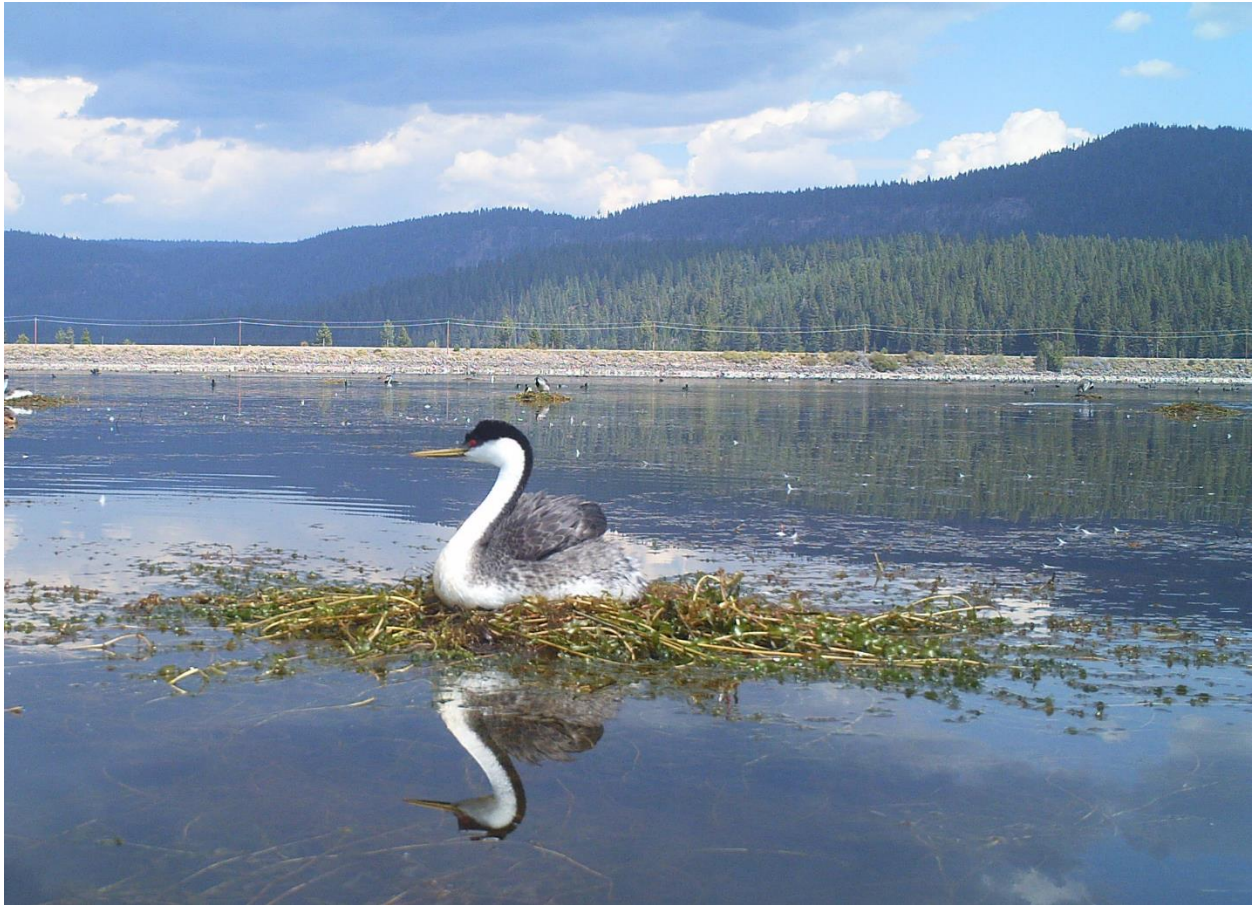


Conservation of *Aechmophorus* Grebe Colonies at Six Northern California Lakes

2014 Breeding Season Summary and Final Report DARRP Settlement Restoration Program 3002.13.042173

January 29, 2015



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EXECUTIVE SUMMARY

Since implementation of the Grebe Conservation Project, Audubon California and Audubon chapters have expanded the knowledge of Western and Clark's grebe (*Aechmophorus occidentalis*, and *A. Clarkii*) breeding populations in three Important Bird Areas (IBA) and three reservoirs in Northern California. The 2014 breeding season allowed Audubon California and chapter partners to build on existing conservation strategies – leading grebe colony conservation through monitoring and evaluation, and public outreach and education; enhancing the capacity for effective conservation going forward. This report summarizes the activities, findings, and outcomes from this 2014 breeding season. Major lessons learned include that the harmful effects of natural disturbances like drought, weather, and climate change on breeding grebes increase the urgency of mitigation efforts that combat disturbance issues that we have control over, including direct and negative human impacts. Nest camera monitoring provided Audubon and chapter partners insight into the effect of sudden water level drops on breeding grebes resulting in nest abandonment and subsequent egg predation. These events adversely impact breeding colony success and may contribute to long-term declines in grebe population. Therefore, strategically applying what we have learned from nest camera observations, outreach, and other monitoring completed during this study is imperative to informing continued grebe conservation efforts. Notable highlights from the 2014 breeding season include the following:

A. Outreach and Education

As part of the many outreach and education efforts achieved during this past year, Plumas Audubon hosted eight high school and college student interns that assisted with monitoring and outreach. Additionally, chapter leaders from Redbud Audubon Society and Plumas Audubon presented results and lessons learned from the Grebe Conservation Project to a National Audubon Society Board meeting in Sacramento in January 2014. This presentation and discussion promoted the conservation efforts made during the grebe project on a national scale and ensured that knowledge of grebe colony dynamics would be accessible throughout the organization and its affiliates.

B. Monitoring and Evaluation

