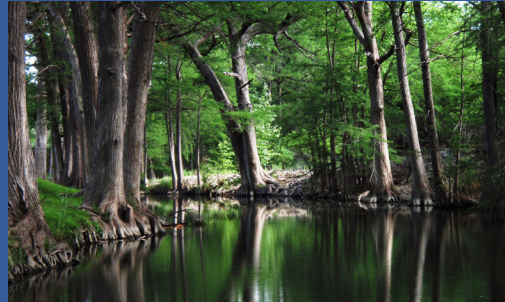


Texas Public Policy Foundation

# Analysis of the Science: The Whooping Crane Decision

*The Aransas Project v. Shaw*



by Lee Wilson, Ph.D.

Foreword by Kathleen Hartnett White

May 2013

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# Analysis of the Science: The Whooping Crane Decision

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### Foreword

The federal Endangered Species Act (ESA) has extended its reach to the rivers and streams of Texas. On March 13, Senior Judge Janice Graham Jack of the federal district court in Corpus Christi found the state of Texas—through the official actions of the Texas Commission on Environmental Quality (TCEQ)—liable for violating the ESA prohibition on a “Take” of 23 federally endangered whooping cranes. This flock of whooping cranes winters in and around the Aransas National Wildlife Refuge (ANWR) in South Texas.<sup>1</sup>

Judge Jack concluded that TCEQ’s management of surface water rights led to the deaths of these whooping cranes. Her injunction imposed a moratorium on new state allocations in the Guadalupe and San Antonio river basins. And her order mandated a federal Habitat Conservation Plan to protect the whooping cranes that would bind the state’s authority to allocate water and to manage existing water rights.

Shortly after Judge Jack’s decision on March 13, the Fifth Circuit Court of Appeals in New Orleans granted the state’s request for an emergency stay of the court’s order. On an expedited schedule, oral arguments will be held in August. If not reversed, this whooping crane decision could have far reaching implications for Texas’ authority to allocate water within its borders.

Science lies at the core of the district court’s decision. To hold TCEQ liable for an illegal Take, the court agreed with two central claims made by the plaintiffs: that 23 whooping cranes died in 2008-2009 and that TCEQ caused those deaths.<sup>2</sup> These alleged facts are established by science, particularly wildlife biology and hydrology.

The crane deaths were the critical fact of the case, because Judge Jack viewed the sheer number of mortalities—a record at ANWR—as evidence of Take under the ESA. The other key fact was causation. The Judge was persuaded that TCEQ “caused” the deaths on the basis of an untested correlation that whooping crane deaths occur more frequently in years with low freshwater inflows to the bays and estuaries. Correlations, however reasonable, cannot establish causation.

Given the legal implications of Judge Jack’s sweeping decision, TPPF asked a highly respected expert on these scientific issues

and on whooping cranes, Dr. Lee Wilson Ph.D., to analyze the role that science played in the district court’s decision. In the pages that follow, Dr. Wilson offers a robust analysis of the inadequacies in the science on which the district court relied.

Utilizing more rigorous methodology, Dr. Wilson critiques the untenable assumptions in the methodology, now abandoned by the FWS, for calculating mortality that was accepted by Judge Jack. Most importantly, Dr. Wilson’s analysis provides a compelling and more statistically significant hypothesis for the cause of whooping crane mortalities observed in 2008-2009.

Dr. Wilson’s study provides an intriguing and hopeful story about the growing whooping crane population in Texas, a flock that has continually increased at the same time that consumptive water use has increased. As Dr. Wilson suggests, past mortality counts of the whooping crane population may be deceptive because the increasing population of whooping cranes in ANWR has increased the range of the cranes’ habitat and made aerial detection more complex.

If, as the U.S. Supreme Court has declared, the protection of endangered species is the “highest of priorities . . . regardless of cost,” then the science underlying judicial rulings of this magnitude must be rigorous.<sup>3</sup> Too often defendants and judges, in cases under the ESA or other federal environmental laws, are reluctant to take on the science and instead focus on legal theory. Yet, the so-called science typically is at the core of the facts disputed.

The Aransas Buffalo Whooping Crane is a magnificent species worthy of the attentive care of humankind.<sup>4</sup> In the 1940s, perhaps only 15 whooping cranes existed. Conservation efforts, in which Texas has played an important role, have helped increase the population to around 500 birds. And the Texas population of around 300 birds is the only wild (or non-captive) flock in the world.

This flock has grown as Texas has grown and utilized more water. Effective recovery programs for the whooping crane population should and can occur without federal control of Texas water allocations. State policies which balance human and wildlife needs historically have been the most effective.

## Analysis of the Science: The Whooping Crane Decision by Lee Wilson, Ph.D.

### I. Summary

**The decision.** In March 2013, federal Judge Janis Graham Jack issued her opinion in a lawsuit brought by The Aransas Project (TAP). She found the presumed deaths of 23 federally protected whooping cranes at the Aransas National Wildlife Refuge (ANWR) in winter 2008-2009 were directly caused by diversions of water in the Guadalupe and San Antonio River basins that were authorized by the Texas Commission on Environmental Quality (TCEQ). She concluded that TCEQ had violated the federal Endangered Species Act (ESA) through illegal “Take” of these cranes.

**My interest in the decision.** I am a Ph.D. scientist with more than 40 years of experience as a consultant in water resources and environmental science. I have credentials regarding environmental flows, coastal ecology, whooping cranes, ANWR, and the Guadalupe/San Antonio Basins. I have testified in federal court as an expert on the ESA and have specific experience in the determination of Take.

**My initial reaction.** I was surprised by Judge Jack’s decision because the sound science of which I was aware did not support a Take finding. 1) U.S. Fish and Wildlife Service (FWS), the federal enforcement agency, did not see the evidence sufficient to allege a Take in 2008-2009. 2) The reliability of the estimated mortality count is in question. 3) TAP’s claim that upstream water uses were the cause of crane deaths was scientifically weak, especially as the crane population has expanded at the same time as water use has increased. 4) The data indicate that drought on the refuge (extremely low rainfall directly on ANWR habitats) was a more likely cause of any stress at ANWR in 2008-2009.

**Purpose of my analysis.** Upon learning that Judge Jack had found a Take when FWS had not, I surmised that: a) Plaintiff TAP had found new evidence to prove Take, and/or b) the Defense had not been effective; and/or c) the Judge had not relied on sound science. The Texas Public Policy Foundation considers this decision to be of great importance to the state of Texas and has asked me to analyze the quality and credibility of the science that was presented to Judge Jack, and to determine whether her use of the evidence to find Take was sound and objective.

**Methods.** As I did not attend the trial, my investigation depends on review of transcripts, exhibits, and briefs, along with consideration of my prior research, which included my reading of many hundreds of documents on whooping crane ecology and consultation with the leading crane expert at ANWR.

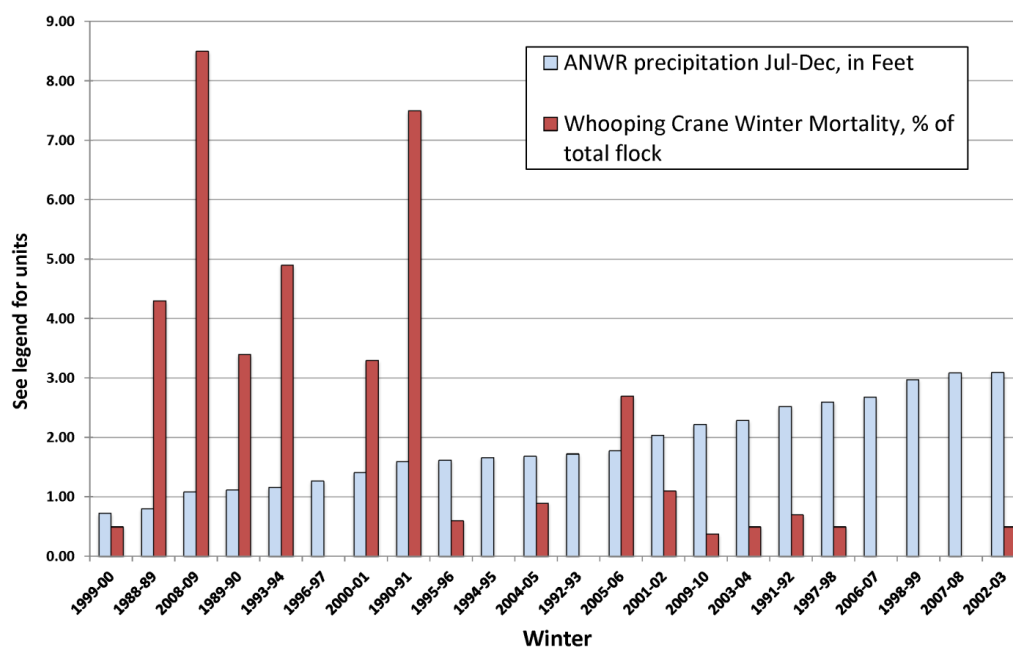
**Key conclusion: mortalities were not based on sound science.** The estimate of 23 crane deaths at ANWR in winter 2008-2009 was the central topic at trial. We now have a September 2012 FWS report that describes the core assumption of the estimate as “untenable” and the method as not “defensible.” I consider this new FWS report to demonstrate that Judge Jack’s reliance on prior mortality counts is not sound science. In particular the FWS report negates the argument she found particularly persuasive, that the magnitude of crane deaths itself proves Take.

