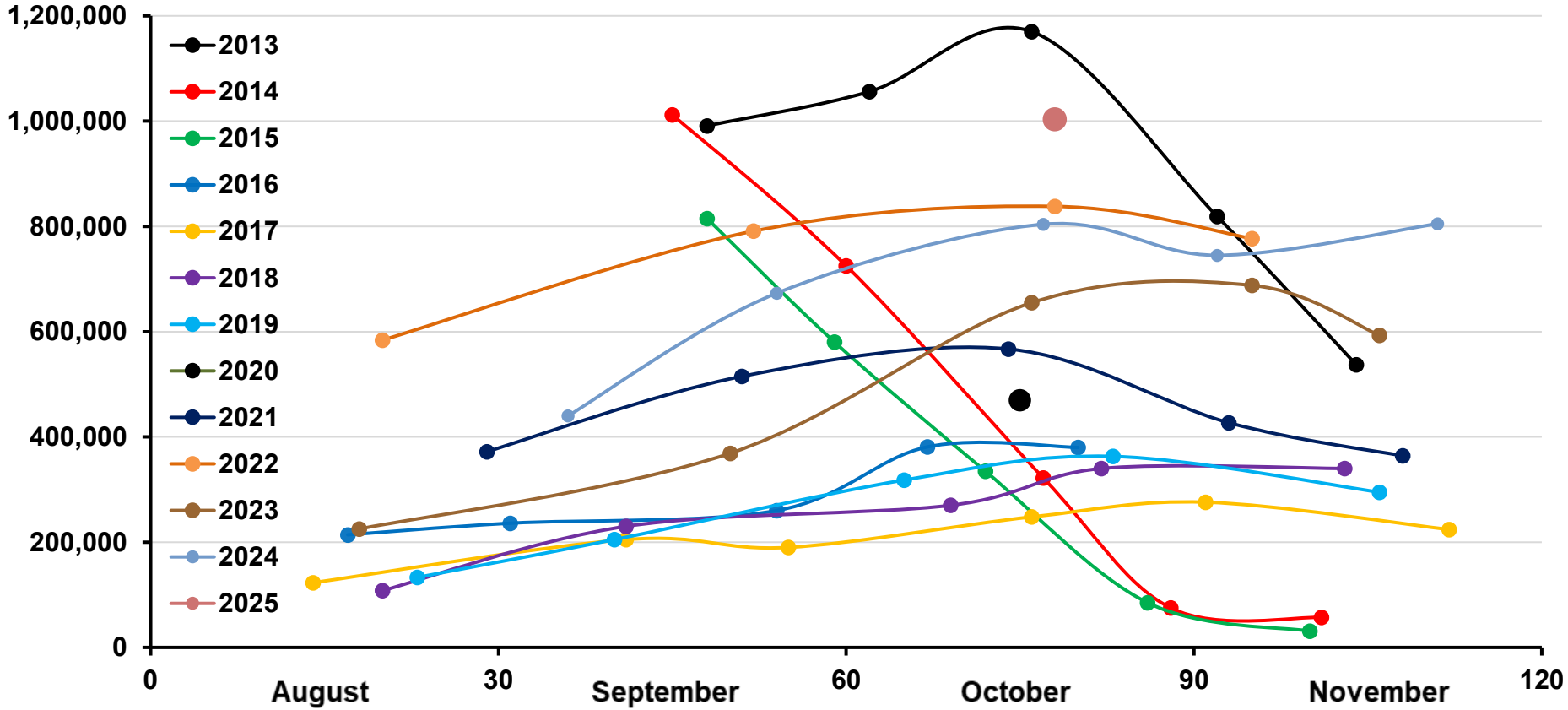
Eared Grebe Counts at Mono Lake CA (Surface Birds Only)

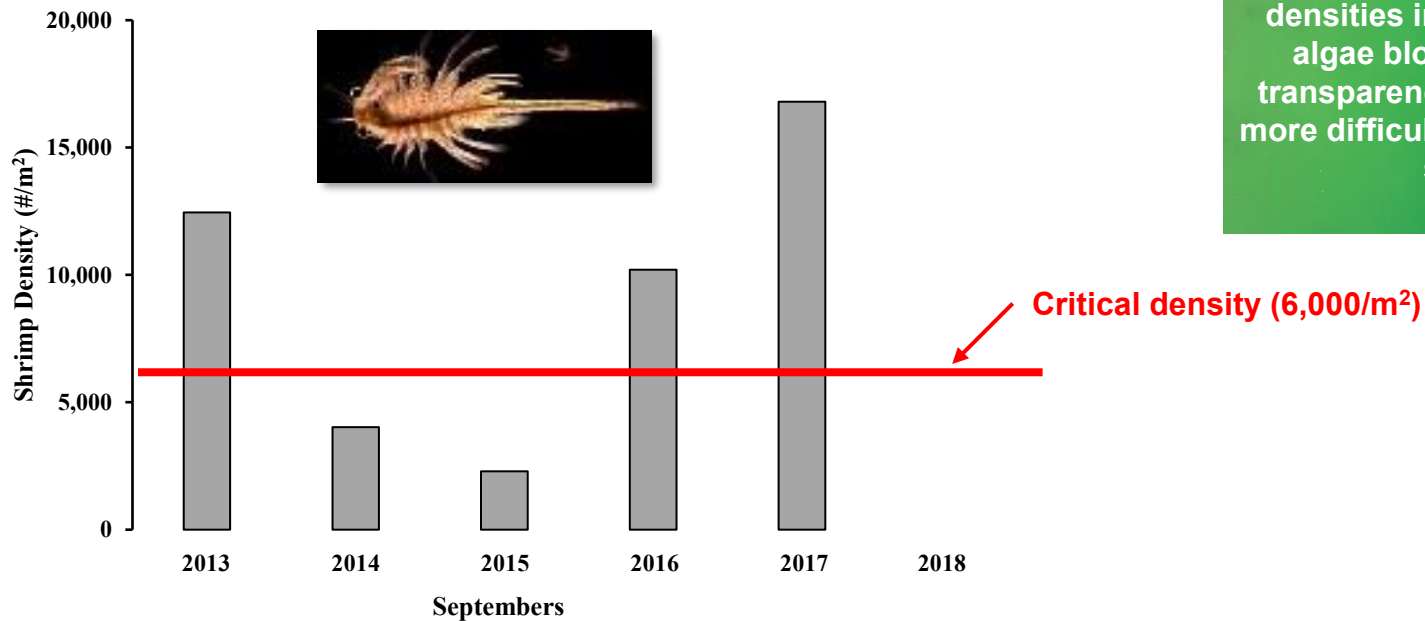
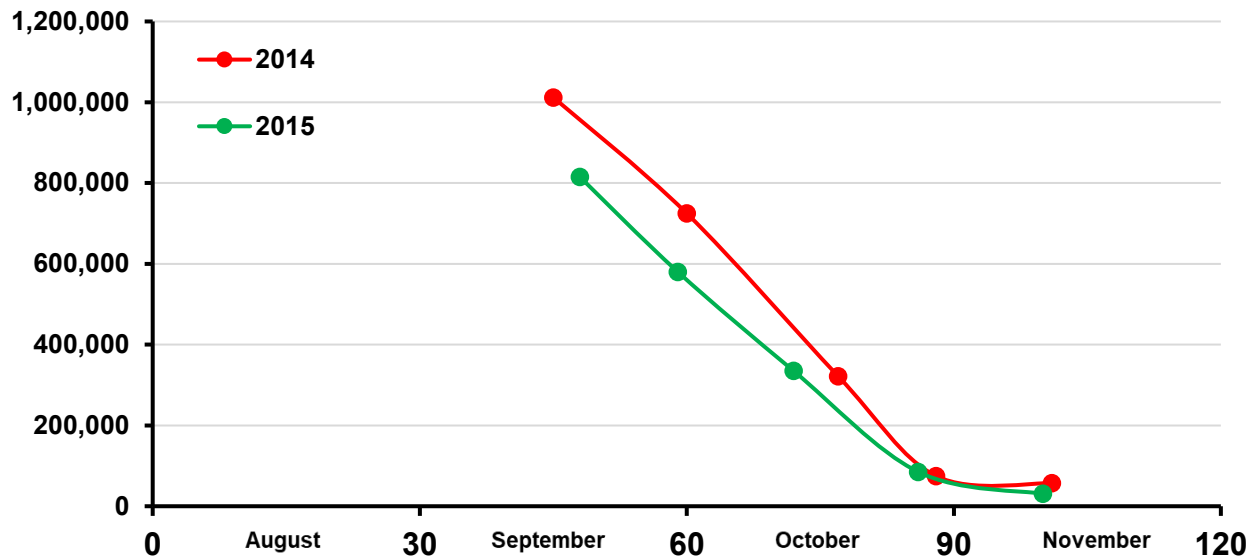