Wildlife cameras and GIS mapping of breeding colonies showed that during periods of low water levels protective lake edges of emergent vegetation are inaccessible to breeding pairs at Clear Lake. As a result, grebes are restricted to nesting far from shore in open water making them vulnerable to weather events and disturbance. Additionally, Antelope Lake's ratio of adult Western grebe to juveniles was much higher than we have ever seen on any study lake.

C. Colony Protection

A local Sea Scouts troop – a specialized segment of Boy Scouts of America – and volunteers continued to monitor and maintain 18 fishing line recycle bins installed around Clear Lake to prevent diving grebes from being strangled in discarded line.

Moreover, this projects continuation has provided multiple opportunities for Audubon chapters to network amongst themselves and share information, lessons learned, and conservation strategies. In July, an information exchange was organized between Audubon California and Altacal, Redbud, and Plumas chapters to discuss the current survey season and ensure that project strategies and protocols remained standardized. Organized and collaborative problem-solving strengthened the framework of the Grebe Conservation Project ensuring that it can be used and interpreted consistently and on a large scale so that this wealth of knowledge can be used to improve grebe conservation at existing sites, as well as further grebe conservation beyond our select study sites.

INTRODUCTION

Western and Clark's grebe (*Aechmophorus*) are charismatic members of California's diverse migratory waterbird population. Audubon recognizes the grebes as residents of several Important Bird Area's (IBA's) and as a Climate Endangered species¹. Their breeding success is an important indicator for the overall health of California's northern lakes which are coveted by breeding grebes and human recreationalists alike.

Aechmophorus grebes are diving specialists that breed at the shallow margins of large lakes and forage in open water. Audubon California, in partnership with Redbud, Plumas, and Altacal chapters set a long-term goal of protecting and improving grebe reproductive success at six intermountain lakes through outreach and education, monitoring and evaluation, and colony protection. The study area includes Eagle Lake, Lake Almanor, Clear Lake,



Fig. 1: grebe chick hatches at Thermalito Afterbay

Thermalito Afterbay, Lake Davis, and Antelope Lake which serve as nesting sites for 76 percent of the total nesting *Aechmophorus* grebes in California (Ivey 2004). This report presents the results of the monitoring and outreach efforts for the 2014 breeding season, as well as highlights from some of the major conservation milestones that have been accomplished by our team.

