

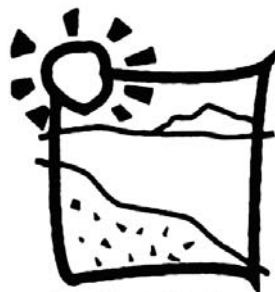
# 2010 FRIENDS of Great Salt Lake Issues Forum



Pre-History by Charles Uibel

## Keeping the Lake Wet: A Water Appropriation for Great Salt Lake

April 28-30, 2010  
Salt Lake City, Utah



FRIENDS of  
Great Salt Lake



## 2010 Great Salt Lake Issues Forum

### Program and Abstracts

Conference Co-Chairs:  
Lynn de Freitas, Emily Gaines

Special Thanks To:  
Robert Adler, Nicole Anderson, Genevieve Atwood, Bonnie Baxter, Jaimi Butler, Jim Carter, Jeff Clay,  
Patrick de Freitas, Sarah Jensen, Cindy Lund, Wayne Martinson, Craig Miller, Don Paul

Website Construction and Cover Art: Charles Uibel ([greatsaltlakephotos.com](http://greatsaltlakephotos.com))

Marketing: Josh Ewing, OutFront Consulting

#### About FRIENDS of Great Salt Lake:

Founded in 1994, the mission of FRIENDS of Great Salt Lake is to preserve and protect the Great Salt Lake Ecosystem and to increase public awareness and appreciation of the lake through education, research, and advocacy. The long-term vision of FRIENDS is to achieve comprehensive watershed-based restoration and protection for the Great Salt Lake Ecosystem.

The Board of Directors and Advisory Board consist of professionals in the scientific, planning, literary, legal, and education communities. The organization sponsors an array of programs, activities, and materials in pursuit of its mission. Every two years, FRIENDS hosts the Great Salt Lake Issues Forum. The goal of each Forum is to illuminate the complexities involved in research, management and planning for the lake, and encourage constructive dialogue about the future of the lake's ecosystem. Visit our website at [www.fogsl.org](http://www.fogsl.org)

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## Conference Overview

All events will take place at the University of Utah Officers Club (150 South Fort Douglas Boulevard) unless marked otherwise.

Wednesday, April 28<sup>th</sup>

- Scientific, Legal and Economic Perspectives on the Value of Saline Systems (8am - noon)
- Keynote Speaker – Dr. Lance Gunderson – “Nurturing Resilience – Lessons from Managing Complex Ecosystems” (8:10am - 9am)
- 2010 Doyle Stephens Scholarship awarded; Presentation by 2009 scholarship recipient Gregory Carling (noon – 1pm)
- Restoration Efforts on Three Saline Lakes in the West - Mono Lake, Owens Lake and Walker Lake (1pm – 5pm)
- Banquet at the Alta Club (6:30pm - 9:30pm)
  - Speaker – Don Paul - “Linking Communities, Wetlands and Migratory Birds”
  - Friend of the Lake Award Presentation

Thursday, April 29<sup>th</sup>

- Above and Below the Meander Line - Great Salt Lake Management, Climate Change, Water Issues, Users, and Politics (8am – 5:00pm)
- Poster Session Reception (5pm – 6:30pm)
- Special Screening of “Pirates of the Great Salt Lake” at Post Theatre (7:30pm)

Friday, April 30<sup>th</sup>

- Water Needs of Great Salt Lake – What We Know and What We Need to Know (8am – 3pm)
- Putting It All Together, Next Steps & Conference Conclusion (3pm – 4pm)

Saturday, May 1<sup>st</sup>

- SALTY (Sharing All Lake Things with Youth) Summit at Westminster College, Malouf Hall (2pm - 6pm)



Jeff Clay, 2006 ([www.clayhaus.net](http://www.clayhaus.net))

## Detailed Conference Schedule: Wednesday, April 28th

### *Scientific, Legal and Economic Perspectives on the Value of Saline Systems*

- 7:15 Registration and Continental Breakfast  
8:00 Welcome  
8:10 Nurturing Resilience – Lessons from Managing Complex Ecosystems  
*Lance Gunderson (Keynote)*  
9:00 Conservation and Management of the World's Increasingly Threatened Salt Lakes  
*Robert Jellison*
- 9:40 BREAK  
10:10 The Legal and Ethical Case for a Conservation Pool for Great Salt Lake  
*Robert W. Adler*  
10:50 Valuing Ecosystem Services In River and Lake Systems: Methods and Case Studies from the Western US, including Mono Lake, California  
*John Duffield*
- 11:50 LUNCH  
Awarding of 2010 Doyle Stephens Scholarship  
2009 Scholarship Recipient Presentation  
*Gregory Carling*

### *Restoration Efforts on Three Saline Lakes in the West – Mono Lake, Owens Lake, Walker Lake*

- 1:20 Importance of Western Wetland Basins to Aquatic Migratory Birds  
*Gary L. Ivey*  
2:10 Beyond Victory – Restoration, Policy Development, and Building Public Awareness for Mono Lake  
*Geoff McQuilkin*  
2:50 Public Trust and the Legal Framework at Mono Lake, California  
*Richard Roos-Collins*
- 3:30 BREAK  
4:00 Dust Storms from a Dry Lakebed Drive Owens Lake Mitigation and Restoration Efforts  
*Peter Pumphrey*  
4:40 Economic Viability of Low Water-Use Crops in the Walker River Basin  
*Kynda Curtis*
- 6:30 – 9:30 BANQUET – Alta Club  
Linking Communities, Wetlands and Migratory Birds  
*Don Paul*
- 2010 Friend of the Lake Award Presentation

## Detailed Conference Schedule: Thursday, April 29<sup>th</sup>

*Above and Below the Meander Line –  
GSL Management, Climate Change, Water Issues, Users, and Politics*

- 7:15 Registration and Continental Breakfast
- 8:00 Welcome
- 8:10 Whither the Great Salt Lake in a Warming Climate  
*Frederic H. Wagner*  
Dirty Little Secrets of the Greatest Snow on Earth and the Future of the Great Salt Lake  
*Jim Steenburgh*
- 9:00 Predicted Population Growth and Demands on Water Resources  
*Eric Klotz*  
How Might Great Salt Lake React to Future Demands on Water Resources Upstream?  
*Craig Miller*
- 9:40 BREAK
- 10:10 Legal and Institutional Barriers To Changing Our Water Allocation System To Address Changing Societal Values  
*Steven E. Clyde*
- 10:50 Water Appropriation Requests from Great Salt Lake and its Tributaries and Effects on the System  
*Kent L. Jones*
- 11:50 LUNCH
- 1:20 State Responsibilities on Great Salt Lake  
*Jodi Gardberg*
- 2:10 Below the Meander- Management of Great Salt Lake  
*Dave Grierson*
- 2:50 Lake Level Effects on Great Salt Lake Ecosystem Structure and Function  
*Gary Belovsky*
- 3:30 BREAK
- 4:00 A Manager's Overview of Great Salt Lake from Lake Elevations 4194'-4205'  
*W. Clay Perschon*
- 5:00 - 6:30 POSTER Session Reception  
Wine and appetizers  
Music by the Avenues Jazz Trio
- 7:30 Film Screening, "Pirates of the Great Salt Lake" at Post Theatre

## Detailed Conference Schedule: Friday, April 30<sup>th</sup>

### *Water Needs of Great Salt Lake - What We Know & What We Need to Know*

7:15 Registration and Continental Breakfast

8:00 Welcome

8:10 How Low Do We Go (and When Should We Do It)?