Eared Grebe Counts at Mono Lake CA (Surface Birds Only)

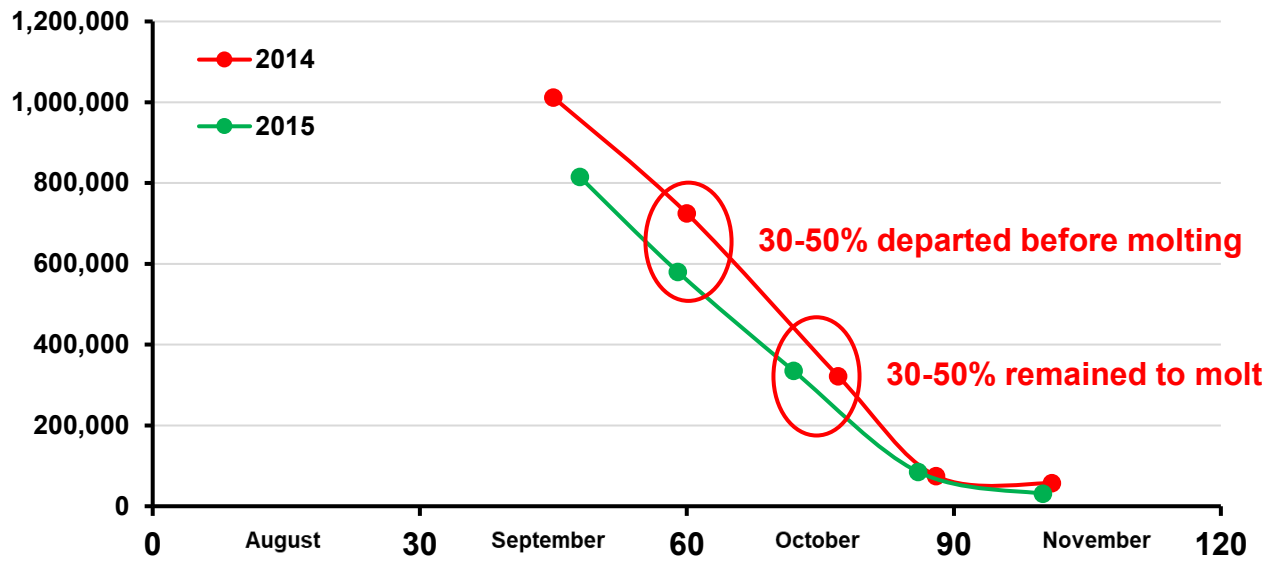


Eared Grebe Counts at Mono Lake CA (Surface Birds Only)

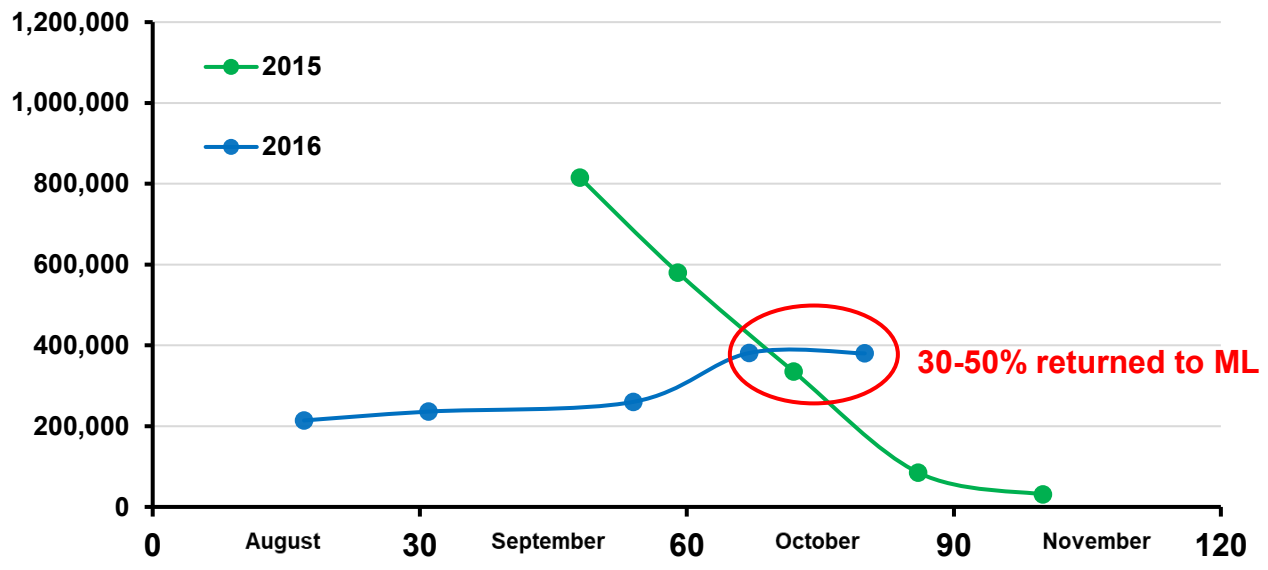
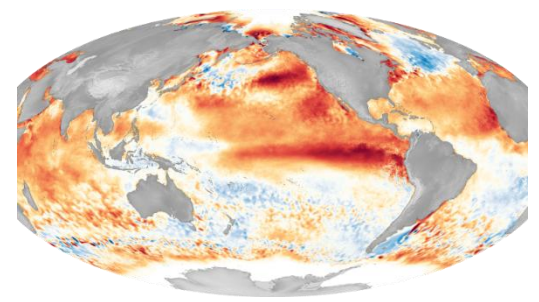




In addition to low shrimp densities in 2014 & 2015, an algae bloom caused low transparency, making it even more difficult for grebes to find shrimp