METHODS

Surveying and Monitoring Colonies

This *Aechmophorus* grebe survey protocol described below was used by the Grebe Conservation Project to study and monitor grebes nesting in Northern California on Clear, Eagle, Almanor, Davis, and Antelope Lakes, as well as the Thermalito Afterbay. The protocol was based on Gericke, et al. (2006) and has been modified based on our experiences on the lakes during the last five breeding seasons.

Monitoring and survey efforts were categorized as follows: nest initiation surveys, nest monitoring surveys, abandoned nest surveys, disturbance surveys, population surveys, and brood surveys.

Nest Initiation Surveys

Weekly nest initiation surveys were conducted from the shore using binoculars and spotting scopes and from the lake by canoe and kayak. Nest initiations vary by lake and ranged from May through August.

Nest Monitoring Surveys

Discrete nesting areas were described as colonies and defined as a grouping of grebe nests at least 400 meters from other grebe nests. Colonies were mapped from shore using kayaks and boats.

¹ The National Audubon Society identifies birds as climate endangered when a species is projected to lose more than 50 percent of their current range by 2050, if global warming continues at its current pace.

On Clear Lake, each nest was classified as either a “shore nest” if built among emergent macrophytic vegetation near the shore or an “open water nest” if placed in open water greater than 1 meter from emergent vegetation. For colonies located in open water, the maximum distances for the nests from the shore or emergent vegetation was measured using a laser range finder or GPS unit.

Nest counts on Lake Almanor were conducted from strategic observation points around colonies. Nest monitoring was conducted before noon whenever possible. Data collected included a count of all nests determined to be active using factors such as size, nest cup, nest completeness, and presence of an incubating adult or eggs. A nest which lacks these characteristics was considered under construction or abandoned. If applicable, an egg count was recorded.

Disturbance Surveys

Disturbance index surveys performed by chapters accounted for the potential and actual effects of natural stresses on grebe colonies and human disturbance pressure. Specific measureable events include avian and mammalian predation, wind disturbance, water level fluctuation, and human disturbance.

A disturbance was defined as an action causing a grebe to noticeably alter their behavior. Weekly disturbance and potential disturbance surveys were conducted once nesting began. These were done at random times of day and week. Colonies would be observed for more than an hour to quantify the disturbance and grebe response.