*Leland Myers*

9:00 Developing a Conservation Pool for the Great Salt Lake

*Nathan Darnall*

9:40 BREAK

10:10 Salinity Tolerance of Artemia and Ephydra: Uncertainty and Discrepancies

*Phil Brown*

10:50 Nutrient Input Modeling to Great Salt Lake

*Dave Naftz*

11:50 LUNCH

1:20 Can the Extraordinary Legacy of Utah Waterfowling on the Great Salt Lake Survive Permanently Reduced Lake Levels?

*Jack Ray*

2:10 What Effects Do Low Lake Levels Have on Recreational Sailing and Search and Rescue Efforts?

*Dave Shearer*

2:50 Forum Summation and What Happens Next?

*Jim Carter*



Gulls by Charles Uibel, 2007

## Special Events

Keynote Speaker – Lance Gunderson



### *Nurturing Resilience – Lessons from Managing Complex Ecosystems*

Ecological resilience, adaptive cycles and panarchy are all concepts developed to explain abrupt and often surprising changes in complex systems of people and nature. These changes involve qualitative and quantitative shifts in system structure and processes. These types of shifts pose great problems and uncertainties for stakeholders, citizens and agencies who attempt to manage and intervene in these complex systems. From these precepts of complex ecosystems, practical approaches of adaptive management and adaptive governance have emerged. Lessons from the application of these ideas in the United States and Australia will be used to show why nurturing resilience may be a helpful organizing concept for fostering ecosystem management.

Lance Gunderson is a systems ecologist who is interested in how people assess, understand and manage large ecosystems. He received B.S., M.S. and Ph.D. degrees from the University of Florida. He has worked as a research botanist for the U.S. National Park Service in southern Florida (1979-89), as a research scientist at the University of Florida (1992-98), and as founding chair (1999-2005) and faculty member of the Department of Environmental Studies at Emory University in Atlanta, Georgia (since 1999).

He is currently Co-Editor in Chief of *Ecology and Society*. He chaired the NAS/NRC committee on Ecological Effects of Road Density. He has also served as the executive director of the Resilience Network. He is a Beijer Fellow, with the Beijer International Institute for Ecological Economics, Swedish Royal Academy of Sciences.

Dr. Gunderson has been involved in the environmental assessment and management of large-scale ecosystems, including the Everglades, Florida Bay, Upper Mississippi River Basin, and the Grand Canyon. His interests are in the human and institutional dimensions to resource ecology, and to that end, he has co-edited several books including *Barriers and Bridges to the Renewal of Ecosystems and Institutions*, *Panarchy: Understanding Transformations in Systems of Humans and Nature*, and *Resilience and the Behavior of Large Scale Ecosystems*. Dr. Gunderson also edited *Foundations of Ecological Resilience*, published in 2009.

## Special Events

*Banquet Speaker – Don Paul*



### *Linking Communities, Wetlands and Migratory Birds*

Linking Communities, Wetlands and Migratory Birds is an experiment in range-wide bird conservation founded in the idea that communities can make a difference in their quality of life through conservation and stewardship of the natural resources that surround them. It is a practical example of the notion to think globally, act locally. Its particular worth is grounded in focusing on specific migratory bird populations and communities that affect their quality of life. The communities sharing similar migratory bird resources work together toward achieving conservation goals. The outcomes are both challenging and stimulating and often serendipitous.

Don Paul is president of AvianWest Inc., a bird and habitat conservation business. He currently serves on the Shorebird Science Team for the Intermountain West Joint Venture and recently served as a committee member of the Waterbird Conservation Council of the Americas. He is an active member of the Linking Communities, Wetlands and Migratory Birds, Utah Committee. He also consults for a variety of organizations interested in conservation as a fundamental part of doing business and contributing to the quality of life.

Mr. Paul is a career wildlife biologist, having served 34 years in several positions for the Utah Division of Wildlife Resources, and four years as the Great Basin Bird Conservation Region Coordinator. He is published in both scientific and popular conservation literature. His career emphasis takes two directions: conservation biology with emphases in international community conservation linkages, and avian conservation with experience in large-scale landscape bird monitoring.

## **Special Events**

### *Friend of the Lake Award*

The Friend of the Lake Award is given to a person, organization, or business performing outstanding work in education, research and/or advocacy to benefit Great Salt Lake. There is a vibrant and active community of people working on behalf of the lake. Their efforts help increase our understanding and awareness of our big salty neighbor. Understanding can lead to positive action for preservation of Great Salt Lake. To recognize these talents and contributions, FRIENDS of Great Salt Lake established an award to be presented at our Biennial Great Salt Lake Issues Forum. The 2010 Friend of the Lake Award will be given at the Banquet on Wednesday, April 28th at the Alta Club.

#### Previous Friend of the Lake Award Recipients

2008 was the first time the award was given to two recipients; one a doctor, and the other an attorney. The award went to Dr. Maunsel Pearce, Chair of the GSL Alliance, and Joro Walker, Senior Attorney at Western Resource Advocates. Dr. Pearce has always been there for the lake – advocating for better management, stronger protection, and greater recognition of this hemispherically important ecosystem. Joro Walker, with her legal prowess and commitment to this important ecosystem, has been extremely generous in providing the necessary legal insights and actions that have elevated the importance of a variety of issues directly affecting the future of the Lake.

In 2006, Al Trout, retired manager of the USFWS Bear River Migratory Bird Refuge in Brigham City, Utah, was honored. During the high water years of the 1980's, Al worked tirelessly to resurrect the Refuge and return it to a state of functionality as important wildlife habitat for native and migratory bird species. He was an arch advocate for Great Salt Lake preservation and protection and was always generous with his time in assisting FRIENDS with field trips, newsletter articles and presentations as needed.

In 2004, Joy Emory received the award. Joy is an environmental engineer and member of FRIENDS. She represents FRIENDS as one of the conservation stakeholders on the Kennecott South End Technical Advisory Committee as part of the EPA CERCLA program. Her understanding of extremely complex surface and ground water dynamics as it pertains to the remediation of mining contamination helped FRIENDS participate more fully in this important process.

In 2002, the first award was presented to the late Dr. Donald R. Currey, geomorphologist in the Geography Department at the University of Utah. Dr. Currey worked to raise awareness of the unique geomorphological features that surround Great Salt Lake and their tremendous value as archives to the past when Lake Bonneville covered this vast region of the west.

## Special Events

### *Doyle Stephens Scholarship Award and Presentation*

The 2010 Doyle W. Stephens Scholarship Award will be presented during lunch on Wednesday, April 28th. Immediately following the award presentation, Gregory Carling, the 2009 Doyle Stephens Scholarship recipient, will present his research.



