The Salton Sea / The Role of Science*

Milton Friend

U.S. Geological Survey

Executive Director
Salton Sea Science Subcommittee

INTRODUCTION

The assigned topic for this presentation suggests that I should focus my comments on two subject areas: the Salton Sea and the Role of Science. The implication is that these topics are related; however, the questions are in what way and for what purpose? Answers to these questions will be provided during the next 20 minutes - a quiz will follow so pay attention. Lights off and slide projection please.

Since accepting my assignment as chairperson for the Salton Sea Science Subcommittee, I am often confronted with statements that the Salton Sea has been studied to death and we need to move on and fix the problems impacting the Sea. My response is: while there have been many studies on the Salton Sea, the Sea has not been studied in a context to provide information needed to address current interest for "Saving the Sea." I offer a context for this interest by: (1) providing background about the Salton Sea that is relevant to the current status of this water body; (2) identifying current objectives regarding the future for the Sea; (3) discussing the role of science relative to attainment of those objectives; and (4) identifying processes initiated to address "Restoration of the Salton Sea."

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THE SALTON SEA - PAST AND PRESENT

I suspect all in this audience know the Salton Sea lies in a closed desert basin approximately 2½ hours driving time to the east of where we are meeting. However, you may not know, and probably do not care, that in addition to being the largest inland body of water in California, the Sea is the third largest interior saline lake in North America. It has a current elevation of -227 feet below sea level, is approximately 35 miles long by 15 miles wide, has an average depth of 29.9 feet with a maximum depth of 51 feet, contains 22 million acre-feet of water, and is currently fed by inflows of approximately 1.3 million acre-feet of water per year, which is also the annual evaporation rate. This hypersaline water body has a salinity of 44 ppt; a level that is 26% greater than ocean water and is continually increasing. These facts provide some perspective about the nature of the "alien spaceship" the Salton Sea was depicted as by the conference keynote speaker yesterday, and correct some erroneous information in a recent Los Angeles Times article.

Of greater importance is recognition that the Salton Sea is little more than 90 years of age. Also, over time, the geographic area occupied by the Sea has undergone major physical and biological changes that are relevant to considerations for restoration. Before civilization, the area of the current Sea was part of the Pacific Ocean; during earlier periods of Homo sapiens, this area was periodically dry and contained a vast freshwater lake referred to as Lake Cahuilla. The Salton Sea was created during 1905-1907 following breaching of an irrigation control structure by a rampaging Colorado River and exists today as a result of agricultural return flows from the Imperial, Coachella, and Mexicali Valleys. Smaller volumes of municipal effluent and storm

water runoff also flow to the Sea to help offset evaporation against an average of less than 3 inches of annual precipitation. Without the intensive agriculture which developed following water for irrigation being brought into the area in 1901, today the Sea would likely be a dry salty lake bed. Just as irrigation created new human values for this region of the Colorado Desert, so has the creation of the Salton Sea.

Recreation was one of the first major values humans sought from this water body. As early as the mid-1920s, developers had visions of the Sea becoming a resort area and began to pursue those visions. A yacht club was developed and major speedboat racing events were brought to the Sea during this period. Shoreline and other development activities accelerated in the late 1950s and continued into the early 1970s (Laflin, et.al. 1995). Camping, boating, swimming, and water skiing became major reasons for people to visit this oasis in the desert. The Sea became acclaimed for sportfishing during the 1960s following earlier introductions of saltwater fish from the Gulf of California (Koening 1971). Thus, a variety of recreational values became expectations and reasons to visit the Sea. Developing facilities to provide associated human needs and continued enhancement of economic development opportunities also became expected values.

Ecologically, the Sea is an important wetland within the Pacific Flyway. This value increases over time because of the severity of wetland losses within California. The current importance as bird habitat is reflected in the millions of bird-use-days during migration and the more than 380 species observed at the Sea. This diversity of avifauna is unequaled in the western United States and established the Sea as a premier bird viewing area, another recreational value.