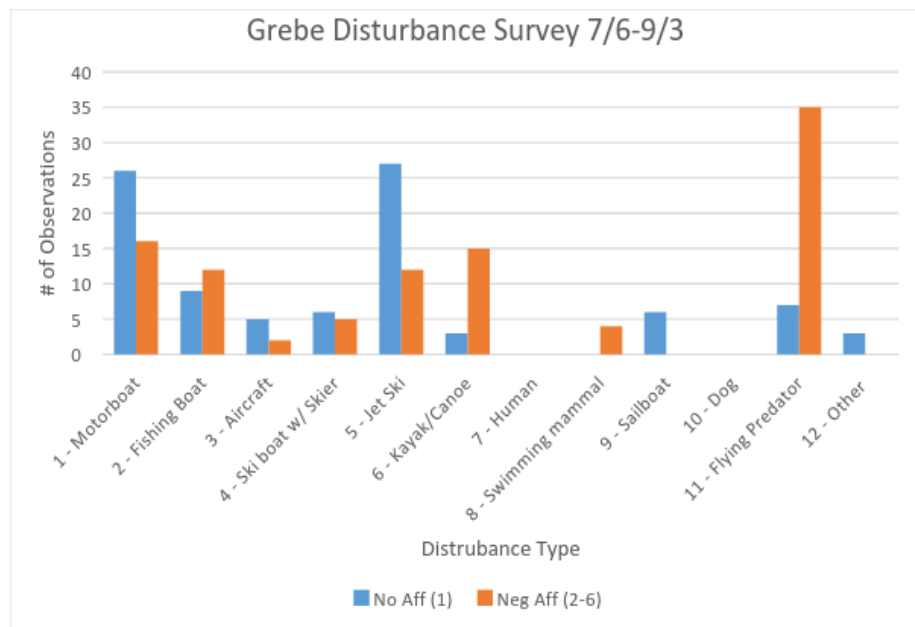


Fig. 2: Disturbance Survey results at Thermalito Afterbay

Population and Brood Surveys

Population counts and brood surveys were conducted by motor boat or kayak depending on lake size. Brood surveys start after young were first observed on a lake and were repeated 1–2 times a month until the beginning of October. Population counts required at least 2 surveyors, 1 data recorder, and 1 boat driver, while population/brood counts were conducted with 4 observers, 2 recorders, and 1 boat driver. Clarks and western grebes were distinguished when possible and otherwise counted as *Aechmophorus*. Grebe young at Thermalito Afterbay were categorized by size as: 1/8, 1/4, 1/3, 1/2, 2/3, 3/4, 7/8, or full sized compared to adults. The survey route was tracked with GPS and the start and endpoints of transects were marked as GPS waypoints. The ratio of young to adult grebes was calculated per transect and averaged across transects to determine an average ratio for a lake. Population counts were conducted during brood surveys to obtain a census of the entire grebe population on the lake.

Water Level Monitoring

An important component of both the Plumas and Altacal monitoring and outreach was determining how the management of water levels on artificial reservoirs affects nesting grebes.

Wildlife Cameras

The most accurate and effective way of monitoring individual nest successes, disturbance, and predation was to use wildlife cameras to monitor individual nests.

Data Management

Data sheets were scanned as PDFs for archival records. Microsoft Excel was used to tabulate data. ArcGIS was used for mapping spatial data, such as colony locations, and associated attribute data, such as number of nets in colonies.

RESULTS

The team accomplished significant conservation outcomes through their focused passion for avian welfare and a commitment to implementing conservation strategies. Audubon California staff were responsible for budget tracking assistance, reporting, and managing funding to ensure that the overall project needs were met. The Redbud, Altacal, and Plumas Audubon chapters led project deliverables including public outreach and education and monitoring and evaluation at study sites utilizing citizen scientists. Notable accomplishments are detailed below.

Public Outreach and Education

Outreach efforts for this program revealed a lack of public knowledge about grebes and their dynamic life history cycle – this could possibly be the cause for much disturbance by humans. Kayakers, fisherman, and other recreational users unknowingly stress grebe colonies by traveling too fast or too close to nests and improperly discarding hazardous materials like fishing line. The following dedicated grebe outreach and education for adults and children increased local knowledge about this species. While it is difficult to measure change in behavior there is no question that outreach and education is valuable not only for direct conservation but for building future generations' respect and understanding of the species:

Plumas Audubon – Lake Almanor, Antelope, Eagle, and Davis Lakes

- Assisted the Lassen Land and Trails Trust with their Nature Camp for the fourth year in a row and led field trips to Lake Davis, Mountain Meadows, and Lake Almanor, as well as one trip to Antelope Lake with disadvantaged youth from the Susanville area;
- Hosted, trained, and supported eight student interns from Humboldt, Chico, Kalamazoo College, Michigan State, Lewis and Clark College, and Feather River College that aided monitoring and outreach efforts throughout the summer. Emily Mickus – a student at Kalamazoo College in Michigan – was inspired to analyze grebe nest camera data for her senior thesis;
- Multiple birding field trips overviewed grebe natural history and the often deleterious effects of water level management on breeding success. Participants included Altacal Audubon Society and the Central Valley Birding Club;



Fig. 3: Feather River Publishing Article, October 2014

- The Lake Almanor grebe population was featured in Audubon Magazine, a national publication, in an article titled “Finding Their Level”. The article discussed how rapid water level drops on managed reservoirs like Lake Almanor negatively affects nesting grebes. The fifth year of monitoring at Lake Almanor showed a strong correlation between the rate of water level drop and grebe reproductive success.

Redbud Audubon – Clear Lake

- Lake County News featured a full article and accompanying photo on the interpretive grebe panel installed at a boat launch ramp at Redbud Park.
- Lake County Record Bee, the largest print newspaper in the county, printed a photograph of 5,000 nest grebe colony at Clear Lake on the first page.
- Outreach and education booths were run at seven major community events including the California State Parks 150th Anniversary Celebration Day at Clear Lake State Park.
- Five interpretive signs explaining grebe behaviors and how to protect their breeding colonies were installed at public parks around the shoreline of Clear Lake.