Jeff Clay, 2009 ([www.clayhaus.net](http://www.clayhaus.net))

### About the Award

Doyle Stephens was born in Ogden, Utah, in 1944. He received his B.S. in Biology from Weber State College in 1967, his M.S. in Entomology in 1969, and his Ph.D. in Limnology from the University of Utah in 1974. At the time of his death in May 2000, Dr. Stephens had been a research hydrologist for the U.S. Geological Survey for nearly 20 years. In 2001, he was posthumously awarded the Governor's Medal for Science and Technology.

Through his work on Great Salt Lake, Doyle made significant contributions toward public awareness of critical issues relating to Utah's natural resources and environment.

This scholarship provides support to undergraduate or graduate students engaged in new or on-going research that furthers the understanding or protection of the Great Salt Lake Ecosystem.

Past recipients include:

Gregory T. Carling (2009) - University of Utah  
Christy Cottrell (2008) - Weber State University  
Misty Riddle (2006, 2007) - Westminster College  
Carla Koons Trentelman (2005) - Utah State University  
Ashlee Allred (2004) - Westminster College  
Henry Hyochang Lee (2003) - University of Utah

## Special Events

### *Pirates of the Great Salt Lake*

On Thursday evening, April 29<sup>th</sup>, we will have a special screening of “Pirates of the Great Salt Lake” at 7:30pm at the Post Theatre (245 South Fort Douglas Boulevard)



Join us for “Pirate talk so salty, you won’t believe your buccaneers!”

Rated PG-13, this film was directed by E.R. Nelson and produced in 2006.

#### Film synopsis:

Kirk Redgrave and Flint Weaver met only three weeks ago. But that hasn't stopped them from becoming the greatest pirates the Great Salt Lake has ever known. Still, pirate life isn't all that it's cracked up to be. For Kirk, it's a life of failure. For Flint, one without reward. That is until they stumble across a long lost treasure map that has the power to not only fulfill their wildest pirate dreams but curse them as well.

## Special Events

### *SALTY Summit and Mirror Images Art Show*

FRIENDS of Great Salt Lake, in partnership with Westminster College's Great Salt Lake Institute, will co-host a S.A.L.T.Y. (Sharing All Lake Things with Youth) Summit on Saturday, May 1<sup>st</sup> from 2-6pm in Westminster's Malouf Hall.

The Summit is open-house style and is FREE to youth of all ages. It will provide a unique opportunity for k – 12 students and families to come together and learn about Great Salt Lake and the surrounding environs. Come enjoy live entertainment, art activities, lectures, refreshments, a student share fair and competition, and lots of fun for all. The Summit will include a live bird show and a presentation by Rosalie Winard.

k-12 students who have completed a lake-related project (dealing with Great Salt Lake, the watershed, local ecosystems, etc.) are invited to bring the project to share. We welcome projects from all disciplines (science, art, writing, history, etc.).

A special art show, *Mirror Images – Great Salt Lake*, will follow SALTY on May 1<sup>st</sup> and will take place in Westminster's Tanner Atrium (Jewett Center for the Performing Arts) from 6-9pm. *Mirror Images* will be curated by art historian Hikmet Loe and will feature the work of over 30 contemporary artists.

More information about SALTY may be found at [www.fogsl.org](http://www.fogsl.org) or by emailing us at [pelican@fogsl.org](mailto:pelican@fogsl.org). Registration is required for SALTY.

For more information about the art show, please visit [www.westminstercollege.edu/gsli](http://www.westminstercollege.edu/gsli)



Rosalie Winard with Einstein the Pelican

## Speakers

### **Robert W. Adler**

*The Legal and Ethical Case for a Conservation Pool for Great Salt Lake*



Throughout much of the western United States, surface waters have been fully allocated or even over-allocated under the prevailing prior appropriation doctrine of western water law. Because the saline waters of Great Salt Lake are less useful for human consumptive uses (such as public water supply or irrigation), to date the lake has been spared some of the impacts of those policies. However, upstream withdrawals from freshwater source streams have already lowered lake levels significantly relative to what would occur under natural conditions. Moreover, lake levels are further threatened by additional potential future upstream withdrawals, proposals to appropriate additional water from the lake itself for mineral extraction and other purposes, and the potential hydrological impacts of climate change. Because significant further reductions in lake levels could severely affect ecological and other public uses and values of Great Salt Lake, it is important to explore the legal and ethical imperatives for preventing those impacts. Those might derive from the public trust doctrine, the Clean Water Act, the Endangered Species Act, constitutional and statutory components of Utah water law, and other sources.

Robert W. Adler is the James I. Farr Chair and Professor of Law at the University of Utah, S.J. Quinney College of Law. His books include *Restoring Colorado River Ecosystems: A Troubled Sense of Immensity* (Island Press, 2007); *Environmental Law: A Conceptual and Pragmatic Approach* (with David Driesen, Aspen, 2007); and *The Clean Water Act: 20 Years Later* (Island Press, 1993). Before joining the Utah faculty, he was Clean Water Program Director at the Natural Resources Defense Council, Executive Director of Trustees for Alaska, and a Staff Attorney with the Pennsylvania Department of Environmental Resources. Adler received his law degree from the Georgetown University Law Center in 1980, and his B.A. in ecology from Johns Hopkins University in 1977.

### **Gary Belovsky**

*Lake Level Effects on Great Salt Lake Ecosystem Structure and Function*



Monitoring and experimental data collected since 1994 by the Great Salt Lake Ecosystem Project along with previous sporadic observations on the Great Salt Lake ecosystem have been synthesized using path analysis and structural equation approaches. These analyses identify the direction and importance that various environmental changes can exert on the biota composing the ecosystem. An important driver of the Great Salt Lake ecosystem is lake level which affects salinity, but even more critically impacts nutrient dynamics. Nutrient dynamics are critical for phytoplankton productivity and taxonomic composition, which in turn is the main influence on brine shrimp (*Artemia franciscana*) abundance.

Ultimately, brine shrimp abundance has measurable impacts on the population of Eared Grebes (*Podiceps nigricollis*) and the brine shrimp industry.

Gary Belovsky is Gillen Director and Professor at the University of Notre Dame Environmental Research Center. He previously held faculty positions at Utah State University and the University of Michigan. Belovsky received a Ph.D. from Harvard University in 1977, a M.F.S. from Yale University in 1974, and a B.B.A. from the University of Notre Dame in 1972.

### **Phil Brown**

*Salinity Tolerance of Artemia and Ephydra: Uncertainty and Discrepancies*



A shrinking Great Salt Lake is expected to strain the current aquatic ecosystem through increased salinity. However, the upper range of salinity that can support viable brine shrimp (*Artemia franciscana*) and brine fly (*Ephydra* spp.) populations within this system is unknown to resource managers. Much of the existing research on salinity tolerance of *Artemia* has either examined different strains or species than those found in the Great Salt Lake, or focused on salinities well below those observed in Gilbert Bay for the past several years. Research on *Ephydra* is even more disparate. The results of existing studies often conflict and provide insufficient information to define the upper salinity level tolerated by these species. Additionally, it is unknown whether a direct physiological response to salinity or a change in algal food resources is the responsible stressor at high salinities. The identification of a maximum salinity threshold for the Great Salt Lake is important for determining a minimum acceptable lake elevation, and will require experiments specifically targeting the resident *Artemia* and *Ephydra* populations.