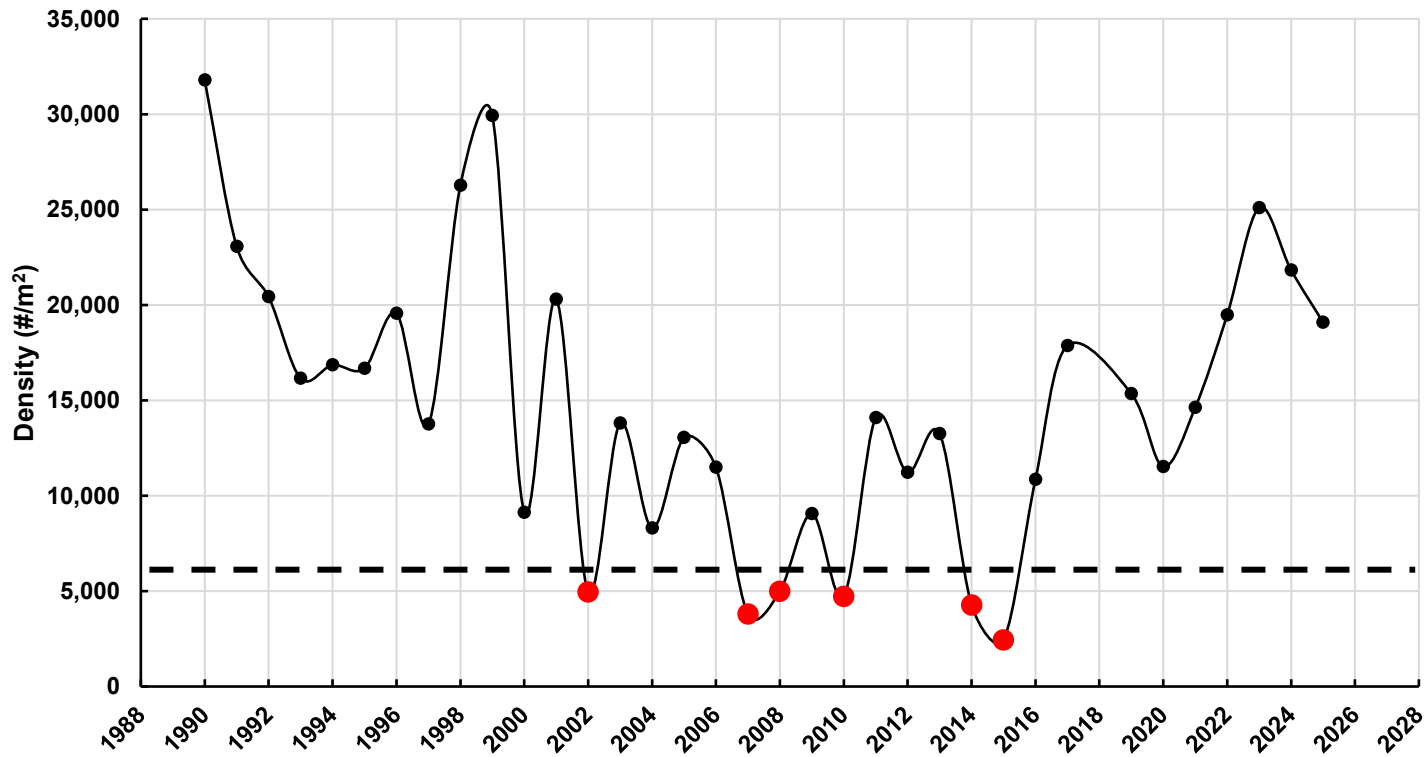


Potential mass mortality:
 In 2015, EAGRs departed ML in poor condition, arrived in the SoC in even worse shape, and then experienced a Super El Nino event

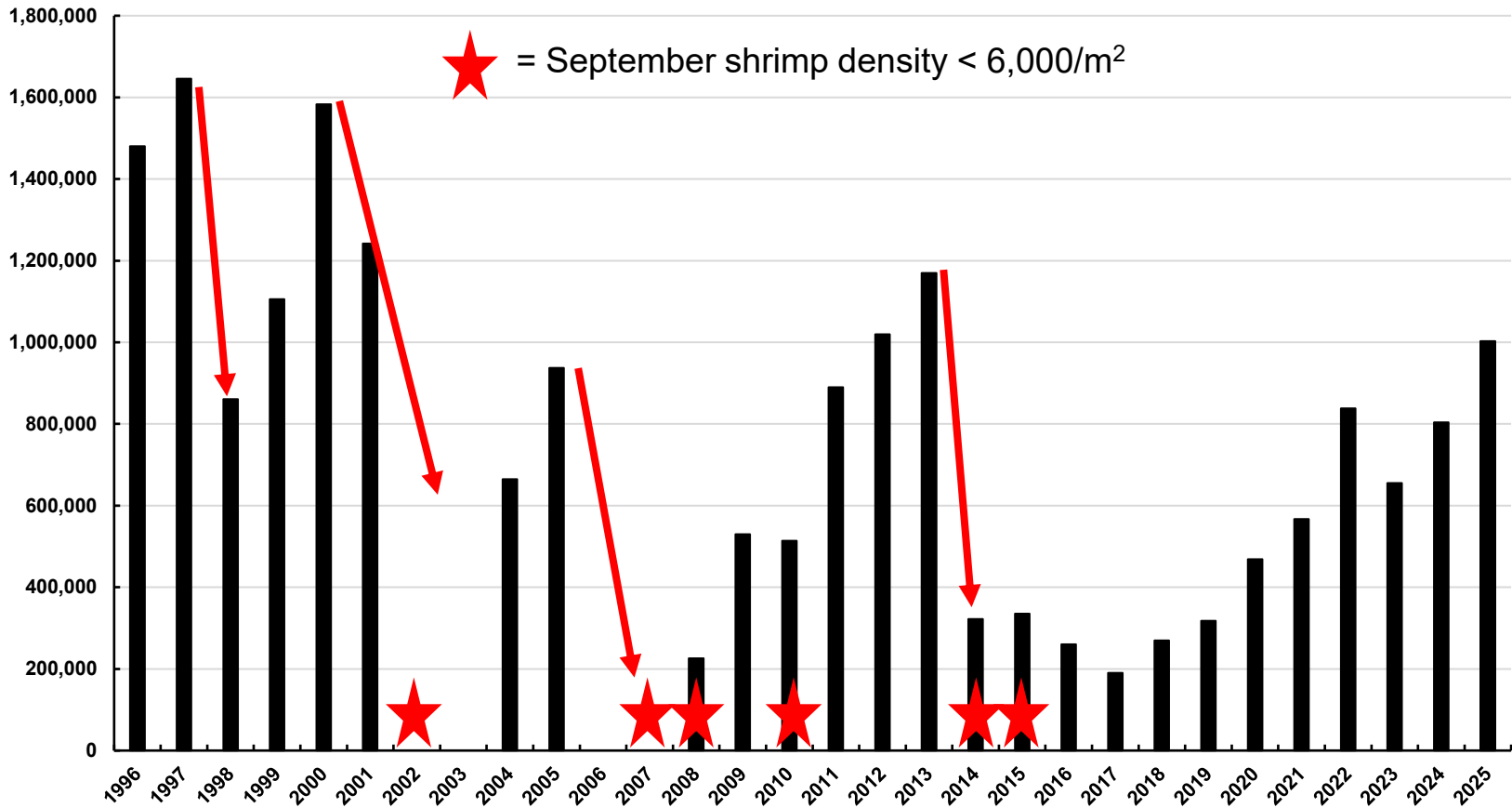




Mono Lake Brine Shrimp Density in September (adults/m²)
(J. Melack et al. & LADWP)