**Key conclusion: causation was not based on sound science.** In science, testing of multiple hypotheses is essential to sound methodology. Ideally the same would occur in an ESA

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enforcement case where Take is alleged and the outcome has far reaching consequences. Yet only one hypothesis was presented at trial, i.e., TAP’s attenuated chain of links in which crane survival depends on the supply of blue crabs and wolfberries as crane food, the foods in turn are said to require substantial river inflow, and inflows were diminished by TCEQ actions and inaction. TAP’s proof of this linkage was a bar graph that shows the official FWS mortality counts to be often higher in years of low freshwater inflows. TAP reported that if a particular statistical test was performed in a particular way, there is significant probability that inflows correlate with deaths. No other evaluation of crane mortality was presented at trial or was required by the Judge; she adopted the TAP explanation in its entirety and as proof of causation.

In sound science, alternate causations of the kind illustrated below would be analyzed. [For purposes of illustration, and to be consistent with the trial, this takes the FWS mortality estimates as valid.]



In this chart the scales on the left are: 1) local rainfall directly on ANWR habitat in July-December, i.e., before and during the early crane occupation (light blue bars) and 2) the estimated winter mortality count as expressed in percent of the total population (darker red bars). The winters are sorted by rainfall amount, with the years of lowest rainfall (shortest blue bars) to the left. The six highest mortalities (big red bars) occur in the eight driest years. This local rainfall-mortality relationship is statistically more significant than TAP’s “reduced inflows cause Take” theory. Causation was tested in winter 2009-2010 when TAP’s theory predicted high mortalities because of a blue crab shortage, whereas there was ample rainfall and I expected low mortality. Only one mortality was confirmed; TAP’s theory failed this test.

**Bottom line.** Endorsement of Judge Jack’s decision requires: 1) complete faith in a method to estimate crane mortalities that FWS has now found to be unreliable and has abandoned; and b) adoption of a failed “hand of man” causation theory when a natural causation explanation is as good or better.

**More information.** The remaining sections of this report provide my qualifications and expand upon the summary above. I welcome comments and discussion.

## II. Background Information on Lee Wilson

**Summary.** Although this is not a formal litigation report where credentials must be established in detail and approved by a court, I am expressing my opinions in this analysis, and readers deserve to know my qualifications to do so. My credentials most relevant to review Judge Jack's decision include the following.

- I am a Ph.D. scientist with training in geology, hydrology, and ecology.
- I have 40+ years of experience as a consultant in water resources and environmental science.
- I have been qualified in Federal Court as an expert on the ESA.
- I prepared an expert report for a U.S. Supreme Court case on the need for instream flows for whooping crane critical habitat in Nebraska.
- I consulted to EPA for 27 years regarding water, wetland, and coastal resources in Texas and Louisiana.
- For EPA, I provided the science that EPA relied on to find future Take of jaguarondi from a coal mine, but no Take of ocelot.
- I have advised entities in the Guadalupe and San Antonio watersheds regarding surface and groundwater resources, environmental flows, and protection of endangered species.
- I served as the science advisor to the Texas A&M study of whooping crane ecology at ANWR.
- I have extensive experience in successfully preparing environmental impact documents, which requires multi-disciplinary and inter-disciplinary expertise and training, and an ability to integrate cause-effect relationships across all environmental resources.



**Personal information.** Born in Texas in 1942; resident of Santa Fe, NM since 1973, which is where and when I formed Lee Wilson and Associates; 44 years married, with one daughter and one granddaughter.

**Education and certification.** I am a graduate of Yale (B.A.) and Columbia Universities (Ph.D.), where my degrees were in geology with minors in ecology. The same coursework today would be called "environmental sciences." I am a Certified Professional Hydrogeologist (American Institute of Hydrology #220).

**Overall experience.** I now have nearly 42 years as an environmental consultant. While my work is focused on water resources in general and hydrology in particular, over my career I have had the fortune not to get pigeon-holed into a narrow environmental specialty, but instead to secure assignments to address a wide range of environmental issues, and to develop a broad expertise in environmental science on top of my credentials as a hydrologist. In particular, my experience in inter-disciplinary projects has taught me the ability to integrate information from many scientific disciplines, and especially to comprehend how ecological and hydrologic processes inter-relate.

**Environmental impact analysis.** My inter-disciplinary expertise is most evident through the several dozen environmental impact documents I have written, documents in which I had the responsibility to understand at a considerable level of detail all but the most arcane environmental issues. A good Environmental Impact Statement (EIS) preparer must understand and integrate the science on all of these issues in order to produce an effective result. I have many examples to indicate I can do this well. Impact assessment is in effect a specialization in analyzing the environment from a holistic perspective, which is important in this instance where the linkages involve so many considerations, from stream hydrology to estuarine salini-

ty dynamics, habitat conditions for the entire food change, ANWR habitats and management, and crane behavior, energetics, and health.

Most of my impact assignments came to me from Region VI (Dallas Region) of the Environmental Protection Agency (EPA). I worked on EPA projects for 27 years, and from 1984 through voluntary retirement in 2001, my company was repeatedly selected as the region's mission consultant on environmental issues regarding water permits and coastal wetlands. Most of the work assignments were in Texas or Louisiana, and the majority concerned coastal environments. Issues of endangered species were common in these assignments, including the technical analysis of Take at the Eagle Pass coal mine. In that project, I joined EPA counsel to write the Record of Decision and provided the technical evidence in support of a Take finding for jaguarondi, but not ocelot.

I have also worked on Environmental Impact Statements for other federal agencies (two mining projects in NM are current), have given impact statement training courses in the U.S. and overseas, and served for many years as the training committee chair for the International Association of Impact Assessment, an organization with members from more than 120 countries.

**Expert testimony.** My inter-disciplinary and multi-disciplinary expertise has proven important in litigation matters. A particular example is my expert work for the state of Nebraska in its water decree suit against Wyoming where my assignment was to evaluate (and in the end defend) the need for Platte River stream flows to benefit whooping crane critical habitat in Nebraska, and in so doing challenge a proposed water supply project in Wyoming. I have undertaken a number of other projects involving protection of environmental flows for endangered species, including currently for the St. Johns River Water Management District in Florida, where conservation of the manatee is a particular priority.

I have been admitted in federal court as an expert with broad environmental credentials. In the case of *ETSI v. Burlington Northern et al.*, Civil Action No. B-84-979-CA, on behalf of the Plaintiff, I analyzed coal transportation alternatives in relation to a broad spectrum of federal environmental regulations, including the Clean Water Act, Clean Air Act, Resource Conservation and Recovery Act, Endangered Species Act, and National Environmental Policy Act. I was qualified as an expert in interpretation and application of these statutes, including the Endangered Species Act. Geographically the work included South Dakota, Wyoming, Colorado, Kansas, Oklahoma, Arkansas, Louisiana, and Texas (and, for some issues, North Dakota, Nebraska, Iowa, Missouri, Arizona, and Nevada). The integrity of science in a regulatory environment was a central issue in the ETSI case.

**Basin experience.** I have been working in the Guadalupe and/or San Antonio Basins for nearly 30 years. This work has included numerous studies regarding protection of endangered species at Comal and San Marcos Springs, and an evaluation for the Edwards Aquifer Authority of the Property Takings effects of their water use restrictions. For the Guadalupe-Blanco River Authority (GBRA) I have undertaken various projects relating to environmental flows and environmental impact analysis of possible projects.

**SAGES project and ANWR.** In the early 2000s, GBRA and the San Antonio River Authority tasked me to monitor and ensure the scientific value of their SAGES project. [SAGES stands for San Antonio Guadalupe Estuarine System.] This was a study by professors and students at Texas A&M regarding the relationship between Guadalupe River stream flows and factors



important to the health of the ANWR whooping crane flock. A&M was chosen for the study because of its reputation as the academic institution most knowledgeable about the ecology of whooping cranes at Aransas. I started by contributing to design of the study, with input from a scientific advisory panel composed of top-line ecologists from across the U.S. And I continued for several years (through completion of the work) to review and comment on the findings, always making the integrity of the results top priority, regardless of how they might impact river authority interests. I did not guide the results to any answer, or try to otherwise interfere with the independence of the investigators, other than to advise as to how best to achieve sound science.

One of the great benefits of the SAGES work was the opportunity to read, assimilate and discuss hundreds of professional articles published about whooping crane ecology (just about everything on the ANWR flock, and a lot on the captive and experimental populations). I read in the FWS Whooping Crane Recovery Plan that freshwater diversions pose a risk to the cranes. Given my background in both ecology and hydrology, I particularly focused on trying to find facts to support that determination, but found little. As best I can tell, the concern over freshwater derives primarily from the beliefs of FWS crane expert Tom Stehn, beliefs that are sincere but not supported by scientifically sound studies or data bases.