Phil Brown is an aquatic biologist with the Utah Division of Wildlife Resource's Great Salt Lake Ecosystem Program. He received a Bachelor's degree in watershed science from Utah State University and a Master's degree in freshwater ecology from Oregon State University in 2008. A native of Utah, Phil had never visited the Great Salt Lake until he worked on the lake as a research technician in 2005 for Dr. Wayne Wurtsbaugh of Utah State University. Now, Phil is thrilled to be conducting fieldwork and research for the Great Salt Lake Ecosystem Program, which is charged with monitoring the brine shrimp population and furthering knowledge of the lake's ecology.

## **Gregory Carling**

### *Trace Element Particulate Pulse and Diel (24-hr) Variations in a Freshwater Wetland Adjacent to Great Salt Lake*



Avian wildlife exposure to trace elements such as mercury and selenium is a result of trace element loads and removal processes occurring in lakes and wetlands. Trace element loads to Great Salt Lake are generally calculated using concentrations measured during daytime hours. However, certain trace elements are known to vary on a diel (24-hr) cycle due to a variety of physical and chemical processes. Loads are an important aspect of calculating numerical water quality standards. Therefore, failing to account for nighttime trace element concentrations could potentially lead to miscalculated trace element loads and biased numerical standards.

In order to more fully understand diel cycling in freshwater wetlands which drain to Great Salt Lake, trace elements and water chemistry (dissolved oxygen, pH, water temperature, etc.) were monitored over a 24-hr period from the outlet of two ponds located at the Ambassador Duck Club wetland complex during August 20-21, 2008 and September 14-15, 2009. Unfiltered and filtered (0.45 micron) samples were collected hourly for all trace elements. Al, Fe, Hg, and Pb were predominantly (>75% of mass) associated with the >0.45 micron, or particulate, fraction. Cd, Cu, Cr, Mn, and Ti were also associated with the particulate fraction to a lesser extent (25-75% of mass). As, Li, Mg, Mo, Sb, Se, Sr, U, and V were predominantly in the “dissolved” (<0.45 micron) form. The particulate-associated elements showed large variations in concentration (up to a factor of 4), most likely due to settling and resuspension of particulate matter in the water column. Certain “dissolved” trace elements (Sb, Se, Sr, U, and V) showed a diel variation in phase with dissolved oxygen, pH and water temperature: high in daylight hours corresponding to oxic conditions and low in nighttime hours corresponding to suboxic conditions. Methyl mercury, which has been shown to vary on a diel cycle in other locations, was consistently low at both ponds, indicating little methylation potential in the Ambassador Duck Club ponds.

Gregory Carling is a third year Ph.D. student in the Department of Geology & Geophysics at the University of Utah. His current research involves dust deposition in the Wasatch Mountains, trace element cycling in the freshwater wetlands adjacent to Great Salt Lake, and mercury methylation in Farmington Bay. During the past two years, Greg has been involved with K-12 outreach as a WEST (Water, Environment, Science and Teaching) and TGLL (Think Globally, Learn Locally) fellow. These fellowships have given him the opportunity to teach 4th and 7th grade science and lead field trips for hundreds of K-12 students. Greg earned a B.S. and M.S. degree in geology from Brigham Young University.

## **Jim Carter**

### *Forum Summation and What Happens Next?*

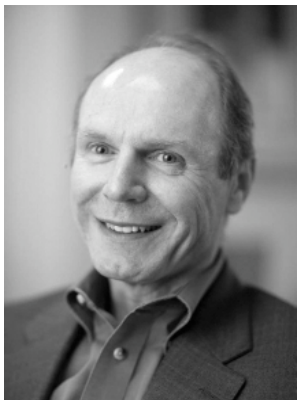


An unstated assumption has been that there will always be a Great Salt Lake. The geologic history of Great Salt Lake, climate change, and increasing demands for consumptive water uses suggest that may not be a safe assumption. We have heard about the value and importance of maintaining the health of the Great Salt Lake ecosystem, and about western water law and policy. We know that water in the west is both a commodity and a resource, in much the same way that light is both particle and wave. Our next steps will be to create a unified theory of ecosystem science, water law, public policy, and societal values that reconciles the disparities of these disciplines to yield a legally and politically supportable framework and plan to secure the future of Great Salt Lake.

Jim Carter is a certified planner, attorney, and public administrator with more than 34 years of experience in law, community planning, and natural resources management. Since joining Logan Simpson Design in 2006, Jim has worked with cities and counties in Arizona, Utah, and Idaho on community planning and ordinance development projects. His previous positions have involved work with the Utah Lake Master Plan, the Utah Division of Oil, Gas and Mining, and the Great Salt Lake Plan. Jim Carter has also worked as an exploration and engineering geologist.

## **Steven E. Clyde**

### *Legal and Institutional Barriers To Changing Our Water Allocation System To Address Changing Societal Values*



Utah adopted the prior appropriation doctrine as its method of water allocation during its early territorial days. It was codified in 1903 and remains the law governing the use of water in the State. Under the doctrine, water is allocated based on whoever is first, without regard to the utility or social value of the use being made or those that might be precluded. The principle limitation on the appropriation or the change of use of established water rights is that the intended use must not harm other water users, although other limitations do exist in the doctrine.

Agriculture was the primary occupation at the time of settlement, and the majority of the readily accessible water was appropriated for agricultural use. These early appropriators acquired vested, protected property rights in the right to use a fixed quantity of water for their intended beneficial use. The basic tenet of the doctrine, "first in time is first in right," provided security for investment enabling the West to develop in the 19th century. However, many stakeholders were left out of the water allocation process and are now seeking a seat at the table. As a common law doctrine, the prior appropriation doctrine is inherently flexible. The doctrine has evolved over time in response to changing societal values, but those changes occur very slowly. The water itself remains the property of the State who holds title for the benefit of all of its citizens. Appropriated rights are clearly limited by the public interest, and this reality creates avenues for change to occur really without significant modification of the doctrine itself.

Unfortunately, there is significant institutional resistance to change, not the least of which is the Utah Legislature where water allocation policies are best addressed.

This presentation will discuss the institutional framework of the prior appropriation doctrine and explore the tools existing within the doctrine to address changing social values including the ability to reallocate currently appropriated water to protect the unique ecosystem of the Great Salt Lake.

For over ten consecutive years, Steven Clyde has been recognized as one of the Best Lawyers in America for his work in environmental and natural resources law. For thirty-four years, he has represented clients in the buying, selling, and conversion of water rights; litigated water rights appeals in the district and federal courts and Supreme Court of the State of Utah; represented parties in the negotiations of a Lease of Power Privilege on Bureau of Reclamation Facilities for the Central Utah Project; and represented individuals and entities before the State Engineer of the State of Utah, both as applicants and as protestants to water rights applications. Mr. Clyde is a graduate of the University of Utah.