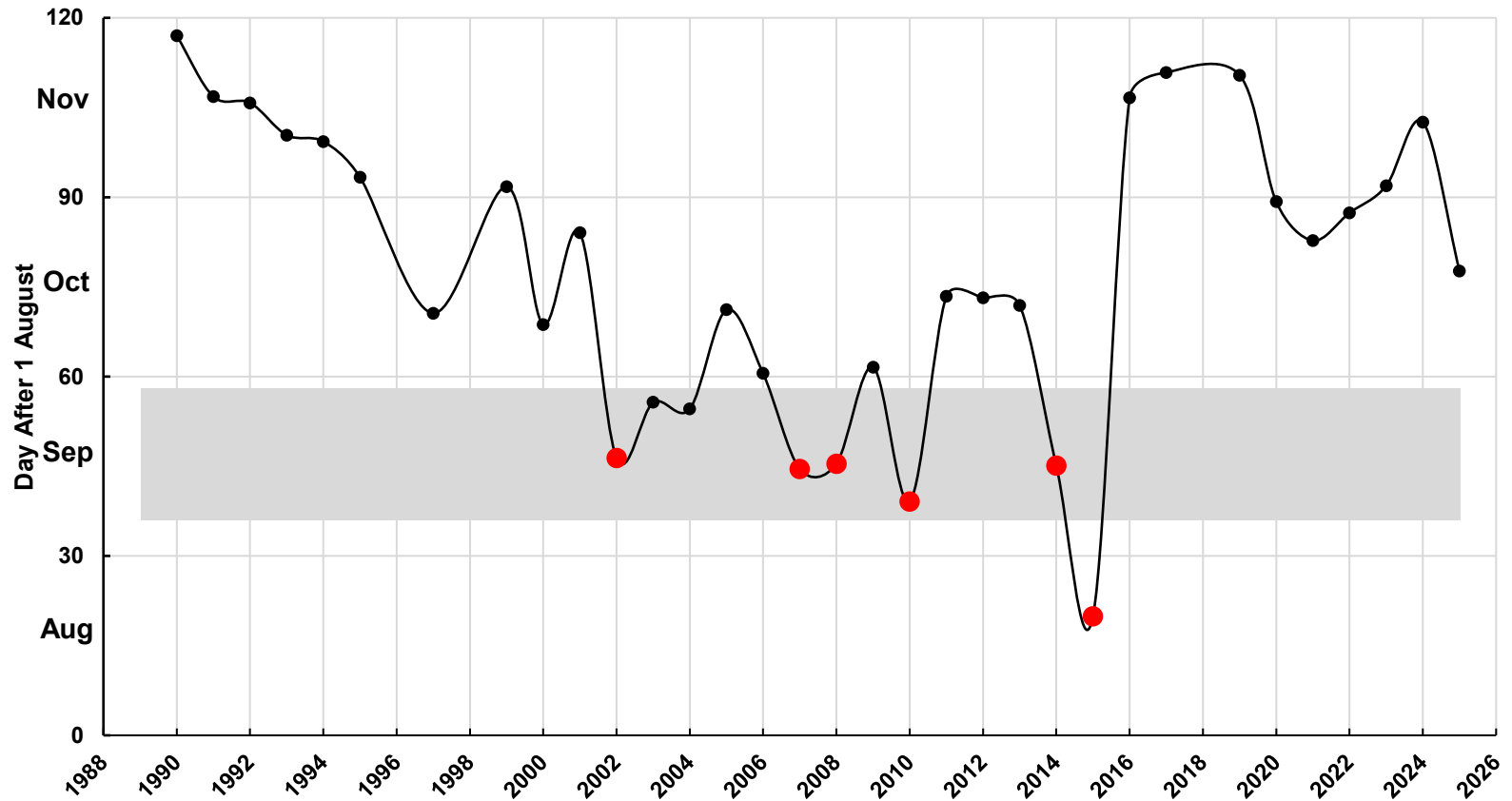


Mid-October Counts of Eared Grebes on Mono Lake CA (Surface Birds Only)

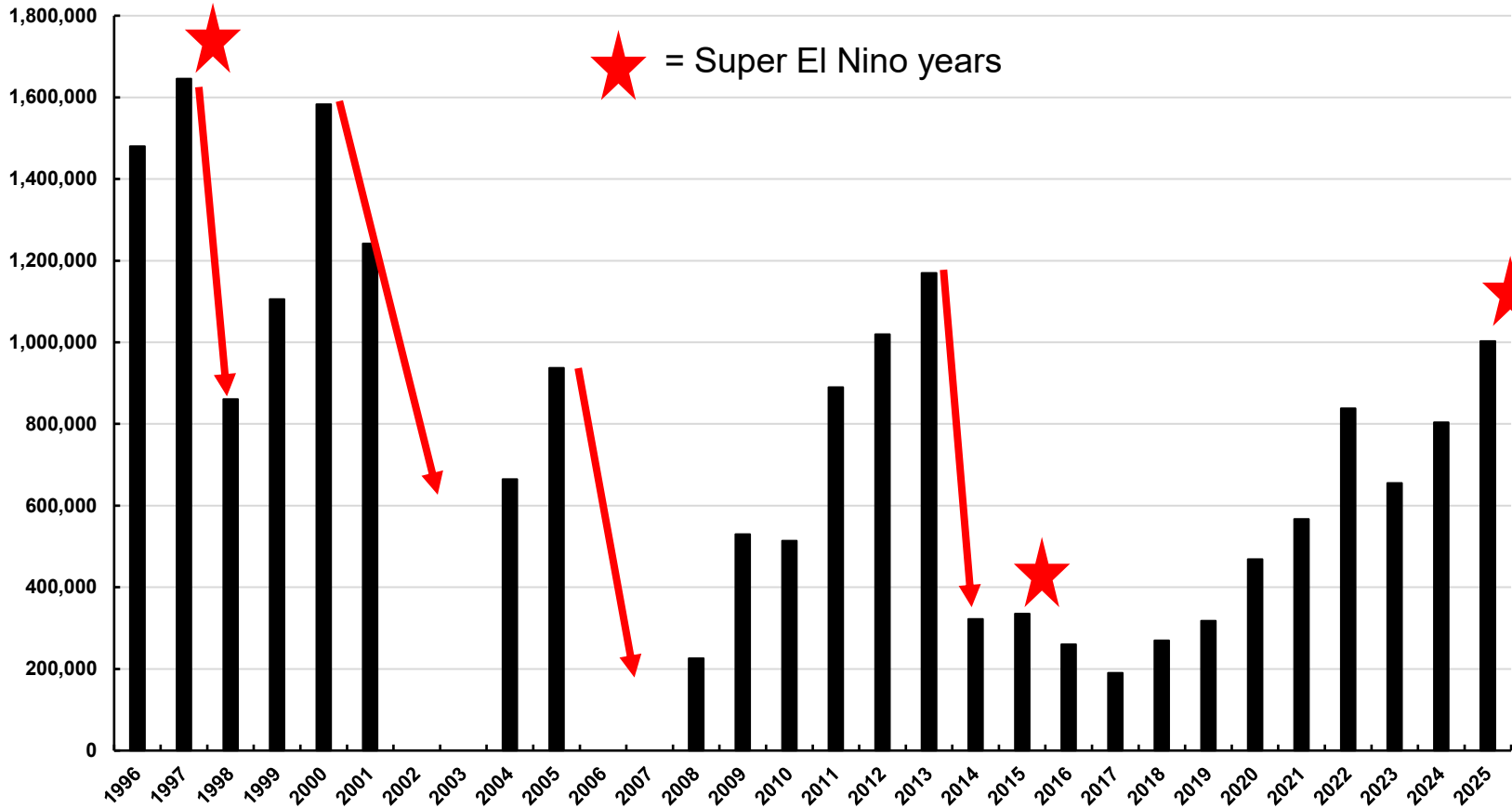




Day Shrimp Density = 6,000/m²
(J. Melack et al. & LADWP)