While I disagreed with Mr. Stehn, I did enjoy the opportunity to visit him on the Refuge, view the ANWR flock, swap stories over beers at Moon Dog, and discuss with him the important questions about how to protect the only remaining wild flock of this species. Added to what I had learned in my Nebraska work, I became familiar with most of what is known about whooping cranes, or at least what is known about their occurrence at ANWR.

**TAP litigation.** When TAP filed its federal claim, GBRA asked me to share my knowledge of crane ecology with their outside counsel and experts and to provide reference lists and documents. I also created an electronic archive of Tom Stehn's materials, which I then read and discussed with him. I prepared some white papers that were intended for public distribution. All this work allowed me even more opportunity to learn about whooping cranes. Some of what is in this analysis I first organized at that time, but I have taken pains to revisit the key points, especially in light of TAP's actual testimony which was not available at that time.

Although I had some involvement in the run-up to the litigation, I was not part of the expert team, was not designated as a trial witness, and did not contribute to the trial strategy. I did not attend or follow the trial; this is my first visit to the evidence as actually presented.

**Independence and objectivity.** Given the controversial nature of this case, and my past work for river authorities, I would expect some to wonder about my independence and objectivity in this matter. Here are three responses.

- **MY RECORD.** I have worked hard to establish a reputation for integrity. Check it out.
- **CONSISTENCY WITH FWS.** If the science were other than I have described it, the expert enforcement agency (FWS) would itself have found a Take, and they have not.
- **OUTCOME.** Everyone gains if whooping cranes are protected. I support environmental flow requirements in many circumstances; this is not one.



One of the dismaying aspects of Judge Jack's decision and of her questions at trial is her apparent belief that paid experts are advocates whose testimony is necessarily suspect (if worthy at all). Her distrust is even stronger if the individual has an ongoing financial arrangement with the party they represent. I have run into hired gun experts in my career, so I know this can be true. But I am confident in my own commitment and ability to accomplish truthful analysis.

**Contact information.** If any reader would like a copy of my resume, a list of my company's reports, or a list of my expert witness appearances, please just drop an email request to [lwa@lwasf.com](mailto:lwa@lwasf.com).

### III. Causation

In this section, I expand upon causation issues that were briefly noted in my summary.

**My understanding of causation.** At the end of this section there is a table that summarizes my understanding of "causation" as it applies to this matter. To find illegal Take under the ESA, the management and diversion of water in the Guadalupe Basin must be proven to be the cause of one or more reported 23 crane deaths at ANWR in winter 2008-2009 (if the deaths are assumed true). As a scientist with ESA experience, I consider this to require that TCEQ's authorization of permits and diversions was so critical that without them the deaths would not have happened. TAP's Executive Director Ron Outen understood this well, when he opined that TAP would show upstream water use and policy killed a whooping crane "just as surely as shot it out of the sky."



**TAP's argument.** TAP's causation hypothesis runs something like the following.

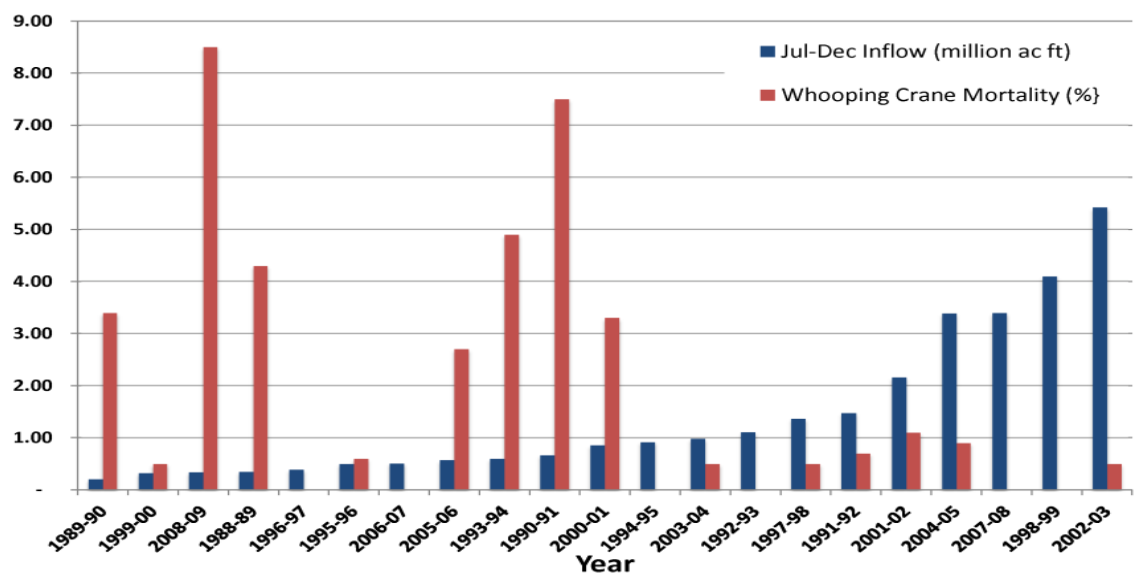
1. Mismanagement of water by TCEQ allows diversions of water from the Guadalupe and San Antonio basins during times when the water is needed for ecological purposes.
2. Diversions of water in the Guadalupe and San Antonio basins decrease the amount of freshwater inflows to San Antonio Bay, especially in times of natural drought.
3. The lack of sufficient freshwater flowing into San Antonio Bay causes increased salinity in the bay and marshes where whooping cranes feed.
4. The lack of sufficient freshwater flowing into San Antonio Bay causes decreases in the transport of nutrients and sediments to the estuary, reducing its productivity.
5. In 2008-2009, the increased salinity resulting from insufficient freshwater inflow caused a significant decrease in the availability of wolfberry fruits and blue crabs upon which whooping cranes feed.
6. In 2008-2009, the increased salinity resulting from insufficient freshwater inflow caused a significant decrease in the availability of drinking water in locations preferred by whooping cranes.
7. Wolfberries and blue crabs are foods essential to meeting the nutritional needs of whooping cranes at ANWR.
8. To find substitute foods and drinking water, the cranes were forced to search outside their safe territories.

9. The alternative foods available outside the safe territories are insufficient in abundance and/or nutrition to meet the energy needs of the whooping cranes.
10. The travel of cranes to alternative foods and water, and the behavior necessary in these alien environments, increased the energy stress on whooping cranes.
11. The requirement to occupy alien environments and the increased energy stress increases the risk of predation.
12. The direct consequence of upstream diversions is thus a reduction in the whooping crane energy budget to marginal or even negative levels.
13. The consequence of a marginal or negative energy budget in 2008-2009 was widespread starvation and emaciation in the flock.
14. Emaciation led to the increased occurrence of disease or otherwise increased the risk of mortality.
15. The official FWS count of mortalities at ANWR in winter 2008-2009 was a minimum of 23 birds, mostly juveniles, a record.
16. Over the years, there is a statistical relationship between the amount of freshwater inflow to San Antonio Bay and the FWS estimate of winter mortalities at ANWR.
17. Therefore TCEQ's authorization of upstream water diversions caused 23 actual crane deaths in 2008-2009.

Having so many linkages is a concern in an evaluation of causation, and it is understandable that TAP did not try to undertake a probability analysis involving the individual links.

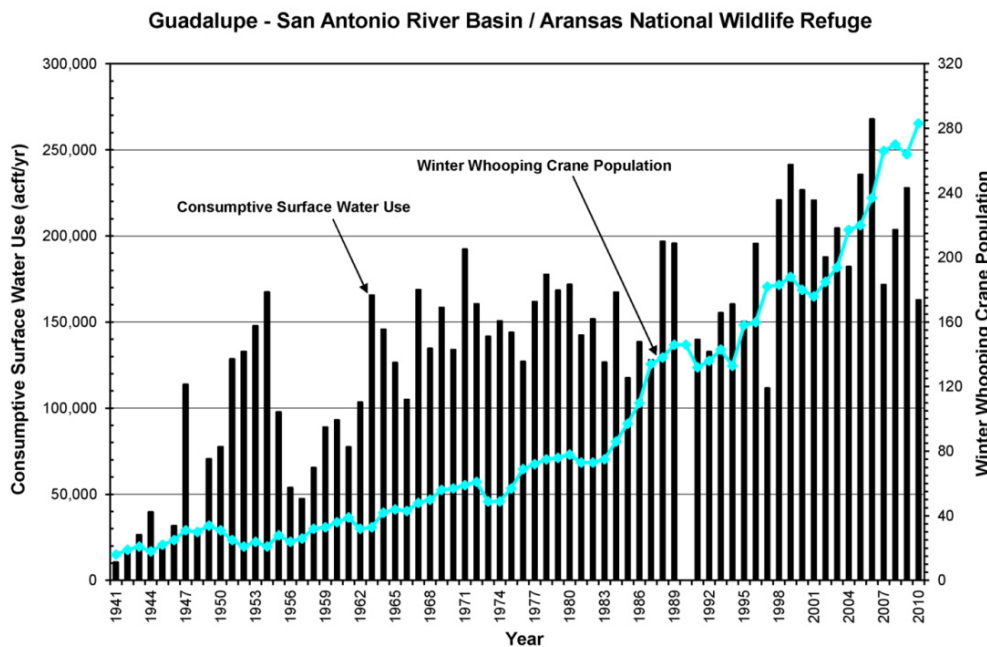
Having so many linkages is a concern in an evaluation of causation, and it is understandable that TAP did not try to undertake a probability analysis involving the individual links. [Had they done so, they would have revealed that for their claim to be more likely true than not, each individual link needed to be shown statistically true at a confidence level of more than 95%.]