### **Kynda Curtis**

*Economic Viability of Low Water-Use Crops in the Walker River Basin*



Walker Lake is facing critical water shortages and becoming excessively saline due to surface water withdrawals from its sources, endangering its ecosystem and economic resources. Water diverted from surface inputs for agricultural use is one cause of this shortage. Unless agricultural water use can be reduced, the ecology of Walker Lake will be altered. The implementation of alternative low water-use crops is one option for producers, but is it economically feasible? This study uses the WinEPIC model, which synthesizes both agronomics and economics, to model yields and returns to alternative crop production under differing irrigation levels. Risk analysis, or the distribution of net returns to alternative crop production, is also examined through the use of SIMETAR. Data on current and alternative crops for this study include cost and return studies, producer interviews, and field trials in Northwest Nevada. Study results show that there are alternative crops that could be feasibly substituted for alfalfa or used as a diversification strategy, while reducing water use by at least one-half. Net returns meet or exceed returns from alfalfa, maintaining profitable agricultural operations.

Kynda Curtis is Assistant Professor in the Department of Resource Economics at the University of Nevada, Reno and State Specialist for University of Nevada Cooperative Extension. Her areas of research interest include international agriculture/food marketing, consumer economics and industrial organization. She works with Nevada agricultural producers to assist them in developing new markets for their products and assessing the feasibility of new products and value-added processes.

## **Nathan Darnall**

*Developing a Conservation Pool for the Great Salt Lake*

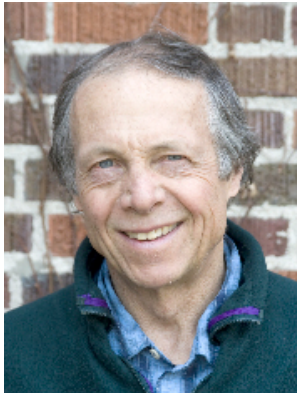


In a July 7, 2009 letter to the State Engineer, the U.S. Fish and Wildlife Service recommended the State establish a conservation pool to protect the internationally-recognized Great Salt Lake. For most lakes with conservation pools, humans have the ability to maintain a minimum lake elevation by simply adjusting flows that leave the lake. Maintaining a minimum pool at the Great Salt Lake may be a challenge, since lake elevations are heavily influenced by precipitation and since evaporation is the primary way water leaves the system rather than anthropogenic diversions that we can adjust; however, there are possible opportunities to help maintain a minimum lake elevation. Doing so will lead to a healthier ecosystem and will benefit the citizens of Utah. The presentation will briefly discuss the concept of conservation pools, highlight the value of the Great Salt Lake, identify potential consequences of allowing the Lake to dry up, and suggest ways to maintain water levels given climatic, legal and political constraints.

Nathan Darnall is Migratory Bird Coordinator for the U.S. Fish and Wildlife Service and has been working for USFWS since 1996. His previous work includes a variety of avian research projects involving topics such as reproductive success, habitat restoration, vocalizations, and agricultural impacts on nesting. He received a M.P.A. from the University of Utah in 2009 and a B.S. (Wildlife Biology) from Colorado State University in 1992.

## **John Duffield**

*Valuing Ecosystem Services in River and Lake Systems: Methods and Case Studies from the Western US, including Mono Lake, California*



A primary threat to the long-term sustainability of aquatic ecosystems in the Western United States is from water resource development, particularly from hydroelectric power dams and extractive water uses such as irrigation, municipal, and industrial uses. In the future, climate change is likely to exacerbate the competition for scarce water resources. This presentation outlines the use of nonmarket valuation tools to help inform efficient and fair allocation of water resources between environmental services, such as biodiversity and recreation, and extractive uses. Human uses of riverine and lacustrine ecosystem services fall into two general classes: direct uses such as fishing, hunting, boating, or wildlife observation, and passive uses that may be motivated by existence or bequest motives, such as the desire to conserve endangered species and unique environments for future generations. Examples where changes in water quality or quantity affect direct use will be discussed, including instream flows to benefit fisheries on Montana's Big Hole and Bitterroot Rivers, and the effect of lake level changes on visitor use at Lake Powell. Passive use valuation cases include the evaluation of dam removal on the Elwah River, and increased inflows to Mono Lake. The latter is a saline system, and the economics of that case have some similarity to resource allocation issues for the Great Salt Lake.

John Duffield is a natural resource economist at the University of Montana, where he has taught and conducted research for the last 35 years. He has contributed to the development and application of tools for the economic valuation of nonmarket resources such as fish, wildlife, recreation, and other ecosystem services. This work has helped inform public policy decisions that require weighing production of marketed goods against potentially foregone environmental services. John was born and raised in Montana and received a Ph.D. in economics from Yale (1974) and a B.A. (economics and math) from Northwestern (1968).

### **Jodi Gardberg**

*State Responsibilities on Great Salt Lake*



This presentation will summarize state agency responsibilities to Great Salt Lake focusing on the Divisions within the Department of Natural Resources and the Division of Environmental Quality and present House Bill 343. The bill was passed by the legislature during the 2010 General Session, creating the Great Salt Lake Advisory Council.

Jodi Gardberg is the Great Salt Lake Watershed Coordinator for the Utah Department of Environmental Quality, Division of Water Quality (UDWQ). In this capacity, she coordinates UDWQ activities pertaining to the lake including staff support for the Great Salt Lake Advisory Council, ecosystem assessments of the open water and wetlands and 401 certification planning. In addition, she is a Statewide Mercury Coordinator and assists with the Statewide Mercury Workgroup, research, fish sampling and consumption advisories.

### **Dave Grierson**

*Below the Meander – Management of Great Salt Lake*



The Division of Forestry, Fire and State Lands is charged by statute to be the management authority on the sovereign lands in the State of Utah. Managing the sovereign lands with a mix of conflicting uses poses a challenge in developing and implementing public policy on these lands. There are over 500 miles of shoreline and 1.3 million acres of land and lakebed in Great Salt Lake, presenting many challenges for the management of those lands. There is great diversity of uses on Great Salt Lake including recreation, aquatic and migratory birds, mineral extraction, brine shrimp harvesting, nutraceuticals and a host of other uses. Management direction for those lands come from Public Trust Doctrine, state statute, rules and regulations, and the Great Salt Lake Comprehensive Management Plan. This talk centers on the difficulties of managing a large, complex lake, among a host of administrative and regulatory agencies, for a wide range of often conflicting uses.

Dave Grierson is the Sovereign Lands Coordinator/Planner for the Utah Division of Forestry, Fire and State Lands.

## **Lance Gunderson**

*Nurturing Resilience – Lessons From Managing Complex Ecosystems*

Please see “Special Events: Keynote Speaker” for complete abstract information.

## **Gary Ivey**

*Importance of Western Wetland Basins to Aquatic Migratory Birds*



The North American west contains some of the driest regions on the continent, where wetlands are isolated oases in this desert region. The region supports a great diversity of wetland habitats both within wetland basins and on a regional scale, and these habitats support very high numbers of aquatic migratory birds. Literally millions of aquatic birds depend on these wetlands which support more than half the world’s population of some aquatic bird species. These wetlands provide critical breeding, migration and wintering habitats for a great diversity of aquatic birds. This presentation will review our knowledge of the importance and connectivity of major wetland basins to migratory birds and review a few case studies of connectivity and movements of birds across this landscape.