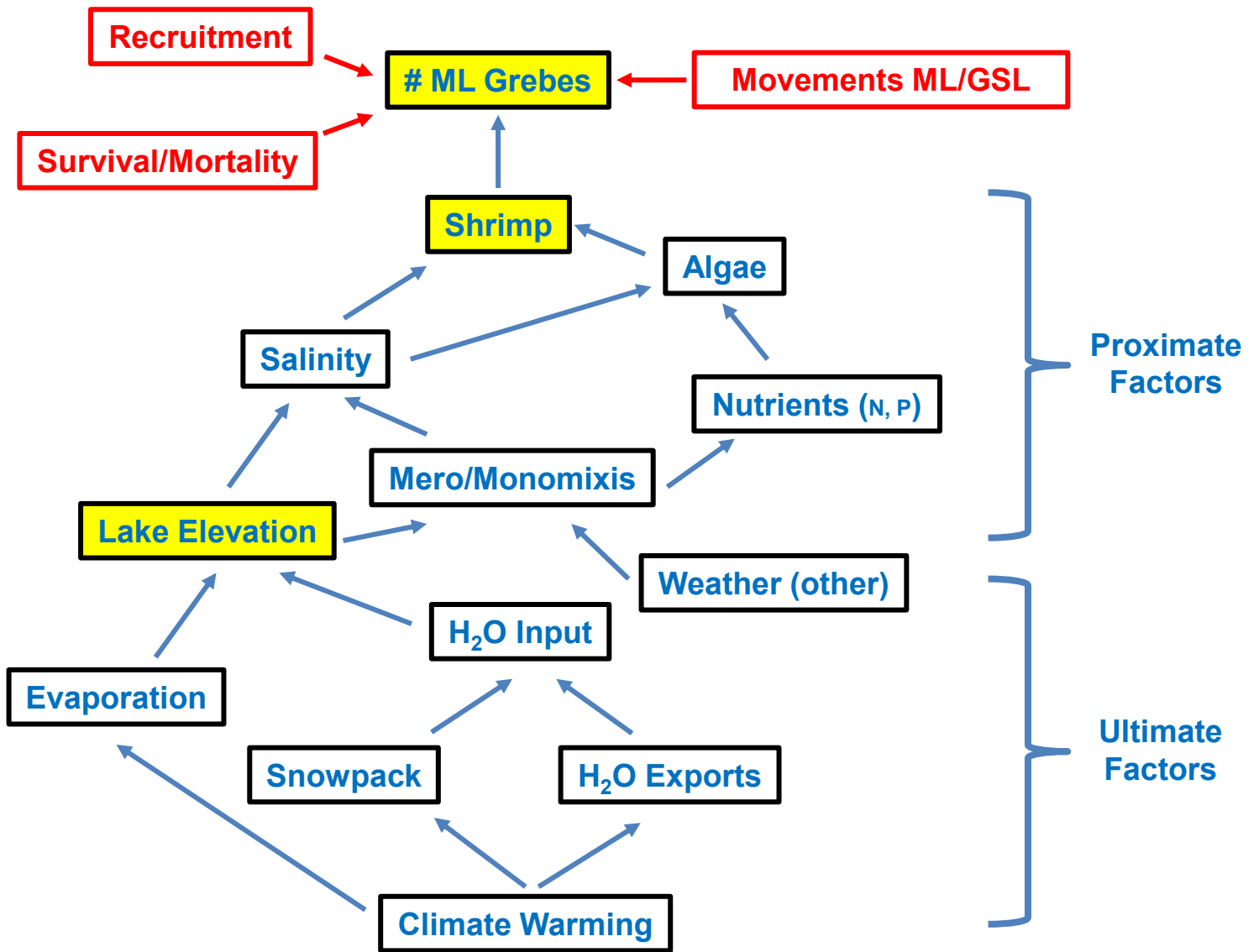


Mid-October Counts of Eared Grebes on Mono Lake CA (Surface Birds Only)



ML Grebes





THANKS



Extra Slides

Migrate GLS, 2017 & 2018

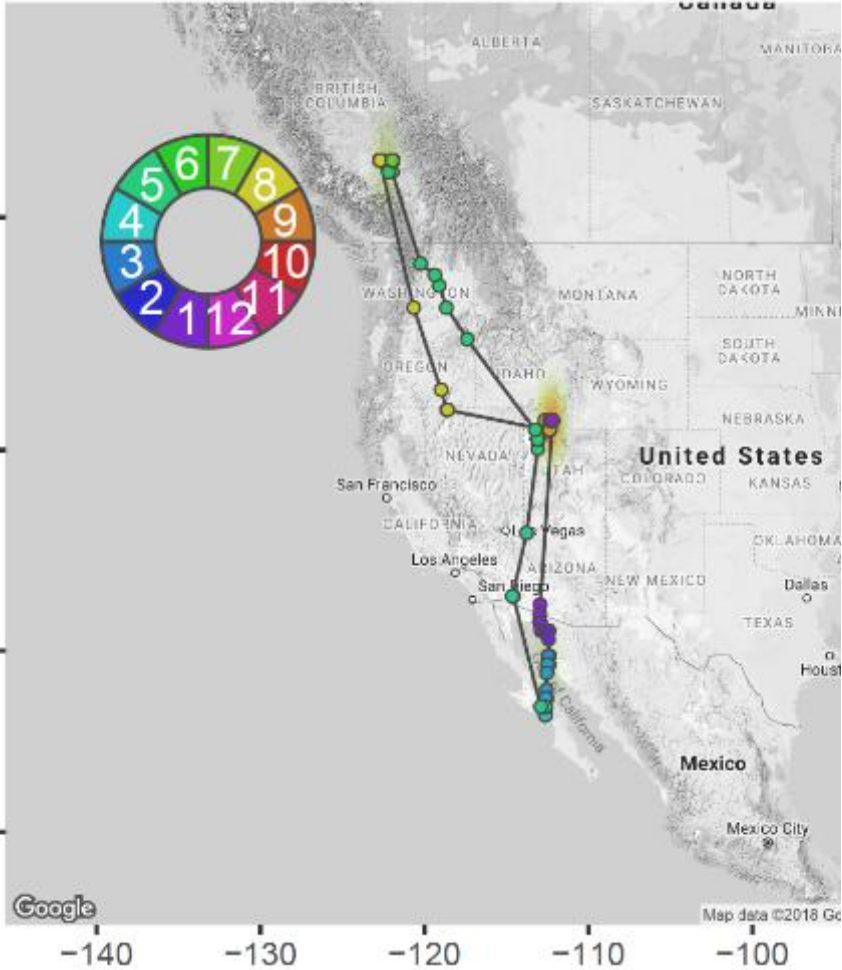


Boyd, W.S., N. Clyde, A. Breault, R. Di Paolo, and M. McAdie. 2021. Abundance, Distribution, and Migration Patterns of North American Eared Grebes (*Podiceps nigricollis*). *Waterbirds* 44(1): 76-85.