Rather, the centerpiece of TAP's quantitative proof was the statistics of the collective linkage. This evidence was provided by TAP witness Professor Ron Sass, who sponsored and testified about Plaintiff Exhibit 76. This exhibit is reproduced below:



The graph shows winter crane mortality counts determined by FWS crane biologist Tom Stehn, as a percent of total population; and inflows to San Antonio Bay from the Guadalupe River basin in the July-December period leading up to the winter. Sass testified that the crane mortalities tend to be higher in years of lower inflows. He reported on a particular statistical test showing the relationship between low inflow and high mortality is significant with 97.9% probability. I can confirm his statistics. Whether this is meaningful, and in particular whether it proves Take, is a different question.

**Correlation is not causation.** Many observations correlate only because each is caused by the same something else. [If you want examples, Google “correlation does not imply causation” and read the Wikipedia entry; or just contemplate why it is that shoe size correlates with reading ability.] Other correlations exist for no apparent reason, as shown in the graph below which is Defense Exhibit 242.

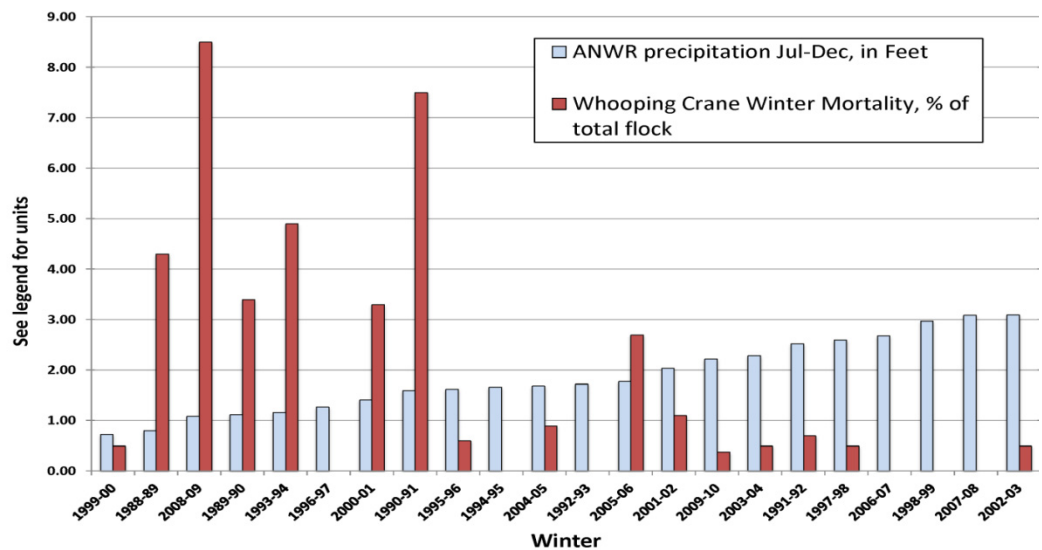


In my opinion, just because Sass found inflows and mortalities to correlate, TAP did not prove a cause-effect relationship. At best, TAP has a hypothesis that deserves to be investigated.

The graph compares Tom Stehn’s reported annual peak whooping crane population at ANWR (line connecting dots) to the annual consumption of surface water upstream (i.e., the amount of river flow that did NOT reach San Antonio Bay, shown by the bars). No statistical analysis is needed to see that the two quantities both increase over time, but I don’t know of a logical way to say that water use upstream is the cause of the remarkable increase in whooping crane numbers, or vice-versa. [I do observe that this graph confirms the successful recovery of the cranes at ANWR and suggests there is no obvious harm from increased water use.]

**Alternate causation.** In my opinion, just because Sass found inflows and mortalities to correlate, TAP did not prove a cause-effect relationship. At best, TAP has a hypothesis that deserves to be investigated. To test the TAP hypothesis in a scientifically sound manner, it must be compared to at least one alternate causation theory, and ideally more. Unfortunately, in this litigation that did not happen. The Judge should have expected one or more plausible alternates from TAP as a matter of scientific proof, but she did not. TAP should have investigated multiple alternates on its own to prove its theory is the best available; they did not.

The absence of alternate correlation from TAP is not because alternate correlations are hard to find. The graph below is the same one presented in my summary, and it is one I prepared for this analysis.



The graph is similar to that of Sass, except my correlation is between reported deaths and a natural cause, namely rainfall directly on the refuge habitat. To be consistent with Sass I used the July-December period precipitation, and as he did, I selected the 10 driest years. I chose rainfall because the FWS annual winter reports consistently tie years of high inferred mortalities to times of local drought at ANWR (e.g., dry conditions on the actual habitat). Certainly the hypothesis that local drought is related to crane habitat and health is at least as plausible as arguing the cause is far upstream.

Using the exact same statistical technique as Sass, the resulting probability of correlation is the same, 97.9%, which is significant. This hypothesis has the statistical strength of the TAP correlation, but without the attenuated link to events upstream. TAP may argue that upstream uses could still add to the natural drought problem. However, my local rainfall graph demonstrates that changes in inflows are not a necessary explanation of the observations. Put another way, it is clear that TAP cannot prove that absent TCEQ's authorization of permits and diversions, the deaths would not have happened.

Further investigation provides support for the drought hypothesis. For Sass, his finding of a 97.9% probability is based on a flow threshold of 670,000 AF, which equates to the 10 driest July-December periods (i.e., he tests if the years with this flow or less are associated with mortalities); for my graph the 10 driest July-Decembers are those with 1.67 feet of rainfall or less. Visually, my graph shows more of the high mortality bars farther to the left. To investigate that visual cue, I redefined the thresholds so that only the eight driest years are tested (instead of 10, the number of dry years used by Sass). The Sass flow threshold becomes 570,000 AF and my precipitation threshold becomes 1.6 feet. The statistics thus tell us what happens if conditions are even drier than the 10 years relied on by Sass. The statistics are follows:

- Probability that low river inflow correlates with high mortalities: 78.7% (not significant)
- Probability that low local rainfall correlates with high mortalities: 99.7% (very significant)

In other words, if conditions are even drier than those that Sass defined as critical, his correlation disappears; mine substantially improves. This result is not unique to a test of eight dry years; almost any test Sass could do with less than 10 dry years would produce poorer results than the one he presented.

**Conclusion.** It would require in-depth study of habitat conditions at ANWR in dry years to know if local drought has particular effects that could explain whatever mortalities did occur at ANWR in the winter of 2008-2009. Just such a study was begun by SAGES in 2005-2006, but as with other Defense evidence, it was dismissed by the Judge. In any case, before reaching a conclusion on this subject, it would be important to research other possible causalities (such as water levels) and to design field investigations for those that seem of potential significance.

What is important is that the Sass correlation was a lynchpin of the TAP case and that Judge Jack found his analysis to be proof that the reported mortalities were due to the hand of man, in the form of diversions upstream in the Guadalupe and San Antonio basins. If the “natural drought on the habitat itself” causation is considered objectively, I do not see how a Take finding can be sustained.



### Table 1: Lee Wilson’s Understanding of Causation

**Causation in science.** Causation in science is about determining what causes an observed effect.

- Because ecological cause-effect relationships are typically complex, understanding of them is usually imperfect. Moreover, any one multi-link relationship is almost certainly to overlap with others, making it hard to isolate, confirm and quantify a particular linkage with certainty.
- For example a change in one environmental condition can ripple through several levels of the food chain before it impacts an animal species that uses the food chain; but at the same time a change in a different condition can have a cumulative or confounding impact on that same food chain and animal.
- These complexities lead to management strategies that are adaptive. Actions may be taken based on a particular scientific understanding, but the results are then closely monitored and the management process may be modified as the actual cause-effect relationships become better understood. Because of uncertainties in causation, adaptive management is a core principle of applied ecology.

**Causation in ESA.** In my experience, causation is important both in determining whether an action may result in Jeopardy to a species, or to finding of past or future Take. The more direct the cause, the more readily Jeopardy or Take can be found. The most obvious Takes occur from observed direct cause and effect (e.g. Take of bald eagles is found when a bird is shot to death, or dies from lead shot poisoning). Take can result from a more indirect cause-effect linkage, but as the links become more attenuated, the stronger the evidence must be. I recall that certain pesticides such as DDT were banned in large part due to their impact on the food chain of bald eagles, the resulting interference with species reproduction, and the consequent decline in the population. Each of the links in this causation was shown to be virtually certain and of profound importance.