Gary Ivey works for International Crane Foundation. Over the past 18 years, he has served as a biologist at various western National Wildlife Refuges. He has over 30 years of experience working with wetlands, waterfowl and waterbird management and conservation planning in the west, with particular emphasis on sandhill cranes in the Pacific Flyway. Mr. Ivey is a Ph.D. candidate at Oregon State University where he is studying the wintering ecology of sandhill cranes in California.

## **Robert Jellison**

*Conservation and Management of the World’s Increasingly Threatened Salt Lakes*



Salt lakes are widespread throughout the arid and sub-arid regions of the world and include a diverse array of aquatic ecosystems of considerable ecological value. Changes in the size and salinity of salt lakes markedly affect their ecological values and throughout much of the 20th century most large salt lakes have shrunk or been desiccated due to water diversions for irrigated agriculture. During the past several decades their ecological importance, especially to migrating and breeding birds, has been widely recognized and conservation efforts have been initiated by international, national, and local non-governmental organizations. Improved agricultural practices, reallocations and restrictions on water rights, and large-scale engineering projects have all played a role in the conservation of salt lakes. However, economic development and population increases are causing ever-increasing demands for fresh water, and salt lakes remain among the most imperiled natural habitats. Their fates will largely be decided by this generation.

Robert Jellison conducted his doctoral research on the limnology of hypersaline Mono Lake during an extended period of meromixis. He earned his Ph.D. in limnology at the University of California, Santa Barbara (1992) and continued his studies of Mono Lake as a research associate at the University of California. His saline lake research has ranged from viruses to

birds, and he has been a leader in illustrating how natural variations in local climate and anthropogenic influences affect the functioning of salt lake ecosystems. He is keenly interested in the scientific management and conservation of salt lakes worldwide.

**Kent L. Jones**

*Water Appropriation Requests from Great Salt Lake and its Tributaries and Effects on the System*



This presentation will discuss the appropriation processes of the State Engineer as authorized under Statute. Section 73-3 of the Utah Code outlines processing and approval criteria for considering applications filed with the Division of Water Rights. The statute directs the State Engineer to approve applications “if there is unappropriated water in the source; the proposed use will not impair existing rights or interfere with the more beneficial use of the water; the proposed plan is physically and economically feasible... and would not prove detrimental to the public welfare; the applicant has the financial ability to complete the proposed works; and the application was filed in good faith and not for the purposes of speculation or monopoly.” Statute gives direction that “if the State Engineer... has reason to believe that an application... will interfere with its more beneficial use... or will unreasonably affect public recreation or the natural stream environment, or prove detrimental to the public welfare,” the State Engineer shall “withhold approval or rejection of the application until the State Engineer has investigated the matter.” An evaluation of the statutory criteria will be made as part of the presentation.

The discussion will also include an evaluation of the types of applications approved and the impacts that may be expected in the Great Salt Lake as these applications are developed. Recently filed applications will also be reviewed concerning their attributes, proposed uses, and processing requirements.

Kent L. Jones is the Utah State Engineer and is responsible for the general administrative supervision of the waters of Utah and the measurement, appropriation, apportionment, and distribution of those waters. He spent 21 years as the state water right hearing officer and worked previously as an engineer. Mr. Jones graduated from Utah State University with a Bachelor’s Degree in Civil and Environmental Engineering in 1975.

**Eric Klotz**

*Predicted Population Growth and Demands on Water Resources*



This presentation will show how the state intends to meet future water needs. Conservation, agricultural water being transferred to municipal and industrial uses, as well as new water development projects, will all play a role in ensuring an adequate water supply for some nearly 6 million people expected to live in Utah in 2050. The four main hydrological basins flowing into Great Salt Lake currently contain about 2.5 million people. What will the doubling of this population, expected by 2050, do to the hydrology of Great Salt Lake? How will lake levels be affected? These are some of the questions this presentation hopes to answer as we bring more

understanding to the issue of future water use along the Wasatch Front.

Eric Klotz is a Registered Professional Engineer in the state of Utah. He has been with the Utah Division of Water Resources for 24 years and currently manages the Water Conservation and Education Section. The state's goal is to reduce per capita water use by at least 25% by the year 2050. Mr. Klotz obtained a B.S. degree in Civil Engineering from Michigan Technological University in 1983.

### **Geoff McQuilkin**

*Beyond Victory – Restoration, Policy Development, and Building Public Awareness for Mono Lake*



The tremendous environmental successes at Mono Lake, California, have been achieved through precedent-setting legal rulings and water rights decisions. The Mono Lake Committee works on the premise that victories on paper require day-to-day commitment to produce true change on the ground. To that end, the Committee works on the ground, in the public policy arena, and with youth education to build an ongoing public vision of a healthy future for Mono Lake. Geoff McQuilkin will discuss the Mono Lake water story, the ongoing 15-year restoration effort for the lake and its tributary streams, and the continuing challenges that confront the effort to protect one of our most ecologically and scenically remarkable salt

lakes.

Geoff McQuilkin became a Mono Lake Committee member in fifth grade, and his enthusiasm for Mono Lake has never waned. As Executive Director of the nonprofit organization for the past decade, he oversees the citizen group's protection, restoration, education, and science programs. He was part of the historic State Water Board proceedings leading to the 1994 order mandating lake protection and stream restoration. A graduate of Harvard in the History of Science, Geoff McQuilkin lives at Mono Lake with his wife and two daughters.

### **Craig Miller**

*How Might Great Salt Lake React to Future Demands on Water Resources Upstream?*



The Great Salt Lake accumulates the effects of water use and depletions of an ever expanding human population within its basin which includes the largest part of the population of Utah. How do various human activities influence the lake's elevation? What are the activities that have the most impact? With all the changes likely to happen in the next fifty years, how might the elevation of the Great Salt Lake be affected? How have the activities of man affected the lake up until now? This presentation will attempt to answer these questions and explain the issues which affect the flow of water into Utah's most famous water body.

Craig W. Miller has worked for the Utah Division of Water Resources (DWRe) for 30 years, first in design and finally in hydrology and computer applications. He began working with various models of the Great Salt Lake in the 1980's. Mr. Miller was born in California and

received a degree in civil engineering from Brigham Young University in 1975 and a master's degree in agricultural and irrigation engineering from Utah State University in 1979. In addition to his work at DWRe, he now teaches part-time at Salt Lake Community College.

### **Leland Myers**

*How Low Do We Go (and When Should We Do It)?*



Wastewater treatment technologies have increased dramatically since the inception of the Clean Water Act. Initially there was secondary treatment which was based on readily available technology in 1972. Then came additional treatment needs based on compliance with water quality standards. This additional treatment was called tertiary treatment and included the reduction of one or more pollutants. With the advent of better analysis technology, we now identify pollutants that previously were not identified. So, in addition to nutrients and toxics which have been the standard targeted pollutants, we are adding endocrine disruptors and a host of other pollutants which are in pharmaceuticals and personal care products. As treatment increases, the cost for treatment increases also. Water quality improves and the question is soon asked, is this water too valuable to just discharge to a river, lake or stream? This question begs an answer and pits man's use of water against the needs of natural systems. This presentation will discuss this conflict.