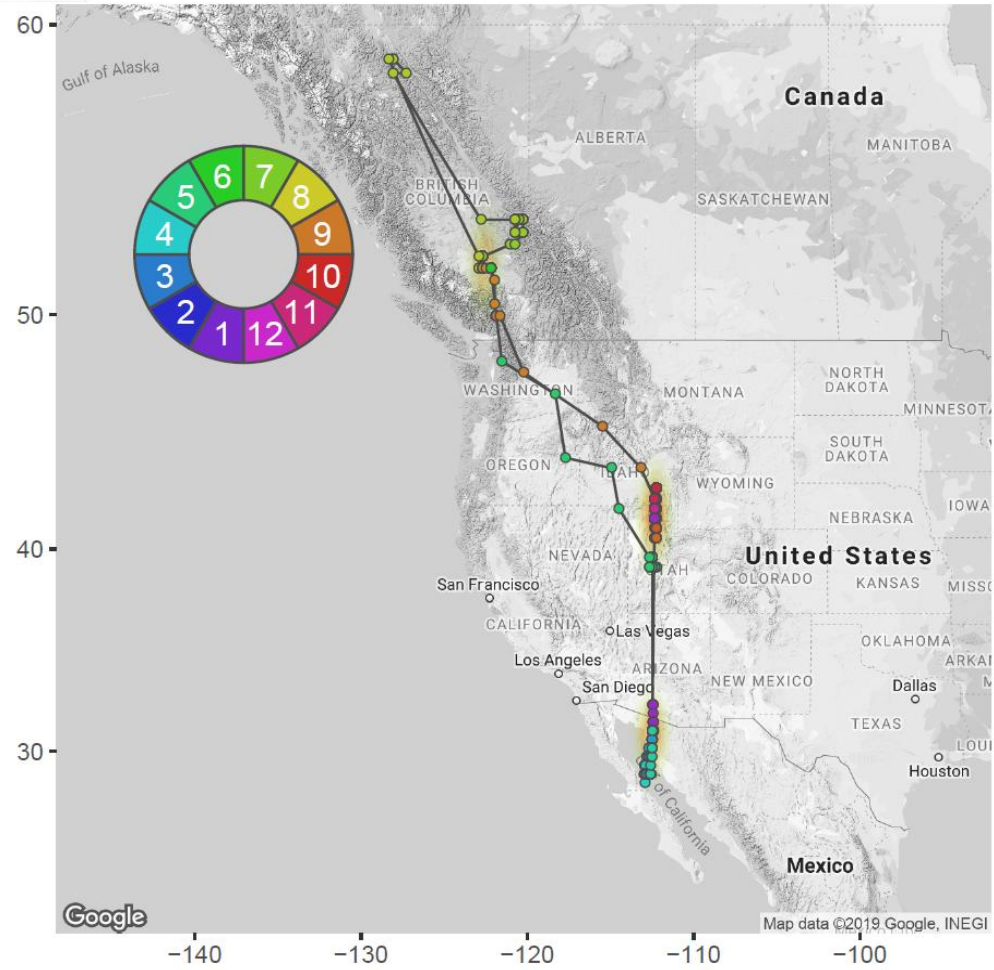
GLS: BG343, VHF:165.569 (2 annual cycles) (detected on GSL Oct 2017)



2017-18



2018-19



Potential EAGR Projects

- Thermal imagery + automated counting to estimate grebe numbers



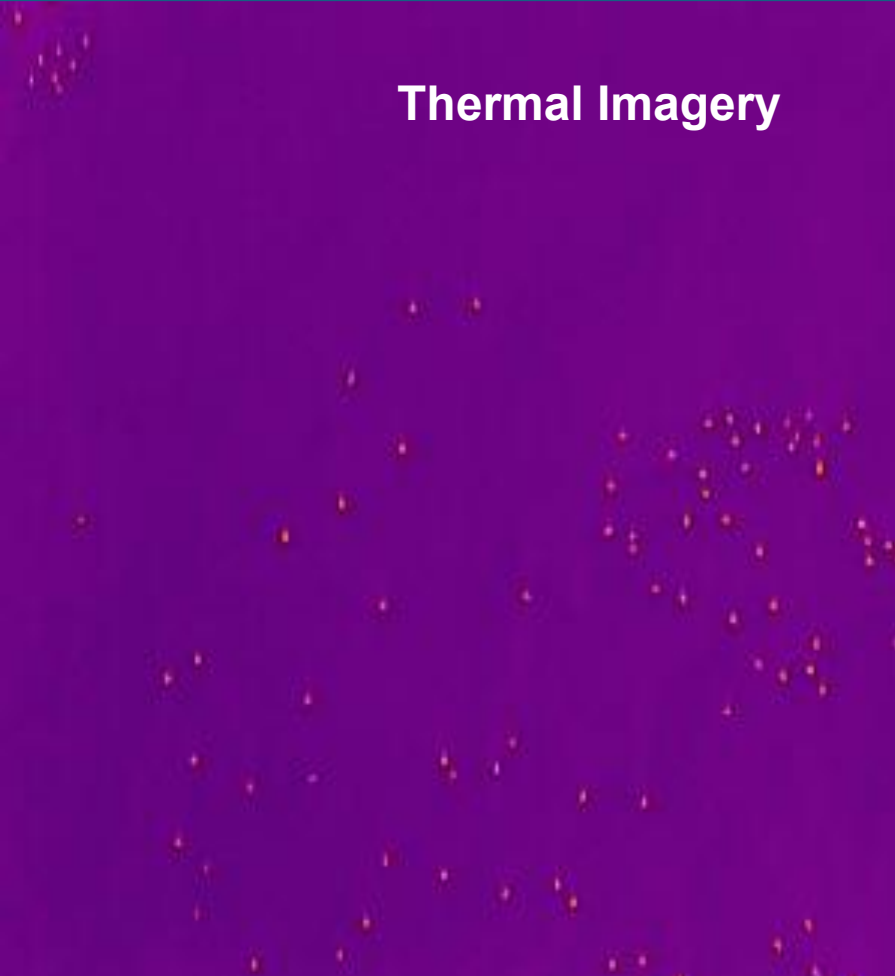
- Stable Isotopes to connect breeding and molting sites