Altacal Audubon – Thermalito Afterbay

- Members sat at booths at the Butte County Fair, Oroville’s Salmon Festival, and Endangered Species Fair at Bidwell Park.
- Thirteen weekend days were spent at the boat launch with a pop-up tent and outreach materials talking to boaters and recreational users at the Thermalito Afterbay about grebe conservation.
- Altacal staff and volunteers gave grebe project centered presentations at Outdoor Education for All (OEFA) events reaching 620 children and 82 adults.
- Grebe project volunteers conducted interpretive nature hikes with State Park staff teaching grebe breeding biology.

Monitoring and Evaluation

Monitoring and evaluation provides data assists in measuring the success of our project and also allows us to adapt our conservation strategies to address the most important threats. Consistent monitoring is critical for clear understanding of changes in grebe breeding populations. This data allows us to work with stakeholders to help make management decisions about how to protect breeding grebes at our study sites and along the Pacific Flyway.

Plumas Audubon – Lake Almanor, Antelope, Eagle, and Davis Lakes

- The fifth year of monitoring at Lake Almanor, when analyzed with the previous four years, showed a strong correlation between the rate of water level drop and grebe reproductive success;
- Lake Davis had only 14 nests all of which failed due to the low water levels and July storms, Antelope Lake had a peak of 29 active nests and the highest rate of reproductive success we have ever recorded on any lake in the last five year, and Lake Almanor had a peak of 2,598 active nests;
- Wildlife cameras were used again this season and documented that some of the nests were destroyed by the unusual storms that occurred in July. In addition, the cameras revealed that in most events where gulls preyed on eggs grebe pairs had already abandoned their nest while eggs in active nests appear to rarely be depredated by avian predators.
- A combined total of fifteen lake-wide surveys were done at Almanor, Antelope, Davis, and Eagle Lakes.
- The water level at Eagle Lake continues to drop to levels lower than ever recorded over the last 140 years. *Aechmophorus* grebes did not breed at Eagle Lake for the third year in a row.
- More than 2,500 grebe nests were counted near the Goose Bay Causeway. Nesting initiated in July with a high of 773 active nests and later during mid-August a second influx of grebes pushed

the population to peak again at 1,444. These high numbers were previously unseen at Lake Almanor.

Almanor	1-Jul	10-Jul	15-Jul	22-Jul	24-Jul	29-Jul	11-Aug	18-Aug	26-Aug	8-Sep	26-Sep	Peak
Causeway	30	505	131	24	-	200	503	260	225	40	0	505
East Island	0	0	642	91	-	0	78	63	23	0	0	642
Meadows	0	7	0	0	-	0	0	0	0	0	0	7
Goose Bay	0	0	0	0	180	706	1,444	1,025	465	160	0	1,444
Total	30	512	773	115	180	906	2,025	1,348	713	200	0	2,598

Antelope	23-Jun	26-Jun	11-Jul	14-Jul	30-Jul	12-Aug	21-Aug	10-Sep	Peak
Lost Cr Cove	11	13	28	29	23	11	8	0	29

Davis	10-Jun	18-Jun	30-Jun	12-Jul	17-Jul	31-Jul	Peak
Cow Creek	-	0	1	14	6	0	14

Fig. 4: Number of active nests in grebe colonies at Lake Almanor, Antelope Lake, and Lake Davis in 2014

Redbud Audubon – Clear Lake

- A total of 5,936 nests were counted in 17 colonies, including a large colony of 5,587 nests extending across 1.9 miles at the north end of the lake.
- The number of nests in emergent shoreline vegetation continued to decline as drought conditions worsened and water levels dropped during the 5-year study, from 70.8 percent in 2010 to 2.0 percent in 2013 and zero percent in 2014. Nests in open water are more vulnerable to wind-blown waves, motorboats and predators.
- Observers recorded eight predation events by American Crows (*Corvus brachyrhynchos*), four by California Gull (*Larus californicus*), and four by Ring-billed Gulls (*L. delawarensis*).
- Nest cameras monitored individual grebe nests for the first time in Clear Lake. They captured two predation events by American Crows, four by a Raccoon (*Procyon lotor*), and two by American Mink (*Neovison vison*).
- Redbud recorded the largest single grebe colony ever recorded by the project: an impressive colony of nests extending 1.9 miles and totaling 5,587 nests at the north end of Clear Lake at Rodman Slough.
- Wind disturbance was documented in previous breeding years, but no events were as extensive as the dramatic loss of over 1,000 nests and 4,000 eggs estimated between monitoring visits on August 10th and August 14th. Evidence of a major wind storm was seen in photos taken by nest cameras and in the nest materials washed ashore.