Leland Myers is General Manager of Central Davis Sewer District. He serves on boards such as the Water Quality Board, The Blue Stakes Board, the Metro Water District of Salt Lake and Sandy's Board and the Great Salt Lake Advisory Council. He is happy to have his head in a manhole where he can monitor the sewer on a close personal basis. He has a master's degree in Environmental Engineering and is a registered professional engineer. He is also a certified wastewater operator and owns two plungers if you ever need to borrow one.

### **Dave Naftz**

*Nutrient Input Modeling to Great Salt Lake*



Great Salt Lake (GSL) receives wastewater discharges from > 15 treatment plants serving metropolitan areas along the Wasatch Front. Farmington Bay (FB), a causeway restricted bay of GSL, receives a substantial portion of this wastewater discharge. This bay is hypereutrophic with massive blooms of toxic cyanobacteria, and concentrations of toxic nodularin have exceeded 200 mg/L (Wurtsbaugh et al., 2009). Previous isotopic analyses (Naftz et al., 2008) have suggested that brine shrimp utilize particulate matter exported from FB; however, additional sampling is needed to confirm these results. To date (2010), only limited data have been collected to determine the annual nutrient inputs into GSL and how these nutrient inputs compare to the nutrient pool residing in Gilbert Bay. From 2003 through 2008, the USGS, in cooperation with the Utah Department of Natural Resources/Division of Wildlife Resources (UDNR/DWR) measured nutrient inputs from Bear River, FB, and Weber River to Gilbert Bay. Nutrients that were monitored included ammonia, phosphate, total nitrogen (dissolved and particulate), total phosphorus (dissolved and particulate), and total

particulate carbon. The USGS loading software, LOADEST, was used to estimate the daily mass loading of nutrients from the three input sites for the period of October 2003 through March 2008. In order to compare incoming nutrient loads to the residual nutrient pool in Gilbert Bay, the same nutrient species were concurrently monitored at four open-water lake sites. Model results found the mean monthly nitrogen (dissolved + particulate) load to Gilbert Bay was 360,000 kg. Although the Bear River watershed is > 2X larger than the Jordan River watershed, FB inflow provided > 51% of the dissolved nitrogen load to Gilbert Bay compared to ~ 46% of the dissolved nitrogen load from Bear River. Relative amounts of annual nutrient loads from Bear River were significantly reduced during lower-than-average runoff years. During water year 2006, riverine load of total nitrogen (dissolved + particulate) was about 8% of the mass residing in Gilbert Bay (70% epilimnion and 22% hypolimnion). In cooperation with UDNR/DWR, nutrient monitoring and modeling efforts on GSL are continuing with the inclusion of two additional inflow sites.

#### References

Naftz, D.L., Angerth, C., Kenney, T., Waddell, B., Silva, S., Darnall, N., Perschon, C., and Whitehead, J., 2008, Anthropogenic influences on the input and biogeochemical cycling of nutrients and mercury in Great Salt Lake, Utah, USA: Applied Geochemistry, vol. 23, p. 1731-1744.

Wurtsbaugh, W.A., Naftz, D.L., and Bradt, S.R., 2009, Eutrophication, nutrient fluxes and connectivity between the bays of Great Salt Lake, Utah (USA): In, A. Oren, D. Naftz, P. Palacios and W.A. Wurtsbaugh (eds). Saline Lakes Around the World: Unique Systems with Unique Values. Natural Resources and Environmental Issues, volume XV. S.J. and Jessie E. Quinney Natural Resources Research Library, Logan, Utah, USA.

Dave Naftz has been a research hydrologist with the U.S. Geological Survey/Utah Water Science Center for over 25 years. He received his Ph.D. in Geochemistry from the Colorado School of Mines and is an adjunct faculty member at the University of Utah and Utah State University. Dr. Naftz has done research on a variety of water-quality and climate-related issues in the western United States and began his research on Great Salt Lake in 2001. His research interests on Great Salt Lake have included mercury and selenium geochemistry, nutrient cycling, historical reconstruction of anthropogenic pollutants, and submarine groundwater discharge.

#### **Don Paul**

*Linking Hemispheric Partners to Achieve Range-wide Migratory Bird Species and Habitat Conservation*

Please see "Special Events: Banquet Speaker" for complete abstract information.

## **W. Clay Perschon**

### *A Manager's Overview of Great Salt Lake from Lake Elevations 4194'-4205'*

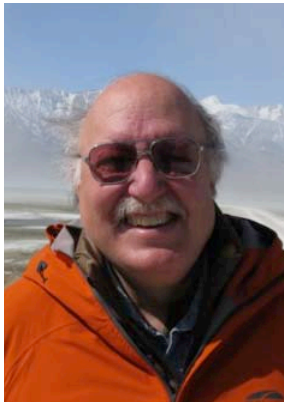


Great Salt Lake elevations fluctuate naturally as a terminal basin lake. Morphology of this shallow basin lake changes dramatically with surface level fluctuations. Bird habitats are created and lost, the water volume can affect brine shrimp population levels, bioherms become exposed and beach areas change. Observations related to these changes are presented and examined.

W. Clay Perschon began working with the Utah Division of Wildlife Resources as a student in 1973 at Ogden Bay Waterfowl Management Area. His professional career started in 1976 when he was hired as the Conservation Officer at Dutch John, Utah. Since then he has held positions as biologist, regional Habitat Manager and Regional Supervisor. In 1996 he put together the Great Salt Lake Ecosystem Program which included cooperative law enforcement of the brine shrimp fishery, management of that fishery and a research program to study the different components of the lake ecosystem. Currently he is the fisheries research and special projects coordinator.

## **Peter Pumphrey**

### *Dust Storms from a Dry Lakebed Drive Owens Lake Mitigation and Restoration Efforts*



Located beneath the peaks of the southern Sierra Nevada, Owens Lake is the remnant of the Pleistocene era. The lake began to recede at the end of the last glacial age. This process was accelerated by the opening of the City of Los Angeles Department of Water and Power Owens Valley aqueduct in 1913. The diversion of the inflow of the Owens River resulted in the drying of the lakebed by 1924. The lake shriveled to a brine pool surrounded by friable alkali soils and became the source of huge dust storms which created plumes as high as 10,000 feet in altitude and drifted for 150 miles downwind. The loss of more than one million tons of lakebed per year made the lake the largest source of PM10 emissions in the United States.

As a result, Owens Dry Lake was designated by the EPA as a “serious non-attainment site” pursuant to the Clean Air Act. The City of Los Angeles was required to mitigate the air quality effects of its water diversions. The mitigation effort is subject to oversight by the Great Basin Air Pollution Control District and DWP activities on the lakebed lie within the jurisdiction of the California State Lands Commission and California Department of Fish and Game. Dust control has been accomplished through the introduction of managed vegetation and application of water creating shallow flooding of more than 40 square miles of surface. These control measures have been successful at significantly reducing the dust problem.

The return of water to the lakebed brought a return of large populations of shorebirds and migrating waterfowl. In addition, the managed vegetation areas have provided shelter to many varieties of songbirds. The habitat is so valuable that, in 2001, Owens Lake received designation as an “Important Bird Area” by the Audubon Society. In 2008, the Eastern Sierra Audubon Society initiated a process aimed at preserving the Owens Lake wildlife

habitat. Now, three years later, the Department of Water and Power is sponsoring a collaborative process to design a master plan for the future of the lake which will include permanently protected habitat while the remaining portions of the lakebed are managed for dust control and, possibly, for solar energy generation.

Peter Pumphrey is a retired environmental prosecutor living near Bishop, California. He is the President of the Eastern Sierra Audubon Society. He is also the Treasurer of the State Bar of California Environmental Law Section, a member of the Board of Directors of the Sierra Nevada Alliance, an Advisory Board member of the Eastern Sierra Land Trust and the chair of the Chalfant Valley Fire Department District Commission. Mr. Pumphrey is a licensed fishing guide and contributes to California Fly Fishing magazine.

### **Jack Ray**

*Can the Extraordinary Legacy of Utah Waterfowling on the Great Salt Lake Survive Permanently Reduced Lake Levels?*



The astonishing numbers of wildfowl drawn to the Great Salt Lake have nourished local residents as long as people have lived along its shores. Instead of abandoning this dependence, the first 100 years of settlement of the region only strengthened it. Subsistence hunting to market hunting to "recreational" hunting evolved with time to form a strong cultural connection to the Lake as generations of Utahns relied on it for food, fun and a bond with a unique natural environment. Although that reliance continues to feed, literally and figuratively, the state's 15,000 waterfowlers and the tens of thousands of Utahns who consume the Lake's bounty, it is increasingly threatened. Industrial development has gradually

overrun miles of surrounding private marshes, contaminated water and, now, brings the pending loss of enough of the Lake's water to irretrievably cripple an already weakened ecosystem. The remaining private and public marshes preserved for decades by or at the behest of the state's waterfowlers serve as the last bastions of this heritage but could easily fall silent with the loss of the Lake's wildlife and the way of life that arose from it.

Jack Ray is vice-president of the Utah Waterfowl Association and an attorney with the Salt Lake City firm of Fabian & Clendenin. The mission of the UWA is to "preserve Utah's waterfowl, waterfowl habitat and rich waterfowling heritage." It represents Utah's 15,000 waterfowlers who carry on a generations long heritage born of and dependent on the lake's health. Mr. Ray began spending his spare time in the marshes surrounding the lake as a young teen, and he and his family frequent those same marshes throughout the year.

## **Richard Roos-Collins**

### *Public trust and the legal framework at Mono Lake*



This presentation will describe the legal basis for the 1994 amendments to Los Angeles' water rights which, as originally issued in 1940, permitted the diversion of all tributary flows to Mono Lake. It will summarize the strategies which the Mono Lake Committee and California Trout successfully used to apply the public trust doctrine and related statutes across nearly 20 years of litigation. It will look ahead to 2014, when the State will review whether the 1994 amendments have achieved their ecological objectives. Finally, it will emphasize lessons learned in the Mono Lake Cases to face emerging challenges, including climate change.

Richard Roos-Collins is Director of Legal Services at the Natural Heritage Institute, a public-interest law firm based in San Francisco, California. Since 1991, he has represented public agencies and non-profit organizations in water and energy matters. Mr. Roos-Collins was trial counsel for California Trout in the Mono Lake Cases, which established a rule of law that water rights must protect public trust resources. Before joining NHI, he was Attorney-Adviser, Office of General Counsel, U.S. Environmental Protection Agency (1986-1989) and Deputy Attorney General, California Department of Justice (1989-1991). He is a graduate of Harvard Law School and Princeton University.

## **Dave Shearer**

### *What Effects Do Low Lake Levels Have on Recreational Sailing and Search and Rescue Efforts?*



Great Salt Lake provides a unique recreational experience. It draws sailors, duck hunters, kayakers and scullers. About the only motorboats ever found on the lake are the parks rescue boats and the vast brine shrimp fleet. Great Salt Lake also sits under the air corridor for commercial, private and military aircraft. Due to the size and location of Great Salt Lake, it can prove to be a violent sea when she wants to be. That along with fluctuating lake levels can make for tricky and challenging situations for the recreational enthusiasts, the brine shrimp industry fleet, and, of course, the rescue boat fleet.

Dave Shearer is currently the Harbormaster for the Great Salt Lake Marina. He and his dog, Taz, have been involved in nearly all the search-and-rescues on and around the lake for over ten years. Before becoming Harbormaster, Dave Shearer managed a local boat yard sailboat brokerage for 16 years. He has a great love for the Great Salt Lake and has studied her history, ecology, weather and geography. He has a passion for sharing that love and knowledge with others. Dave Shearer and his dog Taz have lived at the Great Salt Lake for the last 14 years and have explored almost every bay, island and corner.

## **Jim Steenburgh**

*Dirty Little Secrets of the Greatest Snow on Earth and the Future of the Great Salt Lake (Jim Steenburgh and Tom Painter, University of Utah)*



How will the Great Salt Lake be influenced by future climate change? This talk examines recent global and regional climate change, the range of 21st century temperature and precipitation projections produced by current climate models for Utah, and potential implications of climate change for the Great Salt Lake. There is more to this story than just carbon dioxide, as snowpack and runoff in the Great Salt Lake basin are also influenced by other anthropogenic effects, including dust and pollution deposition on the snowpack. Regional climate prediction for Utah is in its infancy, but could be advanced with improved environmental monitoring and the development of a comprehensive hydrometeorological

modeling system for the Great Salt Lake Basin.

Jim Steenburgh is Professor and Chair of the Department of Atmospheric Sciences at the University of Utah. His research focuses on the weather and climate of the western United States, with an emphasis on mountain precipitation and wind systems, including lake-effect storms. He received the 2001 Outstanding Teaching Award from the College of Mines and Earth Sciences and the 2002 Outstanding Service Award from the National Weather Service for his “outstanding service to the weather support group for the 2002 Olympic Winter Games.” In 2007, he led the preparation of the climate science report for Gov. Jon Huntsman Jr.’s Blue Ribbon Advisory Council on Climate Change (BRAC).

## **Frederic H. Wagner**

*Whither the Great Salt Lake in a Warming Climate*



Analyses of weather records and elevations of the Great Salt Lake showed a close correlation during the 20<sup>th</sup> century. Climatologists predict increased precipitation at higher latitudes, but intensified aridity in the subtropics associated with global warming. The Lake is roughly astride the borderline between these two zones. Annual precipitation declined in the southern half of Utah and increased in the northern half during the 1900s. Higher temperatures increase evapotranspiration, while shrinking snowpacks and altering seasonality of streamflow in the West.

Frederic H. Wagner, a native Texan, is Professor Emeritus at Utah State University where he was Associate Dean of the College of Natural Resources and Director of The Ecology Center at the time of his retirement. Between 1998 and 2003, he coordinated the Congressionally ordered 9-state Rocky Mountain-Great Basin Regional Climate-change Assessment. He has just published, with 32 coauthors, *Climate Warming in Western North America/Evidence and Environmental Effects*. Dr. Wagner received his B.S. in Biology at SMU and his Ph.D. in Zoology at the University of Wisconsin.



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