The significance of this brief historical review is that the Salton Sea has values for human society that developed along with the recent origin of the Sea. These social and economic values are a new dimension for water bodies within the Salton Trough and are the foundation for actions to "Save the Sea."

SOCIAL AND ECONOMIC VALUES FOR THE NEAR-TERM FUTURE

The Salton Sea is a focus for restoration because values humans derive from the Sea, and wish to continue enjoying, are being jeopardized. Increasing water levels flood buildings, roads, and agricultural areas resulting in considerable economic loss. Development of marinas, other recreational facilities, and housing associated with proximity to the waters edge has become an unwise investment because of the instability of the Sea's water level.

Wildlife are also impacted. The majority of National Wildlife Refuge lands are now under water, affecting some species by loss of habitat and nesting areas from flooding. The variety of bird species using the Sea has substantial economic benefits for the area, largely derived from an annual bird festival that attracts many visitors to the Salton Sea and adjacent areas. However, salinity will soon reach a level that will cause a collapse in fish populations, thereby eliminating the food base for the fish-eating species of birds that come to the Sea.

Current recreational use of the Salton Sea has decreased dramatically from the 1960s and 1970s. However, the Salton Sea State Recreation Area experienced four consecutive years of increased visitor use. Visitation for fiscal year 1997/1998 was 74 percent above the nine year average (California State Parks 1998). Fishing remains highly productive, but public health

warnings regarding the consumption of more than small amounts of fish due to high levels of contaminants may account for the decline in the number of anglers. Declines in other recreational use of the Sea may be due to a combination of factors such as strong odors, frequent large-scale fish kills, major bird die-offs, and algal blooms making the Sea unattractive for visitation despite the scenic beauty of the area.

Since 1992, disease outbreaks among migratory birds using the Sea occur with unprecedented frequency, severity, and multiplicity of cause. The notoriety associated with a large mortality from avian botulism of white pelicans and the endangered California brown pelican during 1996 did much to place the Salton Sea in the national spotlight. These and other events awakened interest within the environmental community and became a focus for concern by others as well.

The concerns and issues identified are translated into a series of project objectives for the Salton Sea restoration effort (Table 1).

Table 1.	**Project objectives for Salton Sea ecosystem Restoration**
1.	Maintain the Sea as a repository for agricultural drainage from the Imperial and Coachella Valleys.
2.	Provide a safe, productive environmental for resident and migratory birds and endangered species.
3.	Restore recreational uses of the Sea.
4.	Maintain a viable sportfishery.
5.	Provide opportunities for economic development along the shoreline.

THE ROLE OF SCIENCE

The Salton Sea project objectives reflect values of human society. They are not a scientific issue. The role of science is to provide the knowledge and technology needed to assist society in achieving and maintaining the values it wishes the Sea to provide. For example, the level that salinity must be kept below is a scientific question with implications for all of the project objectives. This level also results in major differences regarding project costs. Reducing salinity to the level of ocean water or below will cost significantly more than stabilizing salinity at the current level. Each of these alternatives will cost far more than stabilizing salinity at some higher level. However, despite years of focus on salinity as an issue to be addressed, scientific evaluations have not been done to provide a sound basis for a salinity action level. Instead, predictions for the collapse of the sportfishery associated with different salinity values can be found within various documents and publications from the past 40 years. The following quote from a 1971 document I read last week illustrates this situation:

> ".....fisheries biologist say that the resource will no longer be able to survive if the salinity continues to increase. Present salinity is approaching 35,000 ppm (35 ppt) and corvina will not be able to reproduce after 1975. The situation is under study by the Salton Sea Project task-force at the present time."

It is now 1998, salinity of the Sea is 44 ppt, and fishing for corvina remains productive. A 31 pound corvina was caught recently and bag limit catches of 10 to 15 pound fish are common.