Altacal Audubon – Thermalito Afterbay

- At 536 individuals, Thermalito Afterbay's average adult grebe population from July through September was at its highest since 2003.
- A total of 341 young produced resulted in a total breeding productivity ratio of 0.60; the highest ratio of young to adult that the Afterbay has recorded since the projects start.
- Water levels remained consistent leading to apparent successes for the 2014 grebe breeding colonies.
- Altacal Audubon adapted a data sheet designed by Plumas that measured breeding success by recording the size of each brood chick.
- Altacal expanded their outreach and monitoring capacity by collaborating on unobtrusive boat surveys with the California Department of Water Resources and California Department of Fish and Wildlife for a fourth year at the Thermalito Afterbay.

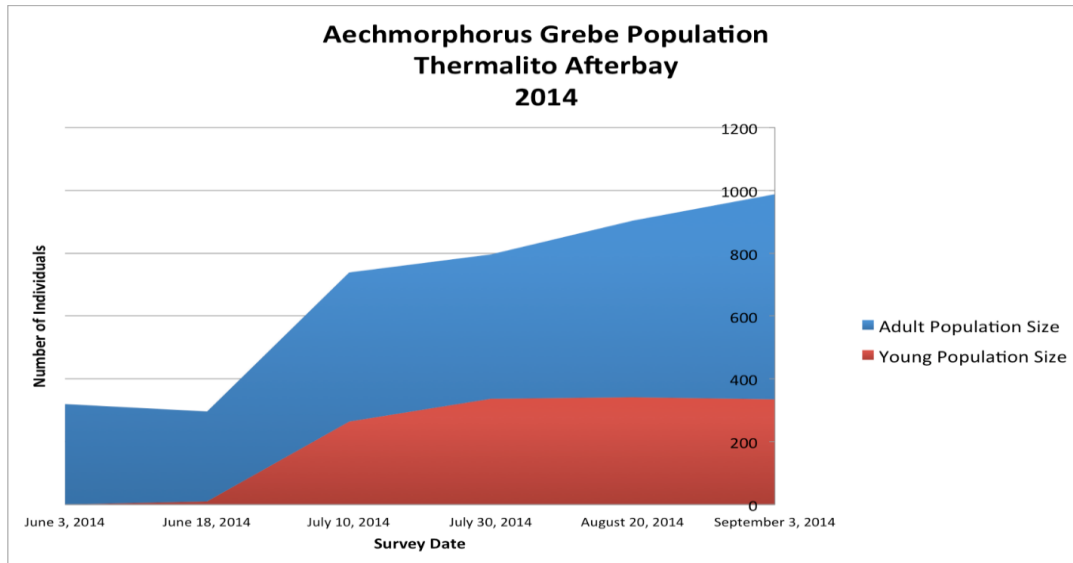


Fig. 5: Grebe Adult to young ratio for Thermalito Afterbay, 2014

Seasonal Breeding Colony Protection

In conjunction with outreach, education, and monitoring, active colony protection is essential to maintaining the viability of these sensitive species until drought management practices better account for the habitat needs of breeding bird populations. Likewise, understanding colonial trends will enable us to get a better sense of what limits and enhances breeding success over time.

Plumas Audubon

- In partnership with reservoir managers, Plumas Audubon was able to closely monitor the water levels in their study areas. Maintaining this relationship and monitoring how changes in water depth influence grebe breeding success is a key component of breeding colony protection. The water level at Eagle Lake continues to drop to levels lower than ever recorded over the last 140 years. Additionally, *Aechmophorus* grebes did not breed at Eagle Lake for the third year in a row. Publicizing the correlation of these events has led to media attention, and ultimately can be used to inform policy that protects grebes.