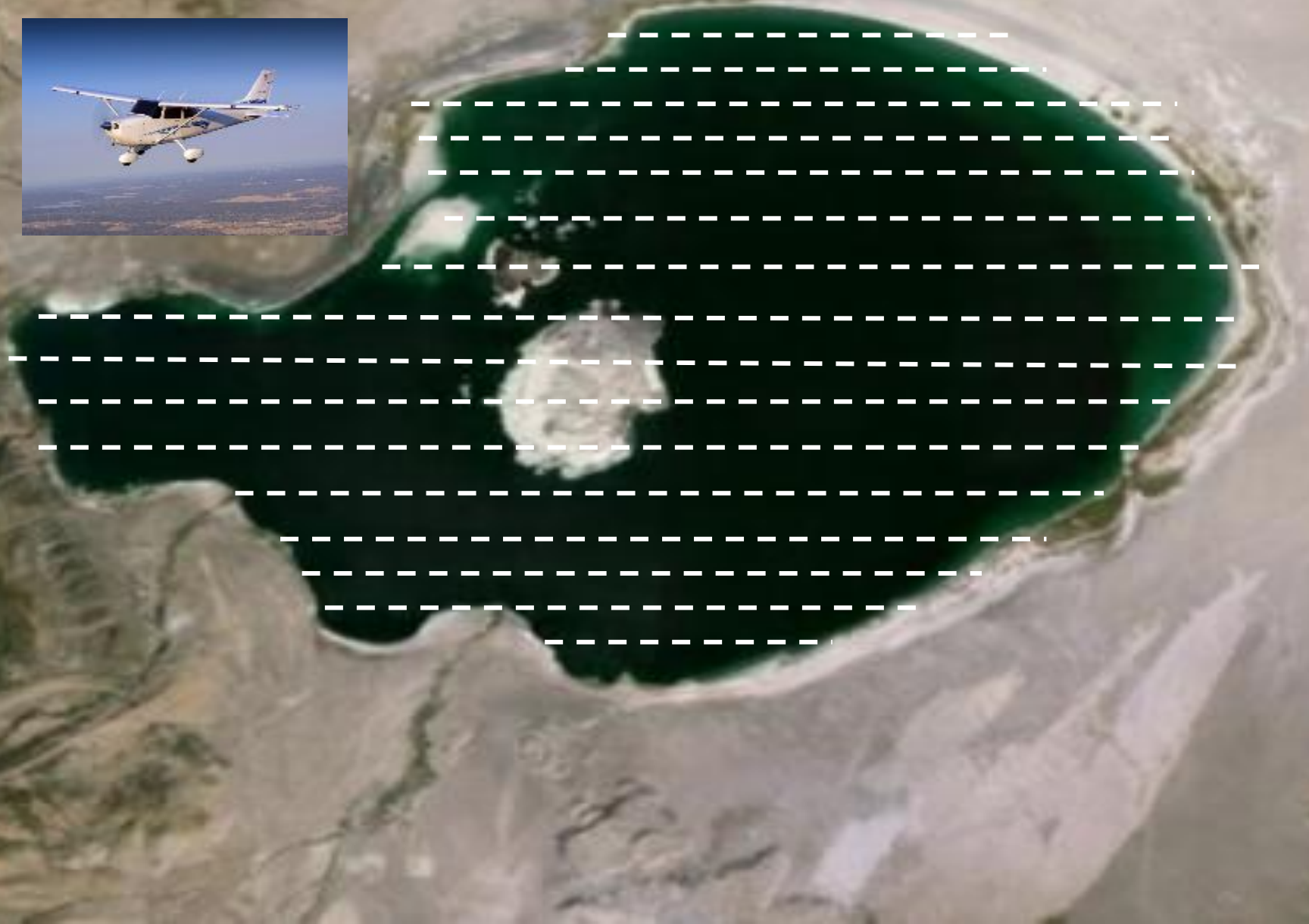


Drone



Thermal Imagery





Stable Isotopes can determine affiliations between breeding sites and molting sites (ML or GSL)



Stable Isotopes

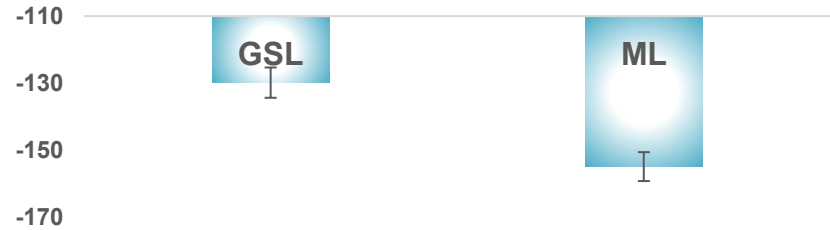
(Dr. Keith Hobson, ECCC)

Brine Shrimp

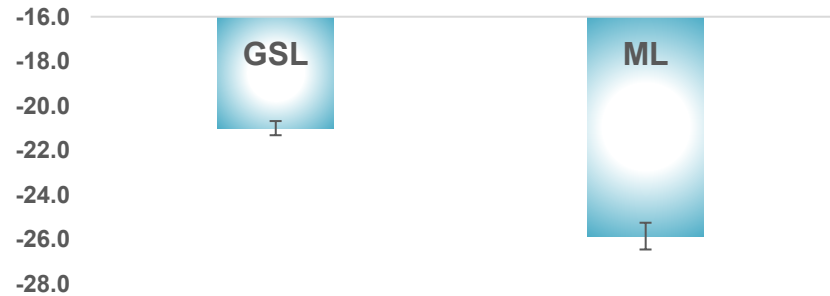
$\delta^2\text{H}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$