## IV. Mortality

The discussion below expands upon my summary by providing more details on the 2012 FWS report which identified “major concerns” with the census method used to estimate 23 mortalities at ANWR in winter 2008-2009.

***FWS position on Stehn methodology.*** In my summary, I cited a September 2012 FWS report in which the agency essentially abandoned the census methods used by FWS biologist Tom Stehn, and introduced FWS’s new more scientific method. Below I briefly describe the Stehn method, present conclusions from the 2012 report, explain a key reason for the new FWS position, and note Judge Jack’s reaction to the report. My reading of the transcripts is that there was no dispute that some mortality occurred in 2008-2009; but the question was whether record mortalities occurred and should be considered as evidence of Take.



***Stehn’s method and the Defense challenge.*** As he had done for decades before, Tom Stehn flew over the Refuge numerous times in winter 2008-2009, and paid particular attention to territories where specific bird families are normally found. When a family member he had previously observed went missing over multiple flights, he concluded the bird was dead. In 2008-2009 there were four deaths evidenced by a body (or at least a pile of feathers), and 19 were territorial birds that went missing (most of these juveniles), so he reports 23 mortalities in all. Stehn’s census results were extensively defended by Judge Jack in her decision, and she considered Stehn’s testimony as dispositive (see discussion beginning at p. 64 of the decision). [Note, I am not practiced in legal citations, but I found the decision referenced as *Aransas Project v. Shaw*, 835 F. Supp. 2d 251 - Dist. Court, SD Texas 2011.]

At trial, the Defense questioned Stehn’s census method and mortality estimate on many counts.

- He had made past mistakes in finding birds to be dead.
- The 23 deaths did not fit subsequent observations of a healthy flock.
- As many as 17 “dead” birds showed up in 2009-2010.
- Aerial surveys are error prone and have become increasingly difficult due to growth of the flock.
- Various changes in survey methods over time have decreased the census reliability.
- The “non-detections” of birds in 2008-2009 were based on too few reliable surveys.

The Defense especially pointed to evidence indicating the missing birds had simply dispersed to outside the survey area. This included statements in Stehn’s own report that conditions in 2008-2009 were “chaotic” with a large amount of crane movement and a breakdown of family groups.

Judge Jack found reasons to discount each fact offered by the Defense through cross-examination or its own expert testimony relating to the aerial census of birds and its use in determining mortality. As I read her decision, the crux is that she trusted Tom Stehn’s testimony and found it especially important that his results have been relied upon for decades and not challenged until this litigation. However, it is important to note that his past results had been used for information purposes or in academic research, never to evaluate a charge of Take or to make a judicial decision against the state of Texas. As this case did involve allegation of Take and an injunction and order against the state, it represents the first time there was a reason to scrutinize the method in depth so as to determine if its results would justify such wide-ranging and serious consequences.

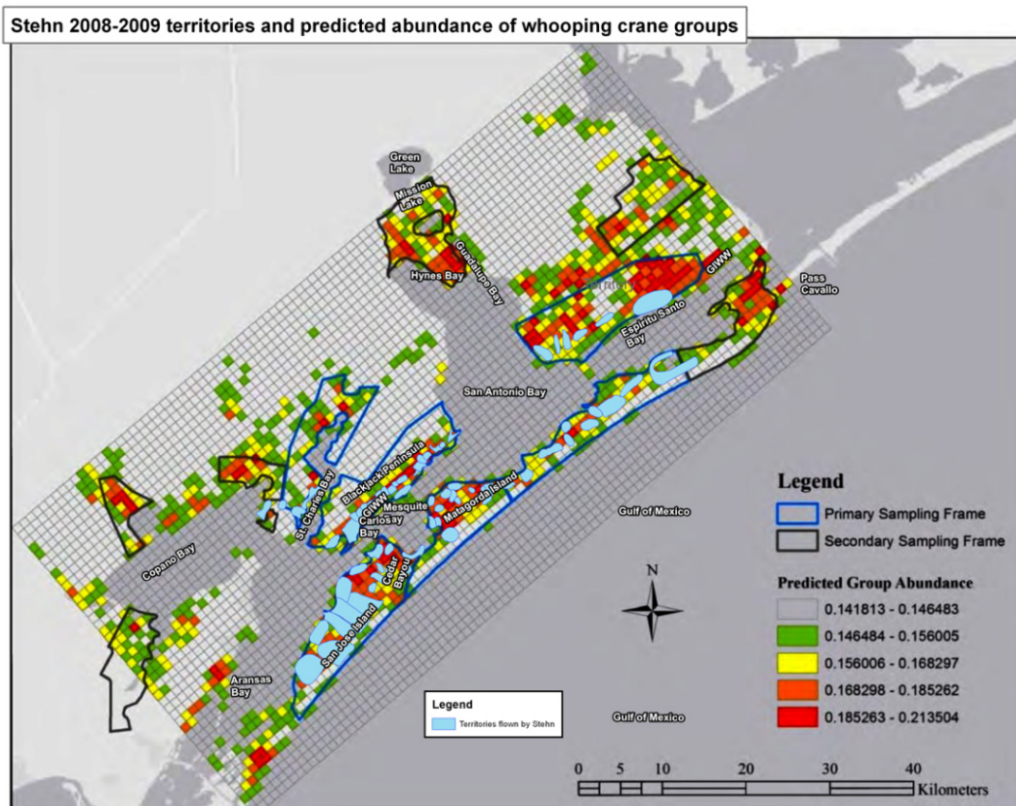
**Key findings in FWS 2012 report.** In 2012, the FWS released “Aransas-Wood Buffalo Whooping Crane Abundance Survey (2011-2012),” a report dated September 24, 2012.\* This report reflects the agency’s interest in getting the science right on an important subject.

The 2012 FWS report critiques the Stehn census methods and indicates that FWS has “identified multiple modifications that would improve the survey’s scientific rigor and value.” At the end of this Section, **Table 2** extracts the “major concerns” that relate to the past Stehn surveys. Among the key points are these:

- Past survey results do not allow for defensible inference.
- Enumerating winter mortalities is a survey objective, but the “methods employed” did not allow this and other objectives “to be attained defensibly.”
- Sampling was not random, search efforts were inconsistent, and credibility was eroded by inconsistent data on bird occurrence outside the search area. The large effort to verify missing birds on territories came at the cost of less effort in sporadically occupied territories.
- And most critically, “a bird that was presumed to be absent from its territory during multiple surveys was assumed to have died. This assumption of territoriality is unnecessary and untenable given recent data.”

**Why FWS no longer relies on Tom Stehn’s results.** The last bullet above notes “recent data” as showing the assumption of territoriality to be untenable. FWS is referring to data obtained from observations indicating much more dispersion of cranes than assumed by Stehn. The map below illustrates the issue.

“a bird that was presumed to be absent from its territory during multiple surveys was assumed to have died. This assumption of territoriality is unnecessary and untenable given recent data.” -FWS



\* The report is available at [http://www.fws.gov/refuge/aransas/science/whooping\\_crane\\_surveys.html](http://www.fws.gov/refuge/aransas/science/whooping_crane_surveys.html).

The blue blobs on the map are crane territories that are the focus of Tom Stehn's aerial surveys. I prepared that map many years ago, and confirmed its accuracy with Mr. Stehn. The rest of the map comes from Figure 5 of the 2012 FWS report and reflects the new FWS understanding of where cranes can be found. The colored squares are areas where cranes are predicted to be abundant based on habitat conditions. Outlined in blue are areas where FWS now observes multiple groups of cranes annually; these extend north of Stehn's routine study areas. Outlined in black are areas of periodic or potential crane occurrence.

The current survey protocol includes flight transects in both the blue and black outlined areas. Few of these areas were routinely surveyed by Stehn. In effect, FWS has concluded that the prior survey did not extend to important areas where cranes are now known to occur. Most importantly, the Service has concluded that it must do its surveys in a manner that reflects scientific principles and that can achieve results that are statistically robust, and not just survey based on the experience and instinct of the observer as done historically.

I consider it quite possible that FWS had concerns about the Stehn surveys for many years—that would explain, for example, why they never even investigated the possibility of a Take in 2008-2009, despite the “record” mortality count.

I consider it quite possible that FWS had concerns about the Stehn surveys for many years—that would explain, for example, why they never even investigated the possibility of a Take in 2008-2009, despite the “record” mortality count. However, only when the method was called into question by the Defense in the TAP litigation did FWS respond and investigate the method scientifically.

***Motion to reopen.*** Shortly after FWS published its 2012 report, the Defense filed a motion to reopen the case to introduce the report into evidence. The basic point was to challenge the argument (as said by TAP in closing) that “whooping cranes simply do not go missing and disappear.” Beginning on page 88 of her Decision, Judge Jack explains her denial of this motion. She states that the new report deals only with peak population, not mortality; it conflicts with evidence at trial from both parties; and is preliminary and incomplete, lacks underlying data, and proposes an unacceptable error rate.