The role of science goes beyond providing sound evaluations for salinity and other specific factors, to also providing assessments of the ecological impacts of alternatives being considered for control of those factors. For example, engineering or other solutions controlling salinity but negatively impacting project objectives need to be avoided since salinity control is not an end-in-itself, but rather a means for addressing an important factor for some of the objectives. Therefore, resolving salinity in a manner that increases bird losses from disease would be counter-productive for the objective of seeking a safe, productive environment for resident and migratory birds and endangered species.

The short-term role of science is to address the types of questions and evaluations just cited to guide evaluations within the NEPA/CEQA process. Science also has a critical role that extends far beyond NEPA/CEQA. This role involves the development of environmental indices and conducting long-term investigations for monitoring progress towards accomplishment of project objectives and the maintenance of desired environmental conditions to sustain these objectives once they are reached. These indices need to be sufficiently sensitive to provide timely identification of need for actions. These actions must be supported by a sound scientific understanding of functional relations within the Salton Sea ecosystem. Attainment of this level of understanding is facilitated by an aggressive, interactive process of modeling, basic research, and systems analysis that is fully integrated with measurable adaptive management processes.

PROCESSES FOR GOAL ATTAINMENT

The following overview of Salton Sea project processes illustrates how project management and scientific activities relate to one another. Direction for restoration efforts at the Salton Sea is being guided by input received through NEPA/CEQA processes being conducted by joint lead agencies - the Bureau of Reclamation for the Federal government and the Salton Sea Authority for the State of California. An Environmental Impact Statement (EIS) and Environmental Impact Report (EIR) will be prepared to identify impacts associated with the various management alternatives being considered. A separate planning document provides for a feasibility evaluation of preferred management alternatives relative to their ability to meet project objectives and goals.

These processes are being assisted by two multi-agency groups that have been operational for several months: the Research Management Committee and the Science Subcommittee described by Tom Kirk during his introductory comments. The Science Subcommittee consists of representatives from various stakeholder agencies in the Salton Sea and the university community. Subcommittee responsibilities are limited to considerations associated with ecological assessments. Data synthesis of existing ecological information, identification of important data gaps, and development of request for proposal to address those data gaps are major Subcommittee functions. The Subcommittee, aided by external peer review, evaluates proposals received in response to solicitations and makes recommendations for funding to the Research Management Committee. The Subcommittee also serves as a coordinating body for science activities associated with the Salton Sea, provides evaluations of probable environmental impacts associated with proposed management actions, and monitors the progress of scientific investigations funded by the Research Management Committee.

The key points to note are that in contrast with CALFED, the Salton Sea Science Subcommittee is not charged with developing solutions or contributing alternatives for addressing the project objectives, nor is the Subcommittee an advocacy body regarding any preferred management alternative. This separation of responsibility is intended to enhance both the independence of scientific evaluations and the strength of administrative decisions since those decisions will, in part, be defended on the basis of the science provided by the autonomous Science Subcommittee.

CONCLUSION

"Saving the Salton Sea" is an ambitious and challenging undertaking in response to the desires of human society. In essence, this project is about human control of an ecological system to serve specific human values, including the conservation of wildlife, recreation, aesthetics, and economic benefits. This type of intervention occurs to various degrees as humans attempt to create environments that satisfy our interests. Nobel Laureate, Rene Dubos spoke to this issue four decades ago by noting that:

> "Whereas other living things survive through adaptive changes in their bodies and their instincts, man strives to impose his own directional will on the relations that he has with the rest of the world. Consciously, though often not wisely, he decides on the kind of life he wishes to have; then he acts to render possible this way of life by shaping the environment and even attempting to alter his own physical and mental self." (Dubos 1959)

The Salton Sea project is an expression of the conscious directional will of humans. Project success will depend upon our ability to understand how the various components of this ecosystem function and a collective willingness to manage this system in a manner which provides the values sought. Project parties are actively pursuing achievement of this level of understanding and action through integrated, collaborative efforts between scientists, management agencies, and society in general. Will these efforts be successful? I can not foresee the future, but I am guided in my perspectives by a sage statement I read once that I believe was made by Thomas Edison: "If you believe you can - or if you believe you can not - you are right." Those of us involved with the Salton Sea project believe we can.