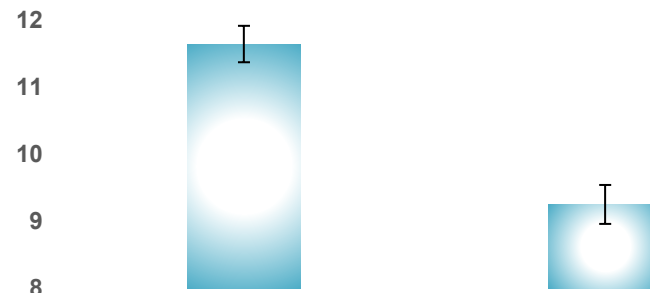
$\delta^2\text{H}$, Mean +/- 95%CI

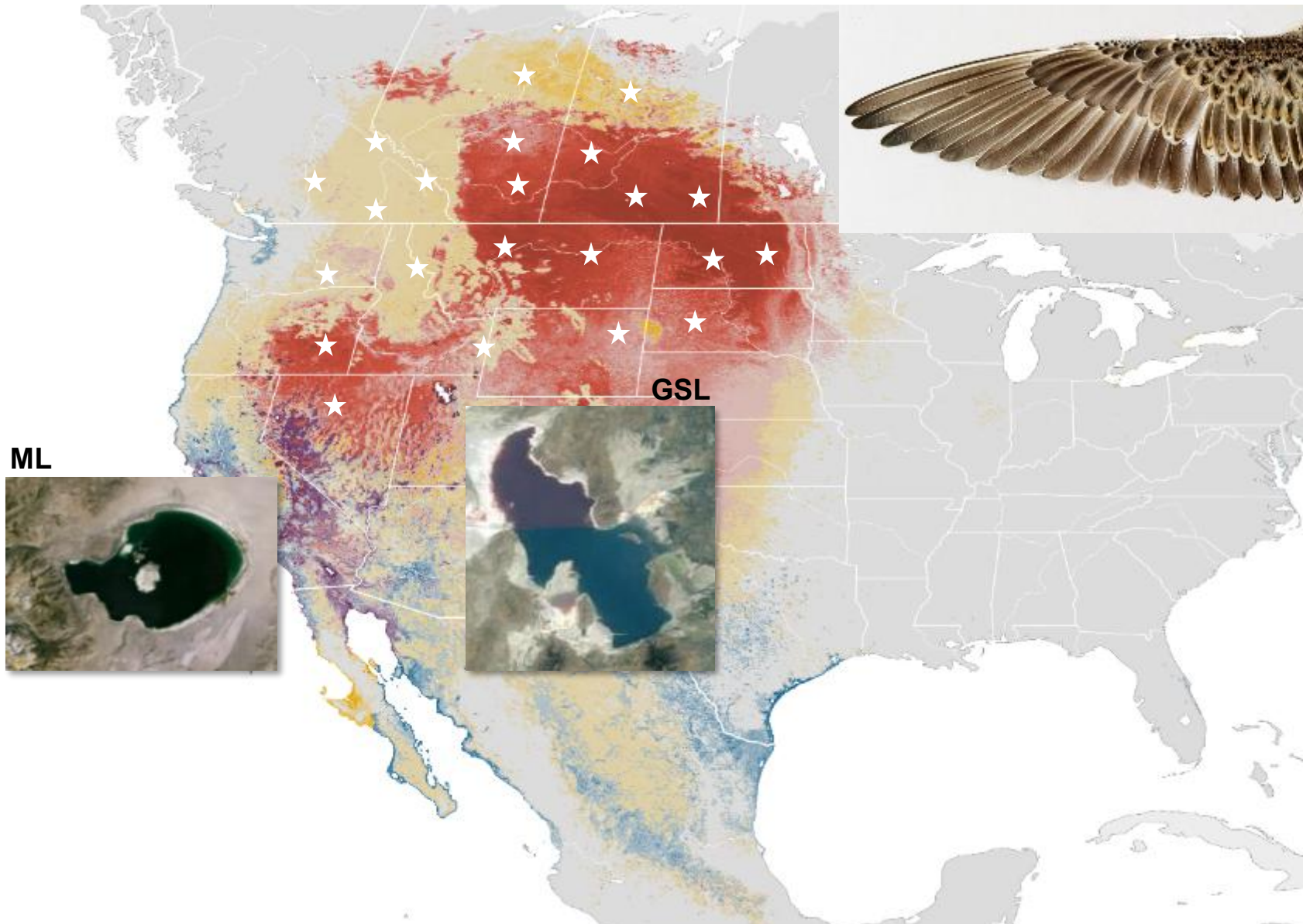


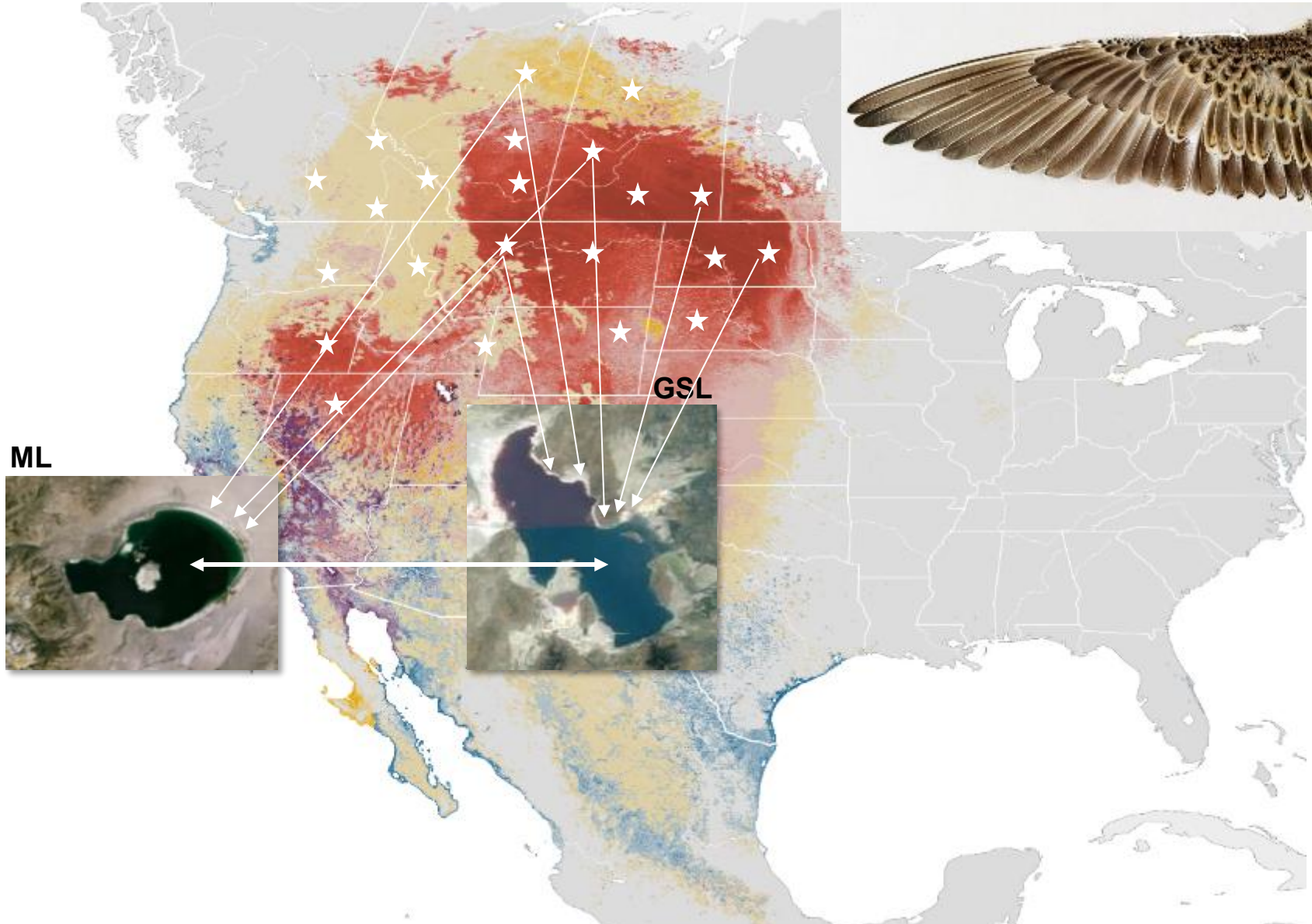
$\delta^{13}\text{C}$, Mean +/- 95%CI



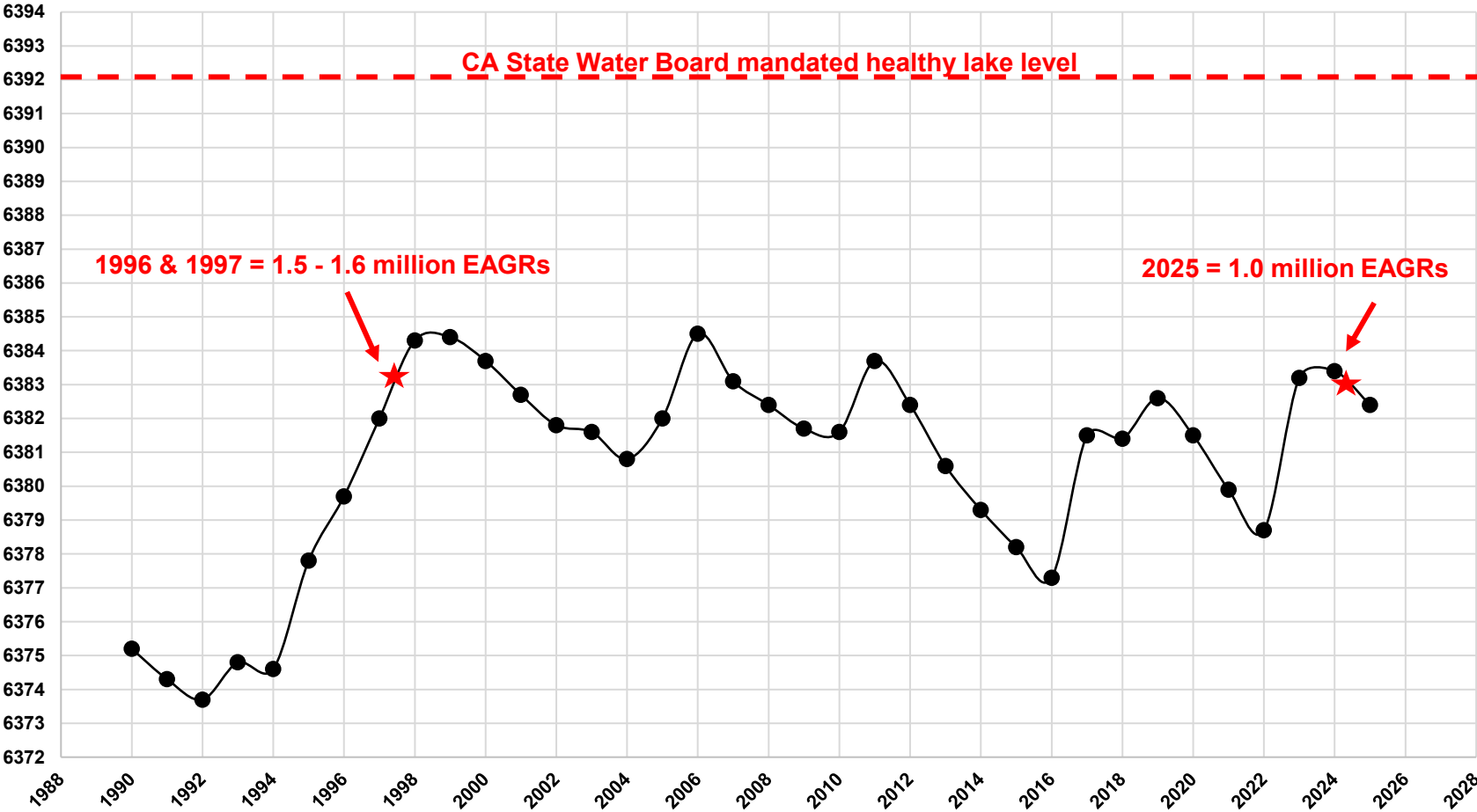
$\delta^{15}\text{N}$, Mean +/- 95%CI







Mono Lake Level in October (ft)



Mid-October Counts of Eared Grebes on Mono Lake CA (Surface Birds Only)