Redbud Audubon

- A local Sea Scouts troop – a specialized segment of Boy Scouts of America – and volunteers continued to monitor and maintain 18 fishing line recycle bins installed around Clear Lake to prevent diving grebes from being strangled in discarded line.

Altacal Audubon

- To supplement monitoring data, Thermalito Afterbay was mapped using GIS to better analyze the dynamics of grebe nesting. Understanding the spatial dynamics of where the birds are nesting allows outreach and education materials to be tailored to provide information to the public on those particular areas and places to avoid creating additional disturbances.
- Identifying and interpreting potential influences on breeding grebes is important for planning colony protection. For example, Thermalito Afterbay was inundated with over 3,000 White-faced Ibis (*Plegadis chihi*) who built large communal nests that overlapped 57 percent with grebe nesting habitat. There was concern that White-faced Ibis would displace grebe populations, however, no apparent threat was observed. This finding allowed Altacal Audubon to determine that future encroachment by White-faced Ibis is not necessarily a limit on grebe population

success and while it should be monitored, at this time, no stronger action to protect the grebe colony from the White-faced Ibis is needed.

DISCUSSION AND RECOMMENDATIONS

Water level management under drought conditions dictated much of grebe breeding success this season. Moreover, monitoring results continue to support the overall project trend of increasing grebe breeding pairs that produce low juvenile:adult ratios.

While high numbers of breeding grebes mark progress, we should also consider the influence of climate change on colony stability and species demographics. As historical breeding sites deteriorate in suitability, grebes may be forced to crowd into previously underutilized lakes out of necessity – potentially accounting for apparent population growth in previously underutilized lakes. Similarly, White-faced Ibis, who appeared suddenly and in robust numbers at Thermalito Afterbay, may be responding to the degradation of their traditional breeding grounds by drought or other weather events. As climate change confounds the predictability of weather events in the future, we can expect grebe populations to endure additional pressures on nesting success. However, fully understanding shifts in species nesting habits can be difficult considering the patterns of natural systems are demonstrated over long time scales. For now, further monitoring and evaluation efforts will continue to document irregular events to help us consider the cause and effect of new environmental stressors on population and breeding. Additionally, outreach and education efforts will advocate publicly for continued grebe conservation that emphasizes the importance of grebe nesting success in IBA's and lake communities.

Maintaining a consistent assessment of grebe breeding colony dynamics, water level fluctuation, and community awareness through monitoring and outreach provide baseline data to improve colony protection strategies. Audubon California and Redbud, Altacal and Plumas chapters submitted a Phase II proposal November 2014 requesting funds for this purpose. If Phase II is successfully funded, the chapters will continue to work on standardizing and improving monitoring processes so that monitoring costs and efforts can be reduced over time. Refining monitoring efforts by reducing monitoring costs provide additional time and funding for more robust outreach, education, and colony protection. However, a baseline of monitoring is recommended for the foreseeable future to ensure identification of colony locations for protection, to capture and address new threats as they arrive (e.g. encroaching White-faced Ibis colonies), and to tailor outreach and education to the current status of the species. Additionally, the chapters will continue to refine and improve their processes to provide more information on the birds with less disturbance. For example, Altacal plans to outfit their Muddy Boat with improvements that minimize colony disturbance during data collection, and Plumas Audubon will continue supporting interns and mentoring those students who provide independent research on grebe breeding colonies post-project.

In addition to continuing and improving baseline monitoring of grebes, we also want to highlight the success and outcome of using wildlife nest cameras to monitor disturbance. The chapters concluded that wildlife nest cameras are essential to accurate disturbance monitoring and lend visual assistance to data interpretation. We recommend that grebe conservation partners, and those who participate in similar species monitoring, utilize wildlife cameras for a holistic view of the breeding season.

We would formally like to thank the Luckenbach Council, NOAA, and NFWF for supporting the strengthening of grebe conservation knowledge and for supporting on the ground conservation work to preserve and increase the population. Audubon California, Redbud, Altacal, and Plumas look forward to working with the Council in the future.

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Fig. 6: Grebe pair and chicks at Thermalito Afterbay