

**Adaptive Management for the Middle Rio Grande Endangered
Species Collaborative Program: Analysis and Issues**

by

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Rio Grande silvery minnow

(Murray et al., 2011)



Southwestern willow flycatcher

(MRGESCP, 2011)

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Committee Approval

The Master of Water Resources Professional Project Report of **Ralph Monfort**, entitled **Adaptive Management for the Middle Rio Grande Endangered Species Collaborative Program: Analysis and Issues**, is approved by the committee:

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Abstract

Adaptive management is a science-based methodology designed to deal with uncertainties in environmental applications using an iterative approach, sometimes called “learning by doing.” The Middle Rio Grande Endangered Species Collaborative Program (MRGESCP), consisting of sixteen federal, state, and local signatory organizations, adopted adaptive management in 2010 to aid in their charter “to prevent extinction and promote recovery of [Endangered Species Act] listed species [the Rio Grande silvery minnow and the southwestern willow flycatcher] while allowing existing water uses and development of future water uses to continue in accordance with applicable federal and state laws” (Kelly & McKean, 2011, p. 4). While adaptive management is designed to handle complex and variable situations, its application often conflicts with established custom, regulations, and statutory practices. As a result, it has had mixed results in similar projects (Doremus et al, 2011, p. 1). This paper presents an analysis, based on a literature review, interviews with MRGESCP participants, prior experience in a government agency adopting a similar “new” management program, and direct observation, of the applicability of adaptive management to the MRGESCP, identifies current and prospective issues, and gauges the likelihood of its success as unlikely. Major reasons for this conclusion include: contentious water politics on the river leading to a lack of collaboration among MRGESCP members, inherent institutional resistance to change exacerbated by the large number of organizations involved, absence of key stakeholders, and driving all of these, water scarcity. Findings and recommendations are presented.

Introduction

Like many rivers in the southwestern United States, the flow of the Rio Grande historically fluctuated widely both seasonally and annually as it evolved its specific river ecology. As human populations settled along its length, people increasingly began controlling the river to optimize its use for their purposes (straightening, diverting, damming, and even supplementing its flow with water from the Colorado River watershed through the San Juan-Chama Project (Glaser, 2011)); their purposes included water for irrigation and municipal/industrial consumption, the development of rich floodplain land for agriculture, grazing and habitation, prevention of flooding, and meeting delivery requirements to Texas and Mexico under the Rio Grande Compact (RGC, 1939). Inevitably, these controls changed the river's ecosystem proving a benefit to some organisms and a detriment to others. The modification of the Rio Grande produced ecological "losers" among the native species, many of which are now extinct. Two that remain are now on the Endangered Species List: the Rio Grande silvery minnow (*Hybognathus amarus*) [minnow] which by 1993 had forfeited about 95% of its historic range (Kelly & McKean, 2011, p. 1) and the southwestern willow flycatcher (*Empidonax traillii extimus*) [flycatcher] based on loss of its breeding and wintering habitats and brood parasitism (Hall, 2003, p. 68). The minnow was declared endangered under the 1973 Endangered Species Act (ESA) on July 20, 1994 and the flycatcher on July 22, 1997 (Hall, 2003, pp. 20, 29). An ESA-listed species provides a means of legal enforcement for ecosystem management.

A significant drought along the Middle Rio Grande (MRG) began in 1996 resulting in a large minnow kill due to the diversion of the entire river flow at San Acacia

for irrigation (Kelly & McKean, 2011, p. 1). The diversion caused a 36-mile reach to go dry for 128 days; this drying perhaps also contributed to a failure of adjacent flycatcher nests (Hall, 2003, p. 63). Dry conditions persisted and on July 8, 1999, the U.S. Fish & Wildlife Service [the Service] issued the first Rio Grande silvery minnow Recovery Plan followed, in 2001, by their first Biological Opinion (BiOp) concerning both the minnow and the flycatcher (Kelly & McKean, 2011, pp. 2-3). In response to a continued drought the following fall, Judge James Parker of Federal District Court ordered water released from Heron Reservoir to keep the river wet for the minnow under the ESA (RGSM v. Keys, 2002). The combined effects of drought, new regulations and court judgments threatened to destabilize the delicate balance of convoluted agreements hammered out through the years by the multiple entities that rely on the waters of the Rio Grande. The result was a series of legal actions by stakeholders seeking to protect their share of the river (Kelly & McKean, 2011, p. 4).



Figure 1. Rio Grande silvery minnow
(Murray et al., 2011, May 18-19)



Figure 2. Southwestern willow flycatcher (MRGESCP, 2011)

Even the formalization of the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP) in 2002 with its twenty-one original participants (now sixteen signatories including most of the major federal, state, and local stakeholders

on the river), did not stop some participants from continuing to seek legal recourse (Kelly & McKean, 2011, pp. 3-4, MRGESCP, 2009). With the issuance of the Service's 2003 update of the BiOp (and the rewetting of the river through precipitation), many of these claims have been mooted by the courts, but uncertainty remained, particularly on whether the Bureau of Reclamation [BOR or Reclamation] had the authority to release San Juan-Chama water (a trans-basin diversion from the Colorado River basin) to support the minnow's recovery (Kelly & McKean, 2011, pp. 5-6). The BiOp quoted a BOR estimate that, given current drought conditions, "the proposed action [i.e., managing the river under current regulations] will dewater a minimum of 105 river miles from May through early November in most years of the proposed action [i.e., 2003-2013]" (Hall, 2003, p. 69). In response, the Service stated that the proposed actions in the BOR's 2003 Biological Assessment "are likely to jeopardize the continued existence of the silvery minnow and the flycatcher and adversely modify critical habitat of the silvery minnow" (Hall, 2003, pp. 84-85). To mitigate the jeopardy to the minnow and flycatcher, the Service presented a Reasonable and Prudent Alternative (RPA) to jeopardy consisting of thirty-one elements along with limits on incidental takes (i.e., permits allowing the "taking" of an endangered species under certain prescribed conditions). The RPA imposed significant restrictions on water operations along the MRG (Hall, 2003, pp. 87-102).

The Middle Rio Grande Endangered Species Collaborative Program was organized "to prevent extinction and promote recovery of listed species [the minnow and the flycatcher] while allowing existing water uses and development of future water uses to continue in accordance with applicable federal and state laws" (Kelly & McKean,

2011, p. 4). This is a challenging, potentially contradictory, set of goals given that many MRGESCP members concede the river was probably fully appropriated even before the 2003 BiOp—in the absence of basin adjudication, no one knows for sure. In 2010, Reclamation provided funds to hire contractors to help the MRGESCP adopt an Adaptive Management (AM) approach (Bingaman, 2010). Major federal resource management agencies (including the Department of the Interior) have made a policy commitment to AM since 1993 (Ruhl & Fischmann, 2010, p. 443). AM offers a methodology steeped in the scientific method to deal with the uncertainties in environmental applications using an iterative approach. Beginning in November 2010 the chosen contractors, ESSA Technologies (ESSA) partnered with Headwaters Corporation (Headwaters), provided guidance and direction to the MRGESCP concerning AM via a work group forum culminating in the delivery of the version 1.0 Adaptive Management Plan (AMP) to the MRGESCP's Executive Committee (EC) on October 31, 2011. Since the contractor-led work group had its final meeting in May 2011, the MRGESCP has been discussing what changes in the MRGESCP's current structure are necessary to ensure their AM initiative continues moving forward.

Background on Adaptive Management

C. S. Holling with colleagues at the University of British Columbia's Institute of Resource Ecology developed Adaptive Management, or "AM", in the late 1960s (OSU, 2011). Holling was primarily interested in exploring the boundaries of natural systems through experimentation (OSU, 2011). Together with Carl Walters, another early advocate who questioned some of the basic management assumptions of the time (OSU, 2011), they pointed out that limited knowledge of natural systems requires an iterative

approach to environmental management with the goal of reducing uncertainty by systematically incorporating learning into the management process (Doremus et al., 2011, p. 2). Kai N. Lee successfully introduced this concept to the Northwest Power Planning Council in 1984 after which AM became increasingly adopted by U. S. resource management (OSU, 2011). The theory matured into a management process and is often illustrated by a feedback loop of multiple steps showing learning from previous project actions (or “experiments”) being used in the formulation of the next project actions. One of the earlier such loops which serves well to illustrate the basic concept of AM is the four phase process of Bormann et al. (1994, p. 2) shown below.

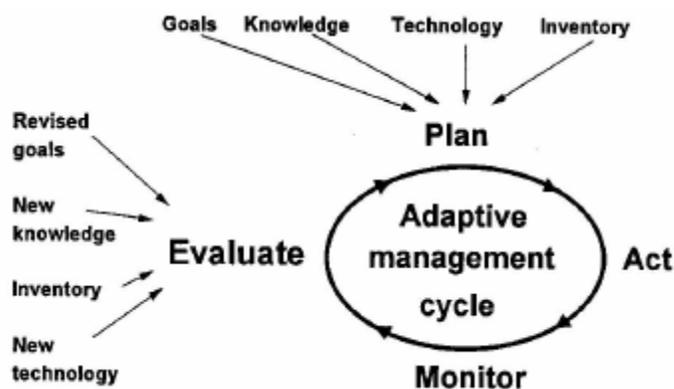


Figure 3. Four-step adaptive management cycle

Since the mid-1990s, AM has been increasingly accepted in natural resource management policy within the U.S. through incorporation into agency guidance, regulations and statutory mandates (Doremus et al., 2011, p. 3). For example, this project’s March 2003 BiOp states that “Reclamation is committed to applying the concepts of adaptive management to all of the proposed Federal actions described in this programmatic biological assessment” (Hall, 2003, p. 18). The U.S. Department of the Interior (DOI) provides an online Technical Guide (2009) to AM in which it presents its operational definition adopted from the National Research Council:

Adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a ‘trial and error’ process. But rather emphasizes learning while doing. Adaptive management does not present an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders. (Williams, Szaro & Shapiro, 2009, p. v)

Intuitively, AM seems a good fit for natural resource management. Natural adaptation is fundamental to the process of species evolution and plays a large part in ecological succession. In addition, nature’s resiliency would aid in the recovery from any suboptimal result of a project management option implemented by the management team. However, the literature is clear that AM is not suited for all projects and that, when chosen for implementation, there are still pitfalls to be avoided. The MRGESCP’s AM contractors provided a list of inappropriate applications (Greig, Marmorek, Murray & Robinson, 2006, p. 3). Among them are:

- 1) when the response time from management’s experiments would be too long;
- 2) when too many variables would need to be monitored for real learning to occur;
- 3) when there are too many confounding factors;
- 4) when you already understand what must be done (i.e., uncertainty is low); and especially
- 5) when the applications of the management experiment are deemed unacceptable or are irreversible.

This last point is particularly salient for the MRGESCP which is managing the recovery of two endangered species whose extirpation through experimentation would clearly be both irreversible and unacceptable. The DOI’s Adaptive Management Technical Guide (2009, p. 63) provides further insight into the ESSA/Headwaters team’s second and third

points above. It warns that if the resource system changes more rapidly than the rate of learning about it or if the objectives change more rapidly than they can be achieved through AM or even if the people on the management team change too often, then “the accretion of knowledge is clearly undermined.” These concerns, and their applicability to the MRG and the MRGESCP, are explored in the Results section.

Project genesis

Most U.S. federal agencies, at some point, have tried to adopt a “new” management approach to gain efficiency, cut bureaucracy, and/or promote creative problem solving. Strategic Planning, Management by Objectives/Results, Total Quality Management (TQM), and Structured Flexibility are just a few of the many programs that have gained wide support through the years (Salafsky, Margoluis & Redford, 2001). My work background was fundamental to the selection of this graduate project. I served 27 years in the U.S. Air Force officer corps, retiring in 2001. During most of the last ten years of my service, the organizations in my chain of command were deeply engrossed in applying the fundamentals of Total Quality Management to all aspects of our management practices. TQM was developed by W. Edwards Deming in the 1940s. After World War II, he proposed this new management approach to U.S. companies to increase their efficiency through continuous improvement; however, in the ebullience and feeling of omnipotence pervasive in post-war America, company managers rejected it. Deming then took TQM to Japan where it helped propel that country’s rapid post-war rise to become a world economic power (Sowerbutts, 2011). In the 1980s and 1990s, U.S. companies and governmental organizations reintroduced TQM to America with mixed results (Sowerbutts, 2011). TQM, like any “new” management approach, generally

requires a shift in mindset within individuals and its adoption into their organization's corporate culture if it is to produce the desired results. The Air Force, often seen as a typical bureaucratic government organization, provided a rich environment to observe such an endeavor. This was especially true since Air Force personnel, who rotate among many jobs at many locations throughout their careers, are thus actually conditioned and amenable to change such that the TQM indoctrination at least had a chance.

From January through December 2010, I attended the MRGESCP's work group meetings and workshops on adaptive management and the Executive Committee meetings. Within the first hour of my first meeting, I noted many similarities between my TQM experience and the MRGESCP's plan to incorporate AM. However, two major differences stood out immediately: 1) whereas the Air Force's contractors provided hundreds of hours of training on TQM to the staffs at each organizational level, the MRGESCP's contractors were constrained to provide training on AM only as a learn-by-doing approach while the contractors gathered information for drafting the initial Adaptive Management Plan and 2) whereas the Air Force organizations involved were tiered such that direction to adopt TQM came from the top and so was (more or less) consistently downward-directed, the MRGESCP includes sixteen different organizations each with its own culture, values, and procedures. These two differences promised a more difficult (and interesting) application of the MRGESCP's approach to AM than what I had experienced with TQM.

Project description

The title of my project is "Adaptive Management for the Middle Rio Grande Endangered Species Collaborative Program: Analysis and Issues." Because of the

MRGESCP's relatively recent incorporation of the AM process, this project's focus is on the initial acceptance of AM as a new and driving approach by this ongoing program and not on the success of the AM process itself.

Methods

Several methods were used to gain information for this project. They include: 1) direct observation of MRGESCP proceedings throughout 2011, primarily Executive Council meetings, Coordinating Committee meetings, and the contractor-facilitated Adaptive Management work group meetings; 2) a literature review on the application of AM primarily with respect to environmental projects; and 3) semi-structured interviews and informal discussions with MRGESCP participants and with interested stakeholders who have chosen not to be formal MRGESCP members. Findings and recommendations grouped under thirteen general headings are presented in the Results section below.

Eight interviews with a cross-section of MRGESCP participants were conducted. The interview process was formally exempted by the University of New Mexico's Institutional Review Board (IRB) process under the Human Research Protection Office due to the public status of the MRGESCP, the non-sensitive nature of the collected data and the assurance of anonymity concerning the participants. The interview instrument used to facilitate the interviews is at attachment A. However, as the purpose for the interviews was not the collection of quantitative data but rather understanding the participant's perceptions of the MRGESCP and its application of AM, interviewees were encouraged to provide any insights they felt contributed to these ends.

Informing my observation, review and discussions was the strong parallel between my previous TQM experience and the MRGESCP's progress in accepting the

AM process. Unlike most graduate level projects, I bring extensive insight to this particular project based on twenty-seven years of managerial experience in a government organization (from entry level team leader to organizational commander) with ten years direct participation in implementing a new management approach (i.e., TQM) very similar to what the MRGESCP is trying to do with AM. This is the reason I chose this project and is such a pervasive element in my findings and recommendations that I considered formally referencing my work experience within the paper itself. However, this is not normal practice so instead I added this paragraph to explicitly explain the somewhat unusual relationship of my previous career to this project.

Research question

A large group of governmental and nongovernmental organizations, each with its own organizational culture, history, regulations, agenda, goals, and/or constraints, agree to collaborate to improve the river/riparian habitat and viability of two endangered species on a fully appropriated river over the full range of New Mexico's (considerable) climatic variability. Will such a group, the MRGESCP, be able to successfully implement the adaptive management process? This is the primary research question of this study. The AM literature is replete with descriptions of successful and failed applications of AM to environmental projects (Doremus et al., 2011, p.1; Ruhl & Fischmann, 2010, p. 445). Some present lists of recommendations and associated examples, for the success of AM. Many of these insights, along with observations from my own experience, are applied to the MRGESCP and its attempt to implement an AM program.

My project, being undertaken so early in the MRGESCP's AM process, will necessarily focus on start-up issues that shed light on my central question. However, my

project will end before the MRGESCP has the chance to demonstrate key steps in the adaptive management process. Consider the AM cycle depicted in figure 4 as a six-step loop which has been adopted by the MRGESCP as recommended by ESSA and Headwaters (ESSA, 2011).

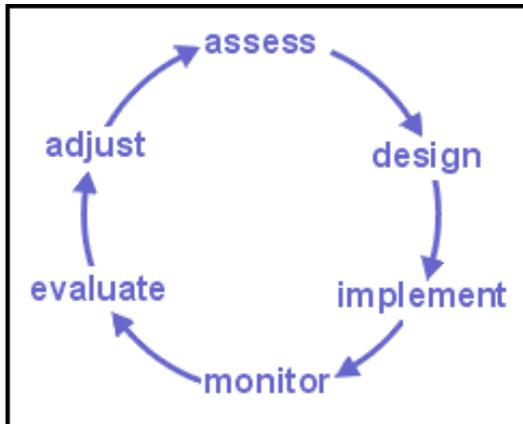


Figure 4. MRGESCP adaptive management cycle

A literature review suggests that a main failure point in the process is “closing the loop” (Doremus et al., 2011, p. 4, Ruhl & Fischmann, 2010, pp. 434, 440-441, 460) or, in other words, taking the analysis gained from one pass through the cycle and applying the knowledge gained as an input to the next cycle (i.e., from the *adjust* step to the *assess* step in the figure above). Unfortunately, fiscal, temporal, political, or other constraints can preclude an organization or program’s ability to take advantage of the real power of AM, the iterative process. This project will end before the MRGESCP completes a single AM cycle which provides opportunity for further work concerning the application of AM by the MRGESCP.

The Middle Rio Grande

To paraphrase Heraclitus of Ephesus, “you can not step twice into the same river, for fresh waters are ever flowing in upon you.” This aphorism refers to the constant

refreshment of the river's water but, concerning the Rio Grande, it could equally describe the variability of the flow and constantly changing nature of the river's form. A look at a hydrograph for the MRG, whether for a year, a decade or a century, defies anyone to make sense of the measure of the river's *average* flow (see figures 5, 6 & 7 below for USGS hydrographs). The various communities living along the river have suffered devastating floods and oppressive drought multiple times in the last two hundred years, and sometimes within the same year. However, without the Rio Grande the people would not be here; it is the lifeblood of Central New Mexico. And so the people have manipulated and changed the river in numerous ways until it bears little resemblance to the river it once was, no longer a braided system of continuously migrating rivulets, then a roaring cascade in full flood, but now a tamed, straightened stream with thick bosque and fertile fields lining both sides, managed to within an inch of its life. This reality is the dominant factor underlying almost every issue presented in this analysis.

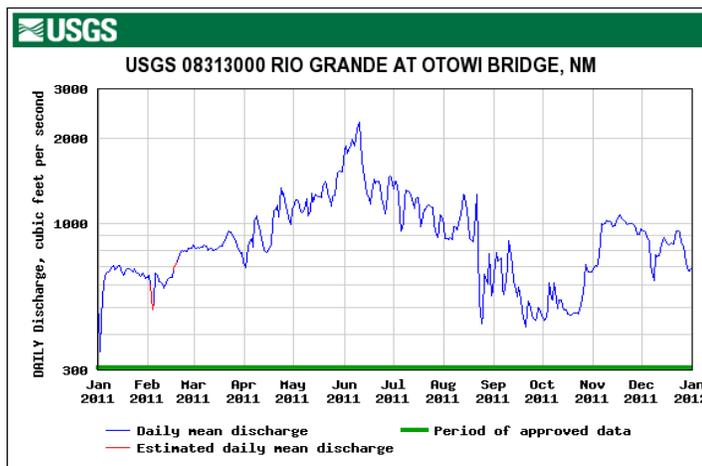


Figure 5. One-year hydrograph of Rio Grande at Otowi Bridge

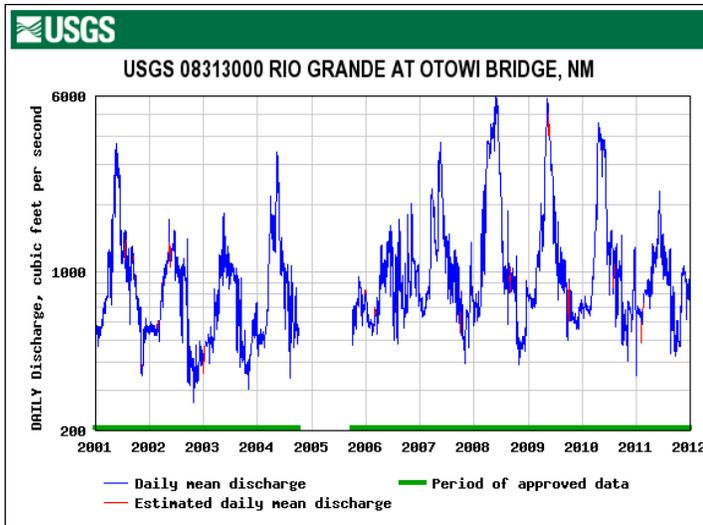


Figure 6. Ten-year hydrograph of Rio Grande at Otowi Bridge

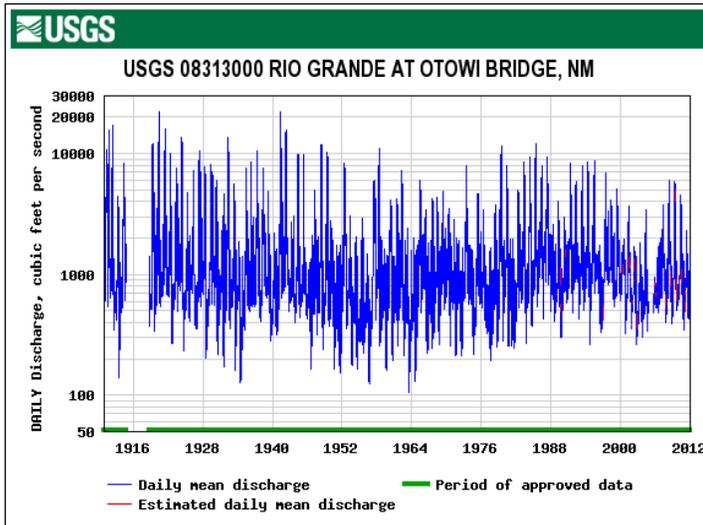


Figure 7. One hundred-year hydrograph of Rio Grande at Otowi Bridge

The MRGESCP

The Middle Rio Grande Endangered Species Collaborative Program celebrated its tenth anniversary in October 2011. It was established in response to two species in the MRG ecosystem being placed on the Federal Endangered Species List. Table 1 is a list of the organizations participating in the MRGESCP as signatories as of July 7, 2010 (MRGESCP 2009 AR, 2011).

Table 1 MRGESCP signatories

| |
|---|
| • Bureau of Reclamation (Reclamation) |
| • U.S. Fish and Wildlife Service (Service) |
| • U.S. Army Corps of Engineers (USACE) |
| • New Mexico Interstate Stream Commission (NMISC) |
| • New Mexico Department of Game and Fish (NMGF) |
| • New Mexico Attorney General’s Office (NMAGO) |
| • Santo Domingo Tribe |
| • Pueblo of Sandia |
| • Pueblo of Isleta |
| • Pueblo of Santa Ana |
| • Middle Rio Grande Conservancy District (MRGCD) |
| • City of Albuquerque (COA) |
| • Albuquerque-Bernalillo County Water Utility Authority (ABCWUA) |
| • Assessment Payers Association of the Middle Rio Grande Conservancy District (APA) |
| • New Mexico Department of Agriculture (NMDA) |
| • University of New Mexico (UNM) |

The first three signatories in Table 1 are the primary Federal agencies involved in water related matters in New Mexico; the Service, in particular, is responsible for oversight of ESA compliance. Most of the organizations representing major water constituencies on the MRG are on the list. Notably absent are any conservation organizations, some of which participated in the beginning of the MRGESCP but eventually dropped out. Specifically, the coalition called the Alliance for the Rio Grande Heritage, which included support from the Defenders of Wildlife, Forest Guardians, the Land & Water Fund of the Rockies, Rio Grande Restoration, the Sierra Club, the Southwest Environmental Center, Amigos Bravos, the World Wildlife Fund, the Rio Grande/Rio Bravo Coalition, the New Mexico Public Interest Research Group, and the National Audubon Society (Amigos Bravos, 2001), was a signatory of the 2002 Interim Memorandum of Understanding (USBR, 2003) .

The Executive Committee (EC), consisting of primary and alternate members from each signatory organization with a government co-chair appointed by the Secretary

of the Interior and a non-government co-chair elected by EC members, is the MRGESCP's governing body. A subordinate Coordinating Committee (CC) manages five standing work groups (Habitat Restoration, Science, Species Water Management, Population Viability Analysis/Biology, and Public Information Outreach) and ad hoc work groups as required (currently four: Monitoring Plan Team, San Acacia Reach, Population Habitat Viability Analysis/Hydrology, and Database Management System) (MRGESCP AMPV1, 2011). A Program Management Team (PMT) provides management and administrative support.

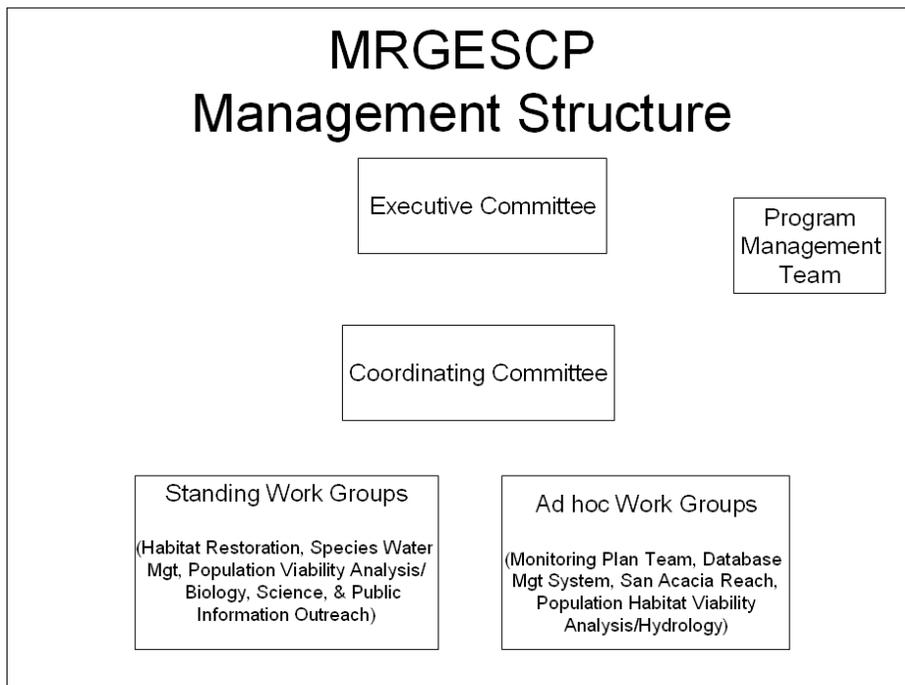


Figure 8. MRGESCP management structure

For the past ten years, the MRGESCP has been operating under the Reasonable and Prudent Alternative (RPA) specified in the 2003 BiOp as an alternative to jeopardy for the species. The RPA list, along with limits on incidental takes, presents a prescriptive set of constraints on the already-convoluted controls governing the river's flow regime. At off-site gatherings in August 2009 and again in November 2011, MRGESCP members

agreed in spirit to transition the MRGESCP to become a Recovery Implementation Program (RIP). A RIP is a formal, cooperative agreement that MRGESCP members enter into with the Secretary of the Interior to recover the listed species (MRGESCP, 2011, August 18) rather than just alleviating jeopardy, which is the current goal. MRGESCP members would agree to use their resources and authority to recover the species in return for ESA compliance (MRGESCP, 2011, August 18). As described by a Service representative at the November 2011 off-site meeting, using the species recovery plan as a starting point, the RIP implements an annual plan to move towards species recovery. Instead of implementing RPA actions to alleviate jeopardy, the Service gauges annual success on “sufficient progress” towards recovery. This then becomes the MRGESCP’s “report card.” It is this rather nebulous phrase, “sufficient progress,” which has caused some MRGESCP members to balk at voting to become a RIP until they are assured ESA coverage is worth the cost to their organizations. As this report was being written, the MRGESCP was working to establish itself as a RIP.

As mentioned in the introduction, the water supply for the MRG basin has not been adjudicated and is generally considered to be over-allocated (Pease, 2010, p. 37). Many parties have rights to a share of the water, and these parties use the water for a variety of purposes. Over the years, as the population has grown along the MRG, competition for the available water, particularly during dry years, has become intense. The situation further intensified with the listing of the minnow and flycatcher, which created a perception that additional commitments of river water would be needed to relieve jeopardy, thereby further taxing an already inadequate water supply. This state of affairs is often reflected in the posturing of MRGESCP members who represent a

constituency with current water rights. Whenever water is involved in MRGESCP discussions, members are less forthcoming until they are able to understand the consequences of the proposed activity to their constituents. As quoted from a member at the August 2009 off-site meeting when the water supply issue was placed in “the parking lot bin” yet again, “The elephant in the room is the hydrology and water management issues” (MRGESCP, 2009, August). Nothing has changed since that meeting; the elephant is still there, an issue so potentially divisive and insoluble nobody wants to broach it.

Results

I have categorized the results of my research into the thirteen general themes. I present discussion, along with one or more findings and recommendations, associated with each of these themes. The general themes are as follows:

1. General concerns and challenges to the application of AM in the MRGESCP
2. The need for commitment to AM principles by all MRGESCP members
3. The need for change in the management culture
4. The need for proactive involvement of the Fish & Wildlife Service
5. The need for AM champions
6. The need for training in AM principles and processes
7. The need for rigorous science
8. Obstacles to “turning the corner” in the AM process
9. The insufficiency of available water to meet all human and endangered-species demands
10. Challenges to funding full implementation of AM
11. The importance of effective communication
12. The influence of human nature
13. The KISS Principle (“keep it simple, stupid”)

In this results section, the application of AM in the MRGESCP is often overshadowed by the water supply realities in the Rio Grande Basin and the management challenges within the MRGESCP itself. The water supply and its management as it has evolved in the

Middle Rio Grande are the central themes of these discussions since they are important determinants of the likelihood of successful AM implementation.

1. General Concerns and Challenges to the Application of AM in the MRGESCP

The literature on adaptive management provides some general insights that are applicable to the MRGESCP. Doremus et al. with the Center for Progressive Reform (2011, p. 1) suggests that AM is not appropriate “where mistakes may be irreversible” (as in dealing with endangered species) and that, in any case, “documented instances of successful adaptive management of public resources are rare” due to “funding structures and agency cultures.” Ruhl and Fischmann (2010) performed a search for federal AM court cases and found thirty-one of which the government lost more than half (with the caveat that not all losses were necessarily *attributable* to AM). The authors concluded that courts seemed to like the “idea” of AM but were unimpressed with its application. In the balance between “flexibility” and “certainty,” courts needed to find the “reasonable certainty” in compliance with legal standard (Ruhl and Fischmann, 2010, p. 466). What the authors found too often instead was a less rigorous form of adaptive management they termed “a/m lite” which at its worst is a “pretext for postponing difficult, but important, decisions in order to dodge the constraints of budgets, politics, or scientific uncertainty” (Ruhl and Fischmann, 2010, p. 442). The authors’ second major point highlights an artifact of the law itself which has evolved to favor a two-step process in which arguments over draft documents and comments are heard and resolved, and *then* the government agency makes the decision to begin implementation. While the courts seem to recognize that the iterative nature of AM is more suitable to a particular class of environmental problems, a “statutory vacuum” exists with no authority, regulatory

standards or even legal definitions for the judges to rule on such an iterative approach (Ruhl and Fischmann, 2010, p. 440).

Ruhl (2005, p. 39) warns that while “[a]dopting adaptive management may be an agency’s dream; practicing it is a nightmare.” In particular, pointing out that AM’s track record is “bad,” Ruhl suggests that legislatures, the public, and the courts can all cause problems. “[I]n order for adaptive management to flourish in administrative agencies, legislatures must empower them to do it, interest groups must let them do it, and the courts must resist the temptation to second-guess when they do in fact do it.” (Ruhl, 2005, p. 31). In fact, the author doubts AM is possible without some changes in administrative law.

***Recommendation 1.1 – Consider the Threat of Litigation:** While the MRGESCP’s nascent AM program has not yet faced the threat of litigation, the EC should consider Ruhl’s above warning when planning initial AM actions. By studying court cases involving AM projects, the MRGESCP might sidestep potential legal problems in the future. Also, as mentioned in the Commitment section below, having all MRG stakeholders involved in MRGESCP actions could lessen the threat of litigation which is certainly the best way to avoid the courts second-guessing MRGESCP decisions.*

The AM literature also offers some insight into why advocates are promoting AM application for the MRGESCP. Given the complexity of the Rio Grande ecosystem with its ever-changing hydrological dynamics, AM does provide a methodology to efficiently and systematically build a scientific understanding (if done correctly) of what works, what doesn’t, and why (Salafsky et al., 2001). In addition, it offers a thoughtful, considered way forward in the face of scientific uncertainty (CSR, 2011, p. 2).

Concerning local constraints to the application of AM on the Rio Grande, New Mexico has no statutory provision for allotting water for environmental reasons although in 1998 the state did recognize the concept of instream flow as a “beneficial use” (Udall, 1998). However, this does not solve the problem of how such use might be gained on a fully appropriated river under the state’s prior appropriation doctrine (Benson & Hopton, N.d.). Even with this caveat, however, authorization of instream flow as a beneficial use of water might be useful in the application of AM along the MRG.

Finally, Kai N. Lee in his seminal book on AM, *Compass and Gyroscope* (1993, p. 58), seems to have had the Rio Grande in mind when describing the difficulties of doing analysis at the ecosystem level. He notes that large changes caused by human perturbations make “natural” ecosystems unknowable. Such a lack of understanding of the current function of ecosystems can significantly complicate the process of hypothesis development in AM. The Rio Grande ecosystem has been so altered during the last 150 years that, while a goal of sustainable populations of minnows and flycatchers might be attainable, returning to the “natural” river ecosystem of the late nineteenth century is not.

2. The Need for Commitment to AM Principles by All MRGESCP Members

Commitment at all levels within an organization that is implementing AM is necessary to the success of that program, but is especially critical at the executive level. Greig et al. (2006) states that a legislative mandate prescribing AM is not sufficient to ensure a smooth implementation. Instead, the authors note that because most institutions aren’t designed for AM, direction from and support of the organization’s leaders is required, especially when “closing the loop” of the cycle. The DOI’s Adaptive Management Technical Guide (2009, p. 13) states that long-term executive commitment

will be required in matters of funding, adapting the corporate decision-making process, and changing the culture. This commitment by the organization's leaders must extend to the organization's common vision and goals if AM is to be effective, especially when organizational goals come into conflict (e.g., conservation vs. development) (USBOR, 2011, pp. 34-36). It is also not enough for managers to espouse commitment to AM, they must incentivize employees to adopt AM principles (Greig et al., 2006, p. 5).

Finding 2.1 – The MRGESCP's Goal Statement Contains Inherent

Contradictions: *As mentioned in the introduction, the MRGESCP's statement of purpose itself includes a potential contradiction since it pertains to the fully or over-allocated MRG system: to prevent extinction and promote recovery of listed species while allowing existing water uses and development of future water uses to continue in accordance with applicable federal and state laws. This purpose statement allows voting members to have almost unlimited flexibility in their decisions while still remaining true to the MRGESCP's stated purpose, since situations will certainly arise in which members must choose among the various goals embedded within that purpose statement. For example, in a low-flow water year, any project requiring additional instream flow to relieve jeopardy to the species could impact existing water uses, both of which are goals imbedded within the MRGESCP's purpose statement. This situation creates conflicting commitments among MRGESCP members.*

Recommendation 2.1 – Prioritize Goals within the MRGESCP's Purpose

Statement: *The EC should consider rewording the MRGESCP's purpose statement to provide some indication of priority within its four segments: 1) prevent extinction, 2) promote recovery, 3) allow existing uses, and 4) develop future uses. A clearer statement of the MRGESCP's priorities now could avert a stalemate later when the various goals are in conflict in a future situation. Forcing MRGESCP members to have this crucial debate now also ensures that the core issues will be debated without the confusion introduced by a specific situation.*

Finding 2.2 – Several Major Changes/Updates are In-Work Creating an Opportunity for the MRGESCP to Implement AM: *The MRGESCP is currently dealing with several major events: multiple Biological Assessments are being finalized in readiness for the Service’s 2013 BiOp; EC members are once again discussing how the MRGESCP can make the transition to a RIP; the MRGESCP’s Long Term Plan is in rewrite; and, with the version 1.0 Adaptive Management Plan delivered by the AM contractors in October 2011, EC members are considering how best to implement AM and to update the AMP to version 2.0. Many MRGESCP members have expressed their reluctance to proceed through another reorganization in response to any of the above events since it keeps them from getting on with the “real work” of the MRGESCP. A draft Adaptive Management Work group (AMWG) charter has been circulated which, if implemented, would add an AMWG into the management structure between the CC and the technical work groups (MRGESCP AMWG charter, 2011). This would certainly elevate AM’s status within the MRGESCP and give it more clout.*

Recommendation 2.2 – Integrate AM into MRGESCP’s Existing Processes: *Adaptive management is not likely to be effective if it is not fully integrated into the MRGESCP’s processes. Addition of a new management initiative into a MRGESCP that has been operating for ten years would generally be a tough sell. However, especially if the MRGESCP becomes a RIP, the EC has the perfect opportunity to ensure adaptive management is given the best chance to succeed. Adding another layer of perceived bureaucracy into an already extended structure, however, could cause frustration (one more meeting to attend, one more step in each up/down-channel chain) and slow the process down. A better strategy is to integrate AM into the existing structure without creating another management layer, such as by merging the CC and the AMWG. If the resulting charter is too much for one work group, then selective functions would either be elevated to the EC or moved back to the lower tiered work groups. This option minimizes the disruption to the current structure while clearly focusing the renamed work group on AM implementation.*

Finding 2.3 – Stakeholder Organizations have Conflicting Agendas and Conflicting Loyalties: *With sixteen organizations on the MRGESCP, all protecting their stake in the water flowing in the Rio Grande, it is inevitable that organizational agendas/goals/objectives will sometimes conflict with those of the MRGESCP. How members react to these instances of conflicting loyalties could impact the MRGESCP’s ability to move forward. In fact, multiple MRGESCP participants both during MRGESCP meetings and in private discussions have questioned whether MRGESCP members are being truly collaborative. The lack of progress towards becoming a RIP between the 2009 and 2011 off-site meetings which both focused on the issue indicates the reluctance of members to accept the test of “sufficient progress” (i.e., the Service’s gauge of annual success for a RIP) without fully understanding the consequences of doing so to their organizations.*

Recommendation 2.3 – Make a Decision to Become a RIP, or not: *The PMT should identify those member organizations still reluctant to move towards a RIP (by EC vote if not already known) and meet with those members (and their organizations’ executives if necessary) in a “smoke-filled” room to either hammer out the differences or accept that a RIP is not appropriate for this Program. The confluence of recent events, as noted in Finding 2.2 above, is appropriate for this decision to be made now and not be continuously pushed into the future. (Note: since this paper was drafted, the EC again began discussion on how to proceed toward becoming a RIP, and the CC has been working on drafting key RIP documents.)*

Finding 2.4a – Despite the One-Organization, One-Vote Policy, Inequities Exist among MRGESCP Members: *Within the MRGESCP’s sixteen signatory members are some large agencies with significant resources (people, money, authority, etc.) and some small organizations with one person trying to cover everything. Therefore, heavy expectations are placed on the larger organizations to be the ones doing much of the MRGESCP’s work, but it also places a stigma on the smaller organizations regardless of the one-organization-one vote policy.*

Finding 2.4b – MRGESCP Work Conflicts with Members’ “Day Jobs”: *Most MRGESCP participants have primary jobs within their parent organizations, and*

MRGESCP work is an “additional duty.” Conflicting work priorities can occur causing missed meetings, a reluctance (or inability to find the time) to do MRGESCP work, and loyalty dilemmas. Consequences might include slow progress on MRGESCP goals as members “get back up to speed” on issues after missing meetings, an uneven distribution of work among MRGESCP members, and the intentional slow-rolling or stone-walling by some members so as to maintain the status quo and impede progress.

Recommendation 2.4a – MRGESCP Member Organizations Must Make MRGESCP Work a Priority: *EC members should work within their own organizations to ensure their MRGESCP participants (at all levels) are given an appropriate amount of MRGESCP-dedicated time to accomplish their MRGESCP work. In addition, the EC should monitor the division of MRGESCP work among member organizations such that it is fair and appropriate to the abilities of each organization.*

Recommendation 2.4b Make EC Meetings More Efficient: *The EC should consider ways to make their meetings more efficient. Recognizing that only a subset of the EC membership has the time to work the detailed problems, one option might be to designate every other EC meeting as a full decision meeting and schedule a working meeting in between. This would allow understaffed member organizations to still fully participate in the decision-making while being relieved of some workload. It might also streamline the working meetings by reducing participation to those doing the work.*

The DOI’s Adaptive Management Technical Guide (2009, p. v) states, “[a]n adaptive approach actively engages stakeholders in all phases of a project over its timeframe ...” and particularly in the initial stage when you are establishing a common purpose (Benson, 2009). By not having all stakeholders involved in the process, the threat is increased that time, effort and money will be expended cycling through the AM loop only to be faced much later by the “absent” stakeholders in court (Williams et al., 2009, p. 50). And, as has been mentioned above, AM has not always fared well in court. The

issue of absent stakeholders was raised at the 2009 Taos off-site meeting, “[c]an we be asked to make commitments yet others [other stakeholders] are able to go about their business without being responsible for their actions? How do we get all stakeholders involved – even the ones who don’t realize they are impacting the system? How can we achieve recovery with other uninvolved actions occurring in the area? How are these other activities made to comply with the ESA? Do they even realize these laws and policies [exist]?” (MRGESCP, August 2009). The answer at that meeting was that it is the Service’s responsibility to handle such outliers, but this answer does not mitigate the problem of later litigation; it would certainly be better were all stakeholders participating collaboratively in the MRGESCP.

A precedent from the San Juan RIP is pertinent here. The environmental community did not choose to participate in the original San Juan RIP; however, about five years ago, after seeing the progress made by the MRGESCP, the environmental community began to participate (Reynolds, D., personal communication, 2011, November 4). Because of the environmental community’s propensity to emphasize their positions through legal means when other methods fail, it is particularly important to get their buy-in. However, as noted from the Taos off-site meeting, other stakeholders on the river besides the environmental community are also not participating in the MRGESCP.

***Finding 2.5 – Not all MRG Stakeholders are MRGESCP Members:** The current MRGESCP does not have representatives from all stakeholders on the river. In particular, the environmental community participated early in the MRGESCP’s history but dropped out for various reasons (based on discussions with MRGESCP members these included lack of money/personnel and feelings that their contributions were not welcome).*

Recommendation 2.5 - Re-engage Non-Participating Stakeholders: *By becoming a RIP and adopting AM, the time might be appropriate for the MRGESCP to approach local environmental advocates (and other non-participant stakeholders on the river) to see if they would be willing to participate as signatory members of the MRGESCP. The EC should consider a way, perhaps through a type of adjunct membership, to entice these stakeholders to buy into MRGESCP goals.*

The advantage of consensus voting (such as the MRGESCP uses) is that it brings all parties to the table to negotiate on every issue and any decision has more legitimacy (CRS, 2011, p. 13). However, such organizations may have difficulty reaching a consensus, especially when changing management direction in response to AM experiments (Doremus et al., 2011, p. 3). Briefings to the EC by a representative of the San Juan RIP stated that their decision-making body changed from consensus voting to a two-thirds majority vote to avoid this problem. Split loyalties within a decision-making body can cause disagreement on how to interpret experiment results or even on what changes are desirable (Doremus et al., 2011, p. 3).

Recommendation 2.6 – The EC should Consider Majority Vote: *Although my research noted no problems with MRGESCP consensus voting, the tough decisions fundamental to AM, such as in determining 1) which experiments to attempt, 2) when and if a mid-course correction is appropriate, and 3) how experimental results are to be interpreted in order to proceed to the next cycle, might challenge the EC's ability to reach consensus. While MRGESCP by-laws do allow a super majority vote (75% vote by an EC quorum) if a consensus cannot be met, it might become necessary to readdress this voting method as the MRGESCP adjusts to its changed circumstances as noted above.*

Finding 2.7 – Multiple Service Consultations put Commitment to Collaboration in Question: *The concept of collaboration is central to the MRGESCP's mission. Nonetheless, despite Reclamation offering their BA as an umbrella for non-federal*

member organizations (USBOR, 2011, p. 12), some members have chosen to have their own consultations with the Service concerning their projects. While there might be short-term efficiencies for the Service by handling the impacts of each project separately, it does force the Service to attempt the difficult task of understanding how the impacts of each BA compound jeopardy to the species. Since most of these BAs are already published and/or in draft, no recommendations concerning them are offered in this paper. However, it could be seen as a lack of true collaboration that there are so many separate consultations concerning the same endangered species on the same river after ten years with a collaborative program managing the species' jeopardy. One indication of the lack of trust among the various organizations is the fact that possibly the most contentious point for the non-federal agencies considering coverage under Reclamation's current draft BA is a footnote at the bottom of page 12 (USBOR, 2011). The footnote reads,

If a non-federal participant seeking inclusion in this BA does not formally agree to provide sufficient assistance between Reclamation's submittal of this BA to the Service and the Service's issuance of a biological opinion, Reclamation will exclude that entity from this consultation process.

The contested phrase among the non-federal agencies is the undefined "provide sufficient assistance" – several non-federal members mentioned that by agreeing to the BA, they are buying a "pig in a poke," and they are having none of it until the phrase is fully illuminated.

Recommendation 2.7 – Reclamation should Encourage Other MRGESCP

Members to be covered under their BA: Reclamation is reworking its draft BA in light of the MRGESCP becoming a RIP. During this process, Reclamation should work with non-federal candidates for inclusion within the new BA to clarify footnote two in such a way as they will agree to be included.

Finding 2.8 - Environmental Commitment of Newer Employees Questioned: An unexpected finding came from separate discussions with two MRGESCP participants. Both were concerned that younger employees in all organizations might not be willing to buck the bureaucratic system in support of the MRGESCP's environmental goals. Two reasons were given: 1) since younger participants did not grow up during the years of strong environmental advocacy, they don't have

the “fire in their bellies” that older environmental advocates have, and 2) in today’s economy, they are worried about job security. At the same time, it was noted as a positive development by a member of the local environmental community that many of the agencies, particularly the ACE, Reclamation, and the ISC, are considerably more progressive with respect to environmental issues than in the past. No recommendations for this finding are presented, but it is worth noting how environmental advocacy is evolving with the times.

The ESA was one of several major environmental protection laws coming out of the renaissance of environmentalism in the 1960s and 1970s. While the law is focused on protecting individual species, most environmentalists now recognize this scope is too narrow (Benson, N.d., p. 7). However, the ESA also focuses on the endangered species’ habitat which can lead to the protection of an ecosystem.

Finding 2.9 - MRGESCP Members have Strong Commitment to River, Not Necessarily to Species: *It was clear in all meetings attended and interviews performed for this study that MRGESCP members are truly committed to the river, its health, and the unique culture that has developed along its banks. This same level of commitment does not necessarily exist concerning the minnow and flycatcher which some members see as ephemeral species (as all species inevitably are) that might be coming to the natural end of their ability to adapt to changing circumstances in their environment.*

Recommendation 2.9 – MRGESCP should Emphasize Actions as Contributing to a Healthy River Ecosystem: *EC members should always emphasize, especially to the public but also to each other, that the MRGESCP’s overriding goal as it works to recover the minnow and the flycatcher is really to preserve the river ecosystem. This seems a simple distinction, but conversations with several MRGESCP participants indicated that making this paradigm shift might change river residents from minnow haters to MRGESCP advocates (or at least not detractors). More explicitly stated, while some river residents look at the minnow, backed by the powerful (federal government-managed) ESA, as an “enemy” to*

private landowners, they might nevertheless support the MRGESCP if it is understood to be the protector of the Rio Grande ecosystem.

3. The Need for Change in the Management Culture

The literature on adaptive management recognizes that some of its inherent concepts conflict with established management practices such that its acceptance will require a culture change in some adopting agencies. Ruhl (2005, pp. 30-31), in a paper asking if regulation by AM is even possible, opines that agencies “have not often been rewarded for flexibility, openness, and their willingness to experiment, monitor, and adapt,” all hallmarks of AM. Both Grieg et al. (2006, p. 6) and DOI’s Adaptive Management Technical Guide (2009, p. 38) point out that large organizations are often risk averse and would seldom accept uncertainty as a normal consequence in decision-making. Such a fundamental shift from the status quo as AM represents would therefore certainly require a strong commitment from top management levels. Salafsky et al (2001, pp. 69-70) adds that, by AM’s very nature, some individual project or experiment will eventually fail so the organization must be willing to allow and *value* failure as an acceptable outcome, recognizing it as another chance to learn.

Finding 3.1 - The Adoption of the “Trappings” of AM without the Understanding of it or Commitment to it is Possible: In the Air Force TQM application, in response to the strong commitment from management for TQM, people quickly picked up the TQM jargon (such as “continuous improvement” or “metrics”) even before the commitment or true understanding of TQM principles were present. As a result, it “sounded” like people were “doing” TQM when such was not the case. Later in the program, some managers attempted to conduct “business as usual” by cloaking it in TQM language, in essence bureaucratizing TQM itself. Resisting change to the normal operations or culture of an

organization is expected and can take many forms, and it can have a deleterious impact on the adoption of a new management concept if left unchallenged.

Recommendation 3.1 – Use Every Opportunity to Teach AM Principles:

Especially if further training in AM is not planned (discussed further in the Training section below), the untutored use of AM terminology can easily lead to inexact science and “a/m lite” (Ruhl and Fischmann, 2010, p. 442). While it is probably too early in the MRGESCP’s application of AM at this time for the misapplication of AM described as the “bureaucratization” of AM above, nevertheless the EC must beware that such instances will almost certainly occur. Forewarned is forearmed. MRGESCP members should take every opportunity to teach the correct AM approach/theory when confronted by members making inexact statements concerning AM.

Finding 3.2 – MRGESCP’s Own “Corporate Culture” Might Impede AM’s

Application: *The MRGESCP has a second order corporate culture problem to overcome. Not only are MRGESCP members instilled with their own organization’s corporate culture, but also with the MRGESCP’s own culture which has had ten years to marinate. The “not-invented-here” syndrome (i.e., the reluctance to accept ideas from outside your own organization) brought on by a member’s strict adherence to either their organizational culture or the MRGESCP’s own culture could be an impediment to accepting new ideas brought by the implementation of AM. With the AM contractors now finished with their contracted work, the strongest AM advocates – those most knowledgeable in AM – are no longer participating in the MRGESCP. Even as the contractors were leaving, some MRGESCP participants hinted that the AM meetings were “government bureaucracy at its finest” having expended much time, effort, and money when all could have been better spent for the good of the endangered species.*

Recommendation 3.2 – Choose a “Sure Success” as an Initial AM Project:

Even while the MRGESCP is coming to grips with how exactly AM will be incorporated into its operations, the EC should examine the MRGESCP’s existing project list to determine if there is one project that could easily serve as an initial

example for how the AM process works. Euphemistically, this is called “picking the low hanging fruit” – an early success can have a salutary effect on MRGESCP member’s acceptance of AM.

4. The Need for Proactive Involvement of the Fish & Wildlife Service

The Fish & Wildlife Service plays a pivotal role in the MRGESCP, essentially that of gatekeeper. They are the guardians of the endangered species through the ESA and establish the ground rules for ESA compliance in the BiOp. Their mandate seems clear at first glance. They must prohibit actions that are “likely” to either “jeopardize the continued existence” of the species or “result in the destruction or adverse modification of [the critical] habitat of such species” (Salzman & Thompson, 2007, pp. 283-4). Section 9(a)(1) of the ESA states that no one, public or private, can take an endangered species of fish or wildlife with “take” referring to actions that “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” the species (Salzman & Thompson, 2007, p. 278). In a query of intent, the Supreme Court ruled that “the intent of Congress in enacting [the ESA] was to halt and reverse the trend towards species extinction, whatever the cost” (Salzman & Thompson, 2007, pp. 283-4). However, as time proved the ESA a formidable defender of the environment, other voices deemed these initial ESA constraints as contrary to “reasonable progress,” and in 1982 Congress provided an “out” in the form of incidental take permits. Such a permit allows the taking of an endangered species if such a taking is incidental to a lawful activity as long as the (non-Federal) permittee filed an acceptable habitat conservation plan (HCP) which must minimize the impact of the taking, show that the taking would not “appreciably reduce the likelihood of the survival and recovery in the species in the wild,” and show that the specified action can be funded (Salzman & Thompson, 2007, pp. 290-1).

With the advent of adaptive management, the permit requester gained a new tool. The Service's HCP Handbook and Addendum both state that AM can be used to meet "statutory and regulatory requirements of incidental take permit issuance" (Doremus, 2001, p. 70). In other words, when scientific information on the species is missing at the time of HCP or Biological Assessment (BA) development, the permit can still be given and the project can go forward as long as an AM strategy is incorporated into the HCP or BA (Doremus, 2001, p. 70). Unfortunately, the AM process has been used for permit approval on the basis of "extraordinarily limited information" (Doremus, 2001, p. 72) and "substantial uncertainty about the effect on protected species" (Doremus et al., 2011, p. 6). The Center for Progressive Reform bluntly states, "[t]his approach is plainly wrong" (Doremus et al., 2011, p. 6). Additionally, Ruhl (2005, p. 53) suggests that the "fuzziness" of the AM concept invites agencies to "game the system" by using AM "as a ploy to placate demands for environmental protection without actually imposing any enforceable constraints on themselves."

Unfortunately for the Service, the nature of AM used in ecosystem applications provides another twist. Because field monitoring generally does not detect minor variations, the impacts of the various AM actions must be substantial to gain the necessary information from the system (Williams et al., 2009, p. 12). This has certainly proven true with the minnow in the Rio Grande – one MRGESCP member stated at the November 2011 off-site meeting that current monitoring techniques can't detect a 10% difference in fish populations but can detect an order of magnitude difference. This situation is compounded by the sometimes large and unplanned flow level variations within the river itself.

Finally, DOI's 2009 technical guide on AM appears to provide (or even "mandate") the Service with new flexibility as it carries out its ESA responsibilities. It clearly states that AM "almost always requires a fundamental shift from the status quo" and that federal agencies must "rethink the nature of risk aversion ... and to explicitly recognize uncertainty as a key attribute of natural resource management" (Williams et al., 2009, p. 38).

Finding 4.1 – The Service is not an Active, or Pro-Active, Program Member:

While the Service is performing its ESA "watchdog" role, it could be more proactive as a collaborative partner in the MRGЕСP. This became clear from individual interviews, informal discussions and during MRGЕСP meetings, as members expressed frustration that Service representatives seemed reluctant to provide information earlier in the process which might make things go more smoothly and quicker.

The Service has a difficult balancing act. The DOI has mandated the use of AM in the ESA consultation process, and this application of AM requires a certain amount of flexibility on the part of the Service. However the Service must also recognize the accountability it has to the courts, legislatures and public, which all require "some objective boundaries" and "a degree of closure" (Ruhl, 2005, p. 55, Doremus, 2001, p.52). Unfortunately, our courts, laws and the public have not adopted AM and could have a very different perspective of the results of its application. Recognizing this dilemma, the Service is best positioned (given its watchdog role) to advise the MRGЕСP on what AM options are acceptable.

Recommendation 4.1 –The Service Should Use its unique Position to Pro-actively Offer Guidance & Advice to the MRGЕСP: *Anytime the EC, CC or work groups begin discussing potential actions that a MRGЕСP member from the Service recognizes as unlikely to be acceptable from a legal or regulatory aspect, the Service member should immediately raise the issue. This can save time otherwise wasted pursuing a dead-end option and can lead to discussion between*

the Service and other members about how the option can be altered so as to be in compliance.

In the same vein, the Service's current incidental take permit process is likely to be inadequately responsive to the AM cycle. By actively participating in the MRGESCP's AM planning process, the Service could accelerate their permit approval process in two ways: 1) they could identify options early in the planning process they recognize as unacceptable based on current legal and regulatory constraints and perhaps work with the particular team to alter the option so it would be permitted and 2) they could help team members jumpstart the permit process on likely options and/or otherwise accelerate the process on projects they have been involved in from the start of planning. While the Service must perform its ESA guardian duty faithfully, it is also a collaborative member of the MRGESCP whose goal is to protect the minnow and flycatcher from jeopardy (and perhaps soon the goal will be to recover the species). A second point is that, while the Service manages the restrictions in the BiOp which is mandated to be based on the best available science at the time of issue, the MRGESCP is using AM to gain more knowledge about the species and habitats and, at some point, this new information might reflect a higher level of knowledge than that in the most recent BiOp. The Service should find some way to incorporate this new information into its own decision process. As Doremus (2001, p. 78) states in her paper dealing with AM, the ESA and "New Age" environmental protection, "[e]xcessively rigid statutory or regulatory demands can severely constrain our ability to learn about the systems we are managing, or to implement our newly-acquired knowledge." This is likely to be among the most difficult recommendations in this paper to implement. However, it is also the one most likely to make the most difference in whether AM is successful. It requires a significant change in the way the Service's process currently works because it requires

Service members to work in a truly collaborative fashion to circumvent the agency's own processes. For this to happen, local Service representatives will likely need to apply to its higher management for an exemption to current

regulations and procedures. The potential benefits to the concept of collaborative programs and ultimately to the endangered species the programs were designed to protect, however, could be worth the effort.

5. The Need for AM Champions

The implementation of TQM by the Air Force was facilitated by TQM “champions,” or people who had studied and/or intuitively understood the new management concepts and who became strong advocates for its implementation (Whitney, 1993). These individuals became critical to the acceptance of TQM into the culture of the organization. The champions highlighted the positive aspects of TQM, demonstrated how it could be applied in different situations, instructed others in the new approach and its application, and incorporated its principles in their own work. Within the Air Force TQM example cited above, TQM was being implemented through several layers within one major command. Thus a champion at a higher level could provide positive reinforcement down through multiple layers, but champions at every level proved advantageous to TQM’s acceptance as “the new normal.”

Finding 5.1 - Strong AM advocates or “champions” will be needed if AM is to be successfully implemented: *In the case of the MRGESCP, sixteen different organizations and agencies are involved. While it is unclear how many AM advocates or “champions” are required to infuse enthusiasm for it throughout the MRGESCP, some number of them will be required if AM’s implementation has a chance of succeeding, and these champions need to be strategically placed within the MRGESCP. While some MRGESCP participants seem genuinely interested in the AM effort, it is not clear if any have the strong enthusiasm for it that depicts a “champion.”*

Recommendation 5.1a – MRGESCP Management Must “Grow” AM Champions: *EC members will likely have their own way of approaching the task of finding/growing AM advocates. However, the following steps should be*

considered: 1) identify personnel in each organization who are most enthused by AM; 2) work with agency management to ensure these people are positioned to make the most impact; positions of critical importance are work group chairs and the AMWG chair (if it is decided to charter an AMWG), with a minimum of one on the EC itself and one on the CC; 3) ensure these people thoroughly understand AM – get them trained in AM if necessary; 4) make it clear to these champions that this is a critical role for MRGESCP success; and 5) provide them with strong management support.

Recommendation 5.1b – Hire AM Contractor to Help Grow AM “Champions”:

It is best if members of an organization “own” the implementation of a new management program as early in the process as possible. By hiring outside contractor experts to do it for them makes it easier for them to continue business as usual and let the contractors handle this “new AM thing.” However, because so little training on AM was provided to MRGESCP members, the EC should consider hiring one of the ESSA or Headwaters contractors to provide at least part time support to the MRGESCP. Any one of the several personnel who participated with the MRGESCP during this last year would be a true champion and could additionally both train MRGESCP champions (and other personnel) and mentor work group chairs as to how to implement AM. The primary task of this AM contractor would be to “grow” and train AM advocates and champions for the MRGESCP, not to “do” the MRGESCP’s AM.

6. The Need for Training in AM Principles and Processes

In the Air Force TQM application, literally hundreds of hours of TQM indoctrination were provided to all senior and mid-level managers in the form of off-site meetings/weekends, team building exercises and classroom training. Trying to inculcate a new way of doing business into an organization’s work culture requires intense and continuous reinforcement of the ideas. While the basic concept of adaptive management is commonsensical and is often abbreviated as “learning by doing,” a reading of the

version 1.0 Adaptive Management Plan delivered to the MRGESCP on October 31, 2011 reveals that the full process is not at all straightforward.

Finding 6.1 – AM Training Provided was Inadequate for AM to Become Engrained within the MRGESCP: *The MRGESCP hired the ESSA and Headwaters contractors to walk its members through the development of an Adaptive Management Plan. Multiple work group sessions towards this effort were held from November 2010 through May 2011. During this period, the contractors provided information on AM concepts and techniques to those MRGESCP members who participated. However, it is likely that this will not be sufficient to successfully integrate AM into the MRGESCP’s operations. Incomplete understanding of AM by different MRGESCP members could result in arguments over the AM process or, worse, inappropriate application of the principles leading to bad science, “a/m lite” and possible legal exposure.*

Recommendation 6.1 – Provide AM Training to people in Critical Positions: *Provide AM training to people in critical positions as identified in Recommendation 5.1a above and also for all of the members of work groups which will be applying AM in their projects/experiments. EC members themselves should be well enough versed in AM principles to recognize when they are being misapplied.*

7. The Need for Rigorous Science

Science is the hallmark of the adaptive management process. According to Sit and Taylor (1998, p.4), “[i]n contrast to the basic trial-and-error approach, adaptive management is a much more organized and powerful approach to learning from experience. Its greatest contribution to learning may lie in the notion of making explicit predictions of the expected outcomes of management actions, then comparing actual outcomes to the predictions before adjusting subsequent actions and the models used to make the initial predictions.” This is the AM paradigm which is not always achieved in reality. Unfortunately, scientific rigor is expensive and trade-offs must be made between

the simultaneous experimentation on multiple alternatives (“active” AM) and, if sufficient resources are not available, choosing for implementation the one alternative most likely to succeed (“passive” AM) (Greig et al., 2006, p. 10).

Finding 7.1 - Uncertainty Exists on Basic Scientific Facts concerning the Species: *Currently the scientific understanding, particularly of the silvery minnow, has significant uncertainty with even basic life cycle information under internal dispute within the MRGESCP. While MRGESCP biologists give the minnow’s lifespan at 1-3 years, long-time river residents in conversation at the November off-site meeting suggested minnows often significantly exceed that lifespan. Based on discussions with MRGESCP members there is also dispute as to the minnow populations and distribution throughout the river – such as the minnow’s use of the river’s thalweg – due primarily to the questionable effectiveness of counting techniques. According to a visiting scientist at the May 18, 2011 work group meeting, the minnow’s own extreme variability, such as spawning timeframe (generally spring, sometimes as late as summer and once perhaps in winter), adds to the difficulty in making sense of the monitoring data. In addition, a MRGESCP member stated at the November 2011 off-site meeting that a group of outside scientists were “appalled” during a visit earlier in the year that peer review on MRGESCP data had not yet been accomplished.*

Recommendation 7.1a – Accelerate the Implementation of a Scientific Peer-Review Process: *The EC is currently working to establish a science peer review process, which will include an examination of the ten years of data collected to date. This peer-review process can help to establish a sound scientific base for the AM process. If the scientific conclusions are debatable, then members will feel free to question the conclusions, as a way to push their organizational agendas in the EC. The outside peer review should provide an objective scrutiny of current scientific techniques and models being used by the MRGESCP. Before this can happen, Reclamation needs to resolve the disagreement with their data management contractor to ensure the MRGESCP’s data is available to anyone needing access to it.*

Recommendation 7.1b - Establish a Fact Book on each Species: A fact book, or annotated central database, should be established for each species, which would include a synthesis of the experimental findings and knowledge of the species and its habitat, along with an assessment of areas of agreement, points of disagreement and gaps/missing data in the current knowledge base. It must be a living document that is regularly updated as project results are received. Making this update the final step in the MRGESCP's experiment/project template ensures that the project leader makes this happen. This document will be the key resource as work groups plan future projects.

Recommendation 7.1c – Reinstitute Scientific Symposia: In addition to an outside peer review process, the EC should team with the University of New Mexico (UNM) to again host annual scientific symposia as were held several years ago. Providing MRG scientists a forum to present their findings to a larger scientific community should foster better science. Highlighting the MRGESCP's good work could also entice non-participating stakeholders to become MRGESCP participants.

Finding 7.2 – The Uncertainties with respect to the MRG Make the Implementation of AM Less Certain of Success: AM is not considered appropriate for high risk operations (Williams et al., 2009, p. 16) such as management of endangered species, for which a failed experiment could contribute to species jeopardy. However, with careful management, AM might still proceed. Unfortunately, this general rule is complicated in the MRGESCP's situation by both the variability of minnow populations (as described above) and by the extreme fluctuations of New Mexico precipitation and of the river's hydrology. As described above, this certainly provides a challenge for the Service in its role of ESA watchdog and emphasizes how important its collaborative role is in the MRGESCP.

Recommendation 7.2a – Because of Inherent Uncertainties of the MRG System, Employ Conservative Methods with AM: Because of the risks involved to the species, the MRGESCP should incorporate as part of its standard operating procedures:

(1) aggressive monitoring throughout each AM project/ experiment, and associated thresholds in monitored parameters at which the MRGESCP would act to prevent worst-case situations from occurring and

2) the safe-fail philosophy discussed at EC meetings whereby the species remain in a safe position even if the AM project/experiment itself fails to meet its projected outcome.

The work groups planning and executing the AM experiments/projects should build into their plans mechanisms that allow the MRGESCP to move towards its goal of alleviating jeopardy/promoting recovery, with minimal risk to the species. This might mean making even smaller iterative changes in a reach of the river over a number of water years rather than making a more desirable but larger adjustment or placing go/no-go decision points within their execution procedure that require evaluation of the project's progress before continuing with the next phase. The basic idea is to ensure that, even if the experiment/project produces unexpected results, the minnow and flycatcher populations are not in greater jeopardy as a result.

Recommendation 7.2b – Take Advantage of Natural System Variations in Experimental Design: *As part of the AM process, the technical/scientific work groups will be building/refining models and designing sets of projects/experiments as they work to fill in the knowledge gaps. Project implementation will necessarily be prioritized to meet current resource constraints – for example, the recently released draft BA from Reclamation (2011) states that both water and money will be constrained during 2012, and there is no reason to believe things will get better in 2013. Given these constraints, the EC and work group chairs should be ready to capitalize on the extreme natural variability of the MRG system by taking advantage of any “natural experiment” that presents itself either through New Mexico’s natural climate variation or events attributed to global climate change. Even events teetering on crises situations which “flip” a system into a different state not generally observed can trigger “lateral thinking” and create opportunities for new system knowledge (Salafsky et al., 2001, p. 72). Such situations might require nothing more than reallocating or refocusing existing monitoring resources to*

capture data in response to the unplanned event, but it would mean that the EC/CC and the project leads must remain nimble in their thinking and focused on the long-term goals of the MRGESCP. A task-order contract (such that discrete increments of monitoring support might be “bought” or options executed) would facilitate this concept. As the MRGESCP’s AM culture matures, it would be prudent to develop monitoring plans that take advantage of such situations as detailed in Recommendation 10.1c below.

Recommendation 7.2c – Develop Remedial Action Plans for Harms that Might be Caused by AM Experiments: *The MRGESCP should consider adopting a technique used by the Lower Colorado AM program, whereby the approved plan for each project includes remedial actions for any foreseeable event that might derail the project (CRS, 2011, p. 27). Then, if one of these events happens, the project team can immediately execute the pre-approved remedial actions so that the best advantage is made of the changed circumstance.*

Recommendation 7.2d – Establish an AM Lessons Learned Document: *Especially since AM is a new concept for the MRGESCP, it would be beneficial for the AMWG (or whatever forum will be managing the AM initiative) to establish a “lessons learned” document to capture the techniques, plans, etc. that work and those that don’t as they implement AM. It should be part of each project lead’s task at the completion of a project to add their lessons learned to this document (an e-document would facilitate maintaining currency).*

The DOI guide points out another impediment to AM implementation that is pertinent on the MRG. The iterative learning (or elimination of uncertainty) concerning the system can be undermined if the system itself is changing more rapidly than the AM process can proceed (Williams et al., 2009, p. 63).

Finding 7.3 – MRG’s Natural Variation could Mask AM Results: *Large changes in the flow of the river due to either water management operations (e.g., Reclamation’s report of a 2012 decrease in water available for lease for the Environmental pool”) or recent and predicted climate trends or a combination of the two could invalidate current project/experiment planning in the MRGESCP’s*

work groups since a significantly large unplanned system response could mask the variability caused by the planned action.

E.C. Hollings (1978, p. 20), an early advocate of AM, wrote, “[v]ariability of ecological systems, including occasional major disruptions, provides a kind of self-monitoring system that maintains resilience. Policies that reduce variability in space or time, even in an effort to improve environmental ‘quality,’ should always be questioned.” He summarizes by stating, “Environmental quality is not achieved by eliminating change” (Hollings, 1978, P. 33).

Finding 7.4 – Removing All Natural Variation of the MRG River could Put Species in Jeopardy: *Before the MRGESCP was formed, the Rio Grande ecosystem was already out of balance. Even so, it is still worthwhile for MRGESCP members to measure their strategies against Hollings’ quotes above. One such strategy being considered by the MRGESCP is to pinpoint the optimal time to release water so as to stimulate minnow spawning and then to gauge the minimum time the flow needs to be at certain levels to produce food for the hatched fish. The logic goes that, at all other times, the river’s water can be used elsewhere more productively. This plan reduces the natural variability and system resilience Hollings believes critical to system health. The use of AM to zero in on the exact water requirements for the minnow and flycatcher in order to provide just the minimum requirements to maintain their populations will likely move the river even further from its natural state and set up a scenario that would put the species in jeopardy.*

Recommendation 7.4 – Re-evaluate Any Minimum Water Requirement for the Species; Recognize Need for Natural Variation: *The EC should reevaluate their goals in light of Hollings’ statements above recognizing that a healthy natural ecosystem provides the best chance for minnow and flycatcher survival. Suboptimizing the minnow’s lifecycle requirements based on best available data might fail under severe natural conditions. The MRGESCP has several potential opportunities that might provide appropriate forums to discuss this important*

point: 1) the programmatic decision to become a RIP, 2) a reconsideration of the MRGESCP purpose statement as described in Recommendation 2.1 above, 3) the decision meeting on how the MRGESCP will incorporate AM into MRGESCP processes (i.e., how the version 2.0 AMP will be written, whether an AMWG will be chartered, etc.), and 4) the long-delayed EC discussion about water management/sharing among MRG stakeholders.

8. Obstacles to “Turning the Corner” in the AM process

Turning the corner – using the results of an adaptive management experiment to learn and adaptively select and plan the next cycle – is the real pay-off for AM (Benson, 2009), but it is also where the AM process is most likely to bog down. One reason for this is that the scientific conclusions reached on the previous step will seldom be unequivocal. The remaining uncertainty could leave room for stakeholders to draw conclusions based on organizational biases, or to stonewall the whole process (CRS, 2011, pp. 9-10). Another block to the continuation of the AM cycle comes from the way large organizational processes evolve linearly such that the mere thought of intentionally going back through the bureaucratic process again becomes anathema (Ruhl, 2005, p. 35). Again as described in section 2 above, this is where executive commitment becomes the key to overcoming corporate culture inhibitions (Greig et al., 2006, p. 6).

Finding 8.1 – Making AM a Truly “Iterative” Process Goes Against Normal Management Practice: *With the number of organizations in the MRGESCP, each with its own bias based on its stake on the river, the upfront effort to get past the bureaucratic hurdles is multiplied and so might be the reluctance to turn the crank on the AM cycle again. As discussed under the Commitment section above, the politics of water has been honed to a science on the Rio Grande. Each of the EC members represents an organization with its own set of goals that at times might conflict with MRGESCP goals. Any proposed AM experiment that requires water diversion will be carefully scrutinized by EC members and particularly*

those that are “next steps” following an experiment that has produced uncertain results will be difficult to defend before the EC.

Recommendation 8.1 – Consider “Active” AM to Generate Consensus: *This type of situation could demonstrate the power of “active” AM. If a consensus cannot be reached to select the next “right” project based on results of previous projects, a compromise (and smart AM strategy) might be to select two or more projects to be executed simultaneously as a means to both clarify which interpretation of previous results is the correct one and to continue moving the MRGESCP forward in gaining knowledge of the species and its habitat. Especially if the MRGESCP does move to become a RIP, the Service should be fully supportive of such a tactic.*

9. The Insufficiency of the Water Supply to Meet All Human and Endangered Species Demands

Anthropogenic water management on the MRG is the reason the silvery minnow and willow flycatcher are on the endangered species list. Although the Fish & Wildlife Service in their 2003 BiOp (p. 41) describes historical low-flow events on the river as “infrequent, of lesser magnitude than they are today,” the minnow’s ability to recover from such events and their population distribution today are largely impacted by the changes that have taken place along the river. Diversion dams block repopulation upstream; the oxbow lakes, cienegas, and sloughs once common along the river, refugia where the minnows survived until the river flowed again, are largely gone; the peak flows thought critical to minnow spawning are now controlled for human benefit; and the river’s morphology has been altered—narrow, deeper channels and the elimination of “spawning, nursery, feeding, resting, and refugia areas required for survival”—to the detriment of the minnow (Hall, 2003, pp.41-45). The same anthropogenic actions have led to the elimination of much prime habitat for the flycatchers which require overbank flooding to create and maintain shallow, low-velocity flow, vegetated areas for nesting

(Hall, 2003, pp. 62-63). In short, “lack of water is the single most important limiting factor for the survival of the species” (Hall, 2003, p. 41)

No adaptive management action (or really any MRGESCP action) on the MRG can be separated from the realities of water management on the river. The MRGESCP’s 2008 memorandum of agreement (MOA) explicitly states that, in addition to ensuring the survival of the minnow and flycatcher, the MRGESCP intends “to exercise creative and flexible options so that existing water uses continue and future water development proceeds in compliance with applicable federal and state laws.” To further emphasize this intent, the MOA continues, “[t]o achieve these ends, the MRGESCP may not impair state water rights or federal reserved water rights of individuals and entities; federal or other water rights of Indian nations and Indian individuals, or Indian trust assets; San Juan-Chama Project contractual rights; and the State of New Mexico’s ability to comply with Rio Grande Compact delivery obligations.” One suspects that such an explicit commandment prohibiting the coveting of other stakeholders’ water (for endangered species survival) was required in order to get the MOA signed, but it also hints that it might be easier for “a camel to go through the eye of a needle” than it will be to find water for the endangered species. For many water managers on the MRG, the minnow and flycatcher are nothing more than unfortunate externalities in the economics of water. However, in 2005, one positive development did occur for the species: an agreement was reached whereby an “Environmental Pool” of 30,000 acre-feet of water can legally be stored in the Abiquiu Reservoir through purchase, lease or donation (Kelly & McKean, 2011, p. 3) for use by the MRGESCP.

The water management concerns discussed above with respect to the endangered species are well known and are perhaps best captured in this warning from the Service's 2003 BiOp (pp.84-85): "it is the Service's biological opinion that water operations and river maintenance of the Middle Rio Grande, as proposed in the February 19, 2003 biological assessment, are likely to jeopardize the continued existence of the silvery minnow and the flycatcher and adversely modify critical habitat of the silvery minnow." In other words, if water management operations continue with business as usual, the flycatcher and minnow will be put in additional jeopardy.

Finding 9.1 - Water for the Environmental Pool will likely be reduced beginning in 2012: Reclamation stated in its current draft BA (2011) that the flow targets outlined in the 2003 BiOp are no longer sustainable because organizations that leased water to the Environmental Pool in the past are now using it for its intended purposes. Reclamation quantified this loss in the August 2011 EC meeting as a decrease from ~29,000 acre-feet to 13,000 acre-feet (EC meeting minutes, August 2011, pp. 3-4). On this non-adjudicated river system, it is uncertain not only whether water will be available to conduct AM experiments but whether enough water will be available for the species to survive.

Recommendation 9.1a - Prepare a list of potential experiments to take advantage of unplanned natural events: As briefly noted in recommendation 7.2b above, one option is for the EC to be prepared to take advantage of extreme flow events by having a comprehensive list of potential experiments ready to be conducted at short notice (see Recommendation 10.1c below for a more complete explanation).

Recommendation 9.1b – Explore using current flow operations to enhance AM experimentation: The EC should attempt to coordinate AM experiments requiring specific flow conditions with agencies already conducting flow operations that might be compatible. For example, water released to fulfill the Rio Grande Compact could be timed, and the flow structured, so as to fulfill the requirements

for a particular AM experiment. Since MRGESCP signatory agencies control most water operations on the Rio Grande, or are at least cognitive of them, cooperative operations should be possible.

Recommendation 9.1c - Address the issue of insufficiency of water to meet all needs on the MRG: *As mentioned above, the topic of the insufficiency of water to meet all of the human and ecosystem needs in the MRG consistently gets tabled at MRGESCP meetings. As late as the November 3-4, 2011 off-site meeting, one of the break-out groups recognized that water insufficiency issues needed to be discussed, and identified a requirement for a Water Management Cooperative Association (WMCA) on the MRG; the topic was acknowledged by the general forum but then was once again placed in the “parking lot bin” and was not discussed again at the meeting. The EC needs to tackle the issue of the insufficiency of water to satisfy the needs of all stakeholders. Its resolution is crucial to the MRGESCP’s ability to recover the species. If it is not resolved, AM will be severely impeded in its implementation.*

10. Challenges to Funding Full Implementation of AM

While some mistakenly believe adaptive management produces results quickly at low cost, such is not the case (Williams et al., 2009, p. v). Because it focuses on resolution through iteratively gaining knowledge about the system, often requiring managers to implement multiple experiments to bound system parameters, AM can incur short-term costs beyond a linear management plan. However, the AM methodology focuses on enhanced understanding of complex environmental issues and therefore is more likely to lead to an outcome with long-term benefits (e.g., species recovery and habitat restoration) that are worth the cost.

Finding 10.1 – AM’s Iterative Process is not Compatible with the Federal Government’s Funding Cycle: *The Federal government’s annual budget process does not lend itself to continuous projects and certainly not to iterative projects, especially when unplanned changes are made mid-project due to new knowledge*

gained as a result of the project itself. The Federal budget cycle also tempts managers to “game” the system when confronted with an unexpected year-end surplus. Euphemistically called “use it or lose it,” a manager is threatened with a reduced budget next year if current year funds aren’t completely obligated. Unfortunately, this often leads to expenditures that do little to further the organization’s mission (e.g., buying extra chairs for a conference room, funding a landscape beautification project, etc.). Federal budgets also tend to fluctuate from year to year. For example, as noted above, Reclamation’s draft BA (2011) suggests that MRGESCP money will be constrained in 2012.

Recommendation 10.1a – Build Out-Year Budgets for AM with all Known

Costs: *The EC should plan now to build out-year budgets to include those potential AM costs that can be envisioned: staffing, monitoring, land and water acquisition, etc. (as was recommended by the MRGESCP’s AM contractors).*

Recommendation 10.1b – Fit AM Cycle into Funding Cycle: *With many of the AM projects likely to be planned around the normal MRG water year, work group chairs and project leads should attempt to fit the AM loop to the government’s fiscal cycle. It is often easier to defend a project’s budget if results are available within the same fiscal year as the project’s funding. Likewise, establishing a record of successful annual projects makes defending each following year’s budget easier.*

Recommendation 10.1c – Establish a Process to Quickly Execute Surplus End-of-Year Funds: *The MRGESCP should position itself to take advantage of surplus year-end money. The following process is recommended for each fiscal year:*

- 1) project leads submit fully conceived project plans (including the funding required to execute it) to CC/AMWG as soon as they are complete;*
- 2) CC/AMWG ensures that the Service reviews the project plan and prepares needed permits;*
- 3) a month or more before the end of a fiscal year, the CC/AMWG prioritizes the projects;*
- 4) a Reclamation contract specialist develops a preliminary contract;*

5) the CC/AMWG alerts funding agencies (for instance all offices within the local Reclamation agency that control their own budgets) that the MRGESCP can quickly put surplus year-end money on contract;

6) when/if surplus year-end funds become available, the CC/AMWG matches available funds to highest priority projects and initiates those projects;

With a well-honed process and a history of successfully funded projects using surplus year-end funds, the MRGESCP can become the preferred method of spending surplus year-end funds within an agency. If the Program maintains the priority list throughout the year, it can also be well positioned to fund high-priority projects if unexpected funds become available (Murray & Marmorek, 2004, p. 5).

To execute this recommendation, two points should be considered: 1) the agency's top executive can be a powerful advocate when shown how to more effectively execute the agency's budget so the EC should brief this executive on exactly what is being attempted; s/he will likely prefer expending surplus funds on mission projects to buying more chairs for the conference room; 2) the key for this process to work is a motivated, mission-focused member of the CC/AMWG to run the process and two experts, an agency finance officer and a contracts officer, willing to seek out ways to quickly accept money and get it on contract – it can be done.

Recommendation 10.1d – Explore Ways to Maximize Available funds: *The MRGESCP should focus limited dollars on project costs with the highest return on investment. Similarly, if tasks can be accomplished with in-house resources or done in partnership with another organization on a shared cost basis, it might be a better investment than hiring an outside contractor to do the job (project monitoring is one example where this could work).*

11. The Importance of Effective Communication

Greig et al. (2006, p. 7) emphasize how important communication is to the adaptive management process. The key step in the AM cycle is the use of information gleaned from the scientific experiments to inform the next set of management decisions.

This can only happen if the managers truly understand the new knowledge generated by the experiments. Therefore, the ability for the scientists and technicians to accurately communicate the new information to the managers is critical to the AM process. However, the different disciplines involved (e.g., management, biology, engineering) each have their own language, jargon, and points of reference which can be confusing. Therefore, lateral communication (as between work groups or project teams) and vertical communication (between the management team and the work groups) need to be both copious and clear (Greig et al., 2006, p. 7).

Finding 11.1 – Ineffective Communication Might be Occurring within the MRGESCP: *From MRGESCP meetings, the tenth anniversary science forum, discussions and interviews with MRGESCP members and in overheard conversation, it is clear that some MRGESCP members are concerned that the EC does not fully appreciate (or understand) the scientific information presented from work groups or experts. In addition, one EC member said that work group members seem uncertain what information to “up-channel” to the CC/EC or how they should do it. This EC member expressed concern that work group members are not thinking about the big picture – for example, why they are doing the experiment and how the results take them to the next step in the AM cycle. Finally, the large number of work groups could keep critical data from reaching everyone who could benefit by it; lateral communication can be difficult to manage, and the task gets more difficult as the lines of communication increase.*

Recommendation 11.1a – Identify and Use Member(s) who Can Effectively Communicate Scientific Information: *Often within an organization, someone will emerge into the role of “translator” between management and the technical team – it is a key, if not often recognized, function within a well-run organization. The EC should consider this skill when choosing someone to be the chair of the mid-level management forum (CC, AMWG, or whatever is decided upon) and make it clear that “translator” is one of the chair’s tasks. Additionally, the*

technical work group chairs and project team leads should be expected to cultivate this skill. EC members must learn ways to query technical group members to best elicit clear information on experiment results.

Recommendation 11.1b – Establish a Forum to Exchange Scientific findings:

While the fact book and lessons learned documents described in Recommendations 7.1b and 7.2d will certainly help lateral communication at the technical/scientific level, these documents are not sufficient to ensure transmission of scientific findings. A regular forum (possibly a standing agenda item at the normal CC or AMWG meetings), should be established to facilitate a free flow of information among the various technical/science work group members. Synergy among the work groups as they design and plan their projects will lead to a more efficient, cost-effective outcome and minimize duplication of effort.

Recommendation 11.1c – Document MRGESCP Definitions of Important

Terms: *MRGESCP members have complained that basic concepts crucial in determining when MRGESCP goals are reached are understood differently by EC members (and possibly slanted to favor an organizational position). Agreement on terms such as “water efficiency,” “desired state of the river,” and “self-sustaining” should be reached whenever they arise in meetings and then captured in writing and placed in an appropriate MRGESCP document (e.g., the Long-term Plan or the AM Plan).*

12. The Influence of Human Nature

This topic does not lend itself well to the finding/recommendation format adopted above. Nevertheless human nature determines whether and how well a new management initiative will succeed, and it permeates many of the issues already discussed above. These next paragraphs can be considered “food for thought.” Most, if not all, of the points presented below were present in varying degrees in the TQM experience cited above, and most, if not all, are or will be exemplified by members of the MRGESCP.

There is a certain evolution to a new management initiative within a bureaucracy. The first announcement is met with general resistance at all levels not directly involved in making the decision to adopt it – people generally dislike change in the work place, especially when it connotes more work; the “not invented here” syndrome comes to the fore (Pulwarty, R.S. & Melis, T.S., 2001, p. 321). Then, as understanding of the new initiative grows, many/most people will (sometimes grudgingly) admit the new process has some good attributes (assuming that most new management initiatives have strong “common sense” aspects). When the new process steps are imposed, some people will accept them but others will become frustrated and resist or find ways to circumvent compliance. In the end, the new process will either be absorbed into the existing bureaucracy (and essentially disappear) or it will become part of the organization’s culture (i.e., the way things are done) either wholly or in part. The acceptance of or resistance to a new initiative is dependent on many things, but the primary ones are 1) the effectiveness of the process itself and how well it fits the organization’s culture/goals/etc., 2) the managers’ skill in the introduction of the initiative and its implementation, and 3) the least controllable, but nevertheless crucial, aspect: the emergence of sufficient champions for the initiative (as described in the section 5 above). The odds of general acceptance can also be increased if the new process leads to some early successes (particularly if the successes might not have happened under the old process) and if the new process can be painlessly and seamlessly incorporated into the daily routine.

It is important to not let the new initiative, in this case AM, become, or appear to become, an end in itself. If it appears to be adding unnecessary steps to an existing

bureaucracy or even worse, adding a new layer of bureaucracy, chances of successful implementation are diminished. Instead, at all times AM must be viewed as providing a better way to achieve the MRGESCP's goals; if it can be shown to be more efficient or successful than past practices so much the better. A TQM example of a poorly conceived management approach will serve to illustrate this point. TQM, which is especially effective in a manufacturing setting, emphasizes the importance of building quality into every step of a process and so requires that each process be measured in order to gauge its effectiveness. In this example, the top manager, (a USAF three-star general) promulgated a decree throughout the multi-tiered organization that each subordinate commander would submit a new, effective metric (the measurement of a process) each week. At first many good metrics were submitted, but very soon it had become a make-work exercise as commanders at every level (and their staffs) spent much time and effort each week coming up with ever-more-useless metrics. TQM had become "the job" and not a tool to make the job more efficient. A similar situation could arise with AM if the wrong emphasis is placed on it. For instance, if AM is perceived as "the job" and not a tool to attain MRGESCP goals, a work group might decide to discard an important objective because it is too hard to measure and choose a minor objective instead because it is easy to measure just to show that they are indeed "doing AM."

As was mentioned by a MRGESCP member at the May 2010 AM work group meeting, "science is hard to do." MRGESCP managers must recognize this and then learn the difficult skill of making decisions based on incomplete and imperfect information. They must decide what degree of uncertainty the MRGESCP is willing to accept, be able to bound that uncertainty, and recognize the reality of the associated risks. All of this is

complicated by the composition of the MRGESCP itself: members from sixteen organizations, each weighing MRGESCP projects against their own organizational goals. While the main point of AM is to provide decision-makers with better information about the system, this does not mean that all MRGESCP members will use that information to make better decisions for the ecosystem or species. Political, economic or other considerations might take precedence in their minds. Reaching consensus under these circumstances, such as a mid-course correction – as is expected and allowable under the AM process – will be difficult (Doremus, 2001, p. 56).

While the ESSA/Headwaters contractors did a commendable job in providing AM knowledge and a good template for an AM plan to the MRGESCP (version 1.0 of the AM Plan), AM will not work until MRGESCP members adopt it into their normal mode of operation. As long as a contractor is hired to “do AM,” it is easy for MRGESCP members to go about their normal jobs knowing that AM is getting done. If the EC decides to hire a contractor to help the MRGESCP move from the version 1.0 AMP to a fleshed out version 2.0 AMP, the MRGESCP needs to have one of its own members be the plan’s editor, ensuring that everything in the plan is fully pertinent to the MRGESCP’s situation. A plan written by a contractor and delivered to the MRGESCP will sit on the shelf.

AM is a science-based process. Feick in a 1991 paper questioned whether “good science” actually leads to “better” decisions. Unfortunately, she found scientific/technical information to be last in terms of perceived influence by decision-makers when compared to economics, politics and personal or subjective factors, but that these very same decision-makers would then use that same scientific/technical data *symbolically* to flaunt

their “rational” decision-making process (Feick, 1991, p. 1). With the water politics along the MRG (which inevitably creeps into EC discussions), the MRGESCP could have a difficult task rationally weighing the scientific/technical results from the AM experiments against the various organizational priorities concerning water on the river and then making the appropriate next-step decisions to meet program goals

One positive aspect of AM being pushed by the DOI and its constituent agencies and being adopted by the MRGESCP is that aggressive advocates of AM at all levels within the MRGESCP can use AM as a “forcing function” to get MRGESCP leadership to make the “right” decisions for the species. This point is best illustrated by an example: when TQM was introduced into the author’s organization and then strongly promoted by top leadership, some long neglected issues were finally resolved by individuals who demonstrated to management how their resolution supported TQM goals – in a sense, the implementation of a commonsensical new management initiative provides leverage to individuals trying to do the “right thing” when up against a bureaucratic and/or recalcitrant management team.

13. The KISS principle (*keep it simple, stupid*)

C.S. Hollings (1978, p. 136) said it: Adaptive Management is not really much more than common sense. Most new management processes are commonsensical at their core; otherwise they would not catch on and probably would not work. Regardless of this, people write whole books about them, expounding complicated theory, and creating new jargon. However, in the *implementation* of such a new process, the more difficult the theory or process is made, the more people will get turned off, the more disagreements will be generated, and the less likely it will be to stick. Even at its most basic, AM

appeals to the scientist with its iterative, “learn by doing” approach. Unfortunately, regardless how intuitive it might be to the administrator, it obviously costs more time and more money in the short-term. More importantly though, AM flies in the face of the normal, linear management flow and government budget cycles – one pass through the AM cycle is generally all that will be approved. An attempt to change an agency’s culture to accept AM will be hard enough without more process added to it. Perhaps the best chance for successful implementation is the quick incorporation of AM into the current processes when enthusiasm for the new, good idea is at its peak. Recognize