Her criticisms go mostly to aspects of the report regarding how to establish a reliable peak population number. She is wrong in saying that the report does not address mortality (as shown in Table 2, it does); and in saying it is inconsistent with trial testimony from both sides (it is inconsistent only with testimony on peak population). All that is “incomplete” is for FWS to finalize a new methodology. It appears her ultimate reason for denying the motion was simply that it conflicts with Stehn's trial testimony (and its endorsement by others), which in itself “necessarily calls into question its reliability.” While the FWS response to its investigation of the Stehn method was to change the method, Judge Jack's response to the same issue was to reject the FWS science without a hearing.

But FWS is the recognized enforcement for whooping cranes, and its published concerns about the Stehn surveys must have credibility, especially here where the consequences of using the abandoned method are so substantial. As stated in the report, the agency is required to use the “most appropriate, best available, high quality scientific and scholarly data and information to support the mission of the Department.” FWS has studied the crane survey issue with far more intensity than any of the trial witnesses, and they have stated without equivocation that Stehn's core assumption—missing from territory means dead—is untenable. The Judge may believe that (as said by TAP in closing) “whooping cranes simply do not go missing and disappear,” but FWS now says otherwise. As such, while I do not doubt that Tom Stehn's testimony is sincere, his mortality estimates are not reliable for a purpose such as finding Take, where substantial certainty is required.



**Table 2:** Major concerns regarding the Stehn “census” using aerial surveys, taken verbatim from pages 5 and 6 in the U.S. Fish and Wildlife Survey report “Aransas-Wood Buffalo Whooping Crane Abundance Survey (2011-2012)” dated 24 September 2012.

### Major Concerns

- **No Survey Protocol Exist:** Although whooping crane surveys have been conducted for over 60 years a formal protocol including: survey objectives, survey methods, sampling frame, data analysis and reporting procedures was never completed. These components are fundamental to defensible inference from surveys. A new comprehensive survey protocol is currently under development and should be completed by November 2012.
- **Survey Objectives were Undefined:** Post-hoc definitions of survey objectives included (1) recording peak population abundance, (2) enumerating paired adults, (3) calculating annual recruitment, (4) enumerating winter mortalities, and (5) reporting habitat use. The methods employed did not allow each of these objectives to be attained defensibly.
- **Results were Influenced by Observer’s Discretion, Judgment and Perception:** Survey methods and subsequent results were dependent upon the observers experience and judgment. As such the methods were not directly repeatable by subsequent observers or on subsequent flights. This flaw is manifested in multiple ways described below.
  - Lack of Standardization and Randomization: Inconsistencies in altitude, flight speed, transect location and search effort limited the inference that can be made across surveys. Furthermore, the order with which transects and areas were surveyed was convenience based and did not utilize basic techniques to minimize bias such as systematic or random sampling.
  - Search Effort was Inconsistent and Unrecorded: Search effort was inconsistently and disproportionately allocated based upon observers experience (i.e., higher effort was allocated to families with 2 chicks versus those with 1 chick and to predictably occupied territories versus sporadically occupied territories). The absence of search effort data results in post-hoc assumptions regarding the validity of “null” detections. In other words, it is unclear if locations where cranes were not recorded were searched.
  - Inconsistent Incorporation of Ancillary Data: Reports of birds sighted outside of the surveyed area were incorporated into the data collected from aerial surveys in unclear and inconsistent ways. These practices caused inconsistencies among reported datasets and eroded the credibility and value of the dataset.
- **Assumed Individuals Do Not Leave Their Territories:** Much of the interpretation of these data hinge upon the assumption that location (i.e., territory) are defensible surrogates for individually marked birds. In other words, data were interpreted under the assumption that birds did not leave their territories. Therefore, a bird that was presumed to be absent from its territory during multiple surveys was assumed to have died. This assumption of territoriality is unnecessary and untenable given recent data.
- **No Defensible Estimates of Precision or Bias:** Previously employed methods are not based on a statistically defensible sampling design and therefore cannot provide meaningful measures of precision. It is USFWS policy to recognize that uncertainty is inherent in science, and the agency considers data as well as their associated uncertainty in the management and conservation of species and their habitats (Department of the Interior 2011b).
- **Imperfect Detection of Individuals:** Observation specific characteristics (i.e., distance from aircraft, group size, plumage coloration) as well as survey specific characteristics (i.e., type of aircraft, sun angle, observer skill) were suspected to influence the probability of detection but were not addressed prior to interpretation of the data. Several methods exist for determining how aerial survey results are affected by the detectability of wildlife under various characteristics (Pollock and Kendall 1987, Conroy et al. 2008, Green et al. 2008).

Note that in the 2012 FWS report, the paragraph prior to this list of concerns identified generic issues with population census methods, and stated that while Stehn (in a cited publication with Taylor) recognized possible bias in his results, he did not provide recommendations to address them.

## V. Objectivity

**Introduction.** Anyone who reads Judge Jack's opinion will likely conclude that the case was quite one-sided, with a sympathetic Judge responding to Plaintiff's overwhelming proof and an inept Defense. That perception is displayed in a blog post by David Owen, a Professor at the University of Maine Law School. Professor Owen sees Judge Jack's decision as demonstrating an unusual case in which the evidence for Take was so overwhelming that the Plaintiffs were able to overcome the odds and prevail. He concludes that this was because TAP apparently had "extraordinarily good monitoring data, an all-star team of experts, [and] poorly prepared experts on the other side." He also concludes that the structure of the opinion "strongly suggests that someone in the court's chambers cared very deeply about this case."\*

In this section, I consider whether the Judge's strong partiality toward the Plaintiff's case reflects an objective consideration of the evidence and the quality of the witnesses, as Professor Owen assumed. I find instances where the Decision misstates or ignores key Defense evidence. More troubling are transcripts which portray a disquieting attitude toward Defense witnesses.

**Weight of evidence.** In her opinion, Judge Jack adopted the Plaintiff's expert credentials, theories, arguments, and allegations of fact in their entirety. In the Defense experts, she found "an alarming trend" of "limited experience and insignificant knowledge." The only Defense evidence that was accepted was that which agreed with TAP. In prior sections I have already noted some of my disagreements with the TAP arguments; more examples are in Section VI. On causation and mortality alone, I don't see how TAP was seen to have met its burden of proof. I cannot think of any unbiased rationale by which the decision in this case gave weight only to the evidence submitted by one party.

**A significant error.** Given that the decision came out more than one year after the trial, I assume the Judge based her findings of fact on a close and careful reading of the record. If so, then any errors are presumably not from carelessness or lack of diligence. There is an obvious and serious error on page eight, where the Judge describes ANWR conditions in winter 2008-2009 (emphasis added):

[W]ithout proper freshwater inflows, the [whooping crane] critical habitat had been thrown out of balance, with ramifications up and down the food chain. That winter, at least 23 [Aransas Wood Buffalo] cranes, or 8.5 % of the ... flock, died at the Refuge. Another 34 birds that left Texas in spring, failed to return in fall.

I have emphasized the last sentence because the Judge used it to reinforce the conclusion that conditions were extremely bad at ANWR in 2008-2009. If it were true that 34 birds died after winter 2008-2009, that would be a record and an observation that might bolster the Plaintiff's case. However, the timing of the 34 deaths was well documented in the record, and her finding that 34 birds failed to return is entirely backwards from the facts in two important ways: 1) the 34 deaths occurred before the birds arrived in fall 2008, not after; and 2) the actual estimate of mortalities in birds leaving Aransas in spring 2009 was exceptionally low, not high (5, not 34).

\* Comments available at [http://lawprofessors.typepad.com/environmental\\_law/2013/04/water-whooping-cranes-and-the-esa.html](http://lawprofessors.typepad.com/environmental_law/2013/04/water-whooping-cranes-and-the-esa.html).

Anyone who reads Judge Jack's opinion will likely conclude that the case was quite one-sided, with a sympathetic Judge responding to Plaintiff's overwhelming proof and an inept Defense.

From the standpoint of causation and mortality, I consider it highly significant that a record number of deaths occurred to birds that left Texas in spring 2008, not spring 2009. The high prior mortality in the birds arriving at ANWR in fall 2008 is of special interest in light of the added fact that a viral infection was identified in the necropsy of one winter mortality and that birds photographed at feeders (i.e., birds with access to food) had a haggard and emaciated appearance. To use the words of the Judge on a different topic, this suggests the population “had been thrown out of balance” before it arrived. By itself the record migration mortality does not preclude a finding of Take in winter 2008-2009; but it does demand a very different analysis of the evidence than was conducted.

The distortion at the other end is also significant: the Judge ignored the evidence in the record that the birds left ANWR in good condition (departed early, only five mortalities, good nesting success in Canada) and replaced it with an incorrect statement indicating exactly the opposite. I cannot know just why the Judge got this wrong, but I can say the end result was to help justify her decision, when the evidence itself leads to the opposite conclusion.

**An important omission.** I consider an important piece of Defense evidence to be the fact that in Tom Stehn’s prediction of how many cranes would return to ANWR in fall 2009, he was wrong by the exact number of birds that he found “missing and presumed dead” the winter before. This number is 17: 17 birds dead in 2008-2009 only because they were missing; 17 “unexpected” birds returning in fall 2009.

Specifically, when Stehn estimated the number of birds he expected back in fall 2009, he predicted only 225 adults (a number adjusted down for his assumption of high mortality in 2008-2009) plus 22 chicks that had been observed to hatch at Wood Buffalo National Park in Canada in summer 2009—a total of 247. He was surprised when 264 birds actually showed up, 242 adults and the 22 chicks. To be clear, 242 adults returned, not the expected 225—17 more adults than Stehn predicted. That is exactly the portion of the 23 mortalities counted in 2008-2009 for which the only evidence was “missing”.

Because the missing birds were not banded, there is no way to prove that these are the exact same 17 birds that were “missing and presumed dead.” But no reasonable other explanation has been offered. TAP’s response was to present incorrect testimony rather than to acknowledge a possible error by Stehn. The TAP response was provided by their witness Felipe Chavez Ramirez; see trial transcript for Day 2, pages 266-267. The witness did the math his way by starting with the number of birds that initially showed up (245), adding in the 22 chicks and 17 “unexpected” arrivals, and observing quite correctly that this was way more birds than ever actually arrived. He concluded this must mean 17 unexpected birds did not show up. His testimony has nothing to do with point made by the Defense, namely the fact that Stehn relied on his assumption of 17 birds “missing and presumed dead” in 2008-2009 to predict only 225 adults would return, and he was short by exactly 17 “unexpected” birds.

There are many instances in Judge Jack’s decision where she goes to some length to explain why she discredits a Defense argument. This important piece of evidence, which supports the Defense and was not effectively disputed by TAP, was ignored, to the benefit of the Plaintiff.

**Opinion on Defense witnesses.** In her decision, Judge Jack expresses no regard for the Defense witnesses. This despite the fact that in my opinion, each had excellent credentials

From the standpoint of causation and mortality, I consider it highly significant that a record number of deaths occurred to birds that left Texas in spring 2008, not spring 2009.

and all of whom testified honestly as to the facts as I know them. [A possible exception is an apparent misstatement by my friend Dr. Slack, whose testimony may have been impacted by his health issues as noted at trial; and/or who may have thought the Judge was asking a question in jest, as she did on many other occasions.] The Judge had no criticism of any Plaintiff expert, even though most had comparable credentials at best, and as noted elsewhere in this analysis, at least some of their factual presentations could have been questioned. Below I briefly discuss two particular defense witnesses.

- I have known **Sam Vaugh** for years and consider his integrity and objectivity unimpeachable. He is respected by all those I have ever encountered, including the environmental community. Yet the Judge characterized him as an “advocate” because he was paid by the Guadalupe Blanco River Authority and had worked for them before. In my opinion responsible experts (including myself) are never “advocates.” When we appear as experts, we do not advocate, but aim to explain the truth to the best of our abilities.
- **Dr. Richard Stroud** was the first Defense witness, whose resume established him as arguably the leading wildlife forensic pathologist in the world; the Judge described him only as a veterinary pathologist, with no mention of his credentials. She discredited him because she understood a remark of his to argue that a green fluid means gangrene, a conclusion she describes as having “no scientific merit,” but one he “kept insisting” on. In the table at the end of this section, I have provided extracts of some of the relevant testimony, along with my comments. Dr. Stroud clearly describes his use of a word association to remind himself that the observation of discolored fluids or pus should prompt the coroner to consider an infectious process, of which gangrene can be such. He was clear that he did not conclude that gangrene is always green, but it can be, hence the word association. The end result was evident on Day 6, p. 40, lines 9-16 where Judge Jack states that in regard to “somebody who sees green and thinks of gangrene. That is disturbing. ... And it concerns me about his qualifications. I’ll tell you that right now.” [With respect to whether gangrene can be green, there will be no doubt for anyone who checks out the photos in the Wikipedia article on gangrene. Please do so if you want to appreciate Dr. Stroud’s frustration over the remarks made by Judge Jack.]

In my experience before judges and hearing officers, I have never encountered this type of bias before. I do not see that the case was tried on an objective basis.

**Conclusion.** In summary, this was a case where the Judge declared Defense witnesses to be advocates, and where the very first Defense witness was discredited to his face, even though he was arguably the world’s leading expert on a subject important to the case. In my experience before judges and hearing officers, I have never encountered this type of bias before. I do not see that the case was tried on an objective basis.

## VI. Concluding Comments

**Issues not considered.** In this analysis, I did not discuss three types of issues.

- **Issues which I do not believe are in dispute.** For example, the critical role of ANWR in recovery of whooping cranes is not in doubt, an appropriate regime of freshwater inflows is certainly important to the health of San Antonio Bay, and the bay is getting flows such that it is in “pretty good condition today” (TAP witness Paul Montagna, Day 3, p. 197, lines 15-16).
- **Issues about which I do not have sufficient expert knowledge or qualifications.** In particular this includes the various matters regarding water rights management in Texas, e.g., whether the state of Texas has the authority to do what the Court says it must do, or whether it can be found guilty of Take through the action of issuing permits.

### Table 3

#### Extracts from trial transcript relating to Dr. Stroud and gangrene.

Day 6, Page 31, the transcript below was in response to a question from counsel: "Please walk us through this internal exam up to the part discussing the interior of the joint." Dr. Stroud is providing a technical explanation of what fluids were observed in the necropsy, and what they might mean. As the transcript shows, he made an effort to be clear that he was using a word association (green and gangrene) to remind himself that the observation of discolored fluids or pus prompt the coroner to consider an infectious process, of which gangrene can be such. He was clear that he did not conclude that gangrene is always green, but it can be, hence the word association.

10 A Okay. Well, as I just mentioned, the overall coloration,  
11 although you can't see it up there very well, is reddened,  
12 hyperemic. That means there's tissue reaction there. There is  
13 a large -- she describes as a large foci of green, tan necrotic  
14 material. And that's what was right in here. You can see  
15 it -- kind of see it, it's not real plain -- but that would  
16 indicate that there is an active, a necrotic process going on  
17 here. You know, green always suggests to me, okay, gangrene;  
18 something's going on there that's fairly significant. There  
19 is -- that's just on the outside. I believe the inside of the  
20 joint shows some further pathology.

21 Q Well, let's look at the photo of the interior of the  
22 joint.

23 A This is where the joint has been, basically, cut open and  
24 the two ends of the bones revealed. In this case, we have --  
25 this would be the end of the one of the bones, probably the  
Page 32

1 tibial bone, and it's kind of got this dark haze to it, similar  
2 to here. It should look more like this area right here. That  
3 would be more the normal view of bone surfaces.

4 In addition to that, we have accumulations of  
5 necrotic material, fibrin, and that type of material indicates  
6 that there is an ongoing tissue reaction. She further  
7 describes --

8 **THE COURT:** I'm sorry; did you say that gangrene was  
9 green?

10 **THE WITNESS:** Yeah. There is a -- it's a

11 discoloration. It literally isn't green, as you say --

12 **THE COURT:** I thought you said that.

13 **THE WITNESS:** -- but it's a discoloration.

14 **THE COURT:** Okay.

15 **THE WITNESS:** Yeah.

16 **THE COURT:** I thought when you said you saw green,  
17 you thought of gangrene.

18 **THE WITNESS:** Well, yeah. I mean, that's kind of one  
19 of those --

20 **THE COURT:** I didn't know gangrene was green.

21 **THE WITNESS:** -- mental notes to bring up gangrene.

22 Gangrene is --

23 **THE COURT:** So, gangrene is -- you're saying, you're  
24 testifying, that gangrene is green?

25 **THE WITNESS:** No. I'm not testifying --

#### Extracts from trial transcript relating to Dr. Stroud and gangrene.

Day 6, Page 33

1 **THE COURT:** Okay. I misunderstood.

2 **THE WITNESS:** -- that gangrene is green. But

3 greenish color, discolored tissue indicates that there's -- you  
4 know, there's a breakdown. Some bacteria, like proteus,  
5 oftentimes will give a green pus. It's actually a kind of a  
6 light green pus. And that's characteristic of certain kinds of  
7 abscesses. You see this in cats fairly frequently, abscesses  
8 that have kind of a greenish-tinged pus to them.

9 **MR. FERNANDES:** Let's go to --

10 **THE WITNESS:** Does that --

11 **MR. FERNANDES:** Oh.

12 **THE WITNESS:** -- answer your question, your Honor?

13 **THE COURT:** No, no. I was asking you --

14 **THE WITNESS:** Okay.

15 **THE COURT:** -- why you thought gangrene was green.

16 **THE WITNESS:** It's a mental note; "gangrene," okay.

17 **THE COURT:** Okay.

Day 6, Page 47. This testimony relates to Judge Jack's position that Dr. Stroud "kept insisting" gangrene is green. The actual testimony is different, and notably includes interruptions by the Judge when the witness tried to explain.

15 **THE COURT:** I'm sorry. I know I'm being difficult  
16 with him, but I have never heard a scientist say when he saw  
17 something green that he thought of gangrene, on that joint back  
18 there. I can't quite move beyond it.

19 Now, you know for a fact that there is no correlation  
20 between the color green and gangrene.

21 **THE WITNESS:** I would disagree with that statement.

22 **THE COURT:** Okay.

23 **THE WITNESS:** There is a --

24 **THE COURT:** You think that there is a direct  
25 correlation between green and gangrene?

#### Extracts from trial transcript relating to Dr. Stroud and gangrene.

Day 6, Page 48

1 **THE WITNESS:** May I explain?

2 **THE COURT:** No; I just want to know: In your mind,  
3 as a scientist, is there a correlation between the color green  
4 and gangrene?

5 **THE WITNESS:** Have you ever seen --

6 **THE COURT:** I'm just saying --

7 **THE WITNESS:** Yes.

8 **THE COURT:** Okay. And you think of gangrene when you  
9 see green.

10 **THE WITNESS:** Greenish discoloration of the tissue --

11 **THE COURT:** That's --

12 **THE WITNESS:** -- is caused by the degradation of  
13 hemoglobin, just like in a bruise. It goes kind of from a  
14 greenish to a greenish-yellow before resolving. Clostridial  
15 organisms, which are common in gangrenous kinds of wound  
16 contamination --

Day 6, Page 75, lines 23-24, the Judge says this about Dr. Stroud: "He's never going to say that a lack of food source can compromise the host and give them infections" which, in context, I take to infer that Stroud will never give truthful testimony in this case--whereas I read his testimony as that of a careful scientist making sure the nuances of the necropsy are understood.

For other examples of the Judge bringing up "green" and the "veterinary guy" see Day 6, p. 166, p. 211, p. 214, and Day 7, pp. 238-239 (and possibly more).

- Subjects that require additional time to address properly. A sampling is provided in the Appendix (*see next page*). I also express an opinion on the crane photo at the end.

**Effect of decision.** There are pressing issues for protection of the ANWR flock, most especially the need to acquire and protect habitat for the growing population, to address known problems such as sea-level rise and habitat destruction by feral animals, and to plan against risks that could devastate the population (e.g., to investigate health problems that may have actually contributed to conditions observed at ANWR in 2008-2009). The remedies ordered by Judge Jack will not squarely deal with these issues, and more likely will distract effort and attention from them, with ultimately no benefit to the species.

**Opinion.** I know firsthand from my experience in Nebraska and New Mexico how aggressive FWS can be in pursuing actions that they consider essential to protecting endangered species, and especially relating to whooping crane survival and recovery. Based on that experience, were upstream water uses as obvious a risk to cranes as TAP alleged and the Judge found, FWS itself would have initiated a Take proceeding. They did not, and so far as I know, did not even consider it. This does not mean the agency would agree with every conclusion I have reached; but it does indicate to me a likelihood that knowledgeable FWS employees agree with the overall conclusion that the science does not support the Judge's finding of Take in this instance. I am confident that FWS can identify many actions that would benefit ANWR cranes, and that curtailment of upstream water uses is not one of them.



Photograph by Diane Loyd, provided courtesy of GBRA.

When they are living in the ANWR salt marshes, whooping cranes love to eat blue crabs. But all probative evidence I have seen indicates they live quite well during the times each year when crabs are scarce, and in those winters when crabs are scarce for many months. The key is that other nutritious foods such as stout razor clams, insects, fiddler crabs, and the like are almost always available.

*Among all the aspects of this matter, the fact that Take was not found by the enforcement agency, U.S. Fish and Wildlife Service, should be a compelling consideration. ★*

## Endnotes (from Foreword)

<sup>1</sup> Section 9 of the ESA broadly defines Take as "to harass, harm, pursue, hunt, shoot, would, kill, capture, or collect or to attempt to engage in any such conduct." (16 USC 1532(18)). The U.S. Supreme Court and subsequent rule by the USFWS has extended the definition of "harm" to include "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns ... ." *Babbitt v. Sweet Home*, 515 U.S. 687 (1995).

<sup>2</sup> The plaintiff in this case is The Aransas Project (TAP), a Texas environmental organization. TAP is a non-profit organization devoted to the environmental health of the Guadalupe River basin and surrounding areas. TAP sued the TCEQ for violation of a Take violation under Section 9 of the ESA. This is a rare use of the citizen lawsuit provisions of the ESA. Those provisions are more typically used to challenge FWS for failure to enforce the ESA. FWS, the federal authority responsible for enforcing the ESA, did not find Take because of 23 mortalities in 2008-2009. Nor did FWS participate in this case.

<sup>3</sup> *TVA v. Hill*, 437 U.S. 153, 184 (1978).

<sup>4</sup> The whooping cranes in south Texas are known as the Aransas Wood Buffalo (AWB) flock. The name derives from the two preserves where the migratory cranes live. The flock winters in the Aransas National Wildlife Refuge of Texas and migrates in the summer to the Wood Buffalo National Park in Canada for breeding grounds.

## Appendix

Examples of my opinions on issues raised in the TAP litigation. These examples are included to ensure that their omission from the analysis does not mean that I concur with the TAP evidence or Judge Jack's use of the evidence. I can provide an expanded discussion if that proves appropriate.

1. Nowhere does TAP or Judge Jack demonstrate a practical understanding that estuaries are habitats with great natural variability in tides, salinities, and food availability, and that any species living in that environment is by necessity able to adjust its diet to changing conditions. Indeed, the fact that whooping cranes have evolved to live in a salt marsh seems not to have taken hold.
2. Whooping cranes are opportunistic omnivores which forage on foods based on quality and availability. They prefer high-value foods present in their salt marsh habitats such as blue crabs and wolfberries. But wolfberries are only available early in the winter, and blue crabs are routinely scarce in the colder, low water level months. At those times, whooping cranes often move to nearby mud flats to forage on nutritious stout razor clams; or are encouraged to feed on uplands (acorns and insects) through the FWS program of burns. When these foods are scarce the entire winter, this shift in foraging occurs over a longer period.
3. Blue crab availability is determined far more by temperature, water level, and historic decline than by salinity; and TAP's calculated impact on crabs due to salinity is far too small to justify its inclusion in a Take finding.
4. It is unfortunate that there has been no scientific study to relate the need of cranes for "fresh" drinking water. Absent such a study, it is hard to analyze judge TAP's anecdotal hypothesis that cranes fly to fresher water when marsh salinities are somewhere in the 15 to 23 ppt range. But even if TAP is correct, I see no significance of this to Take. First, in 2008-2009 salinities were so high that even with zero upstream diversions, the TAP models show salinity well above 23 ppt; this factor could not have contributed to mortality. Also, the energetic cost of such short flights is a minor consideration in the energy budget of a species that flies 2500 miles over a few weeks twice each year.
5. The FWS 2012 report does indicate that Stehn's annual peak population counts are not statistically reliable. This does not negate the key fact that there are numerous indicators of substantial growth in the ANWR flock, to the extent that FWS has stated that "recovery is in our grasp."
6. If one is to rely on the Stehn counts, then attention should be paid to the low migration mortality and high nesting success following winter 2008-2009, which in any other situation would be taken as indicating low stress at ANWR in that winter.
7. There is no evidence that food shortages contributed to the known crane deaths that occurred at ANWR in winter 2008-2009. The visual evidence of emaciation of some cranes occurs even for birds at feeders, thus with access to a food supply, and may be an indication of disease. FWS programs such as burning and supplemental feeding are undertaken even though they are known or suspected to require flights of the birds to uplands and to increase the risks of predation or disease.
8. TAP's estimate of what inflows and salinity benefits would be in 2008-2009 in the absence of diversions is too high because they added in diversions from previously stored water. Their use of State median flows to set a flow target is unrealistic as those flows would not occur in a drought even if not one drop of water was diverted upstream.
9. Any causation theory (TAP's or mine) needs to account for anomalous winters of harsh conditions but low mortalities, such as 1999-2000 when salinities were high and blue crabs short; or 1996-1997 when salinities were high but blue crabs were sufficient; or 1993-1994 (when Dr. Chavez-Ramirez was in the field), with low salinity but extremely low water levels and limited supplies of crabs and stout razor clams, and high reported mortality. I note that the energy-budgets developed by Dr. Chavez-Ramirez, when corrected for an error in nutritional values, show a positive energy budget for cranes in 1993-1994.
10. It is correct that the FWS Recovery Plan echoes Tom Stehn's opinions about the importance of freshwater inflows to ANWR whooping cranes. After the dust settles in this case, it would be appropriate for those interested in whooping cranes to meet with FWS informally and determine how this and other recommendations in the plan can be reviewed for accuracy, and how collectively a cooperative effort to ANWR can be designed and implemented. There is no need for court injunctions or mandated Habitat Conservation Plans to protect the ANWR flock.

## About the Authors

**Lee Wilson** has B.A. and Ph.D. degrees in geology (with a minor in ecology) from Yale and Columbia Universities respectively. He has more than 40 years of consulting experience in hydrology and environmental analysis, with much his work being done for the U.S. Environmental Protection Agency and along the Texas and Louisiana coasts. More information on his background is provided in the report proper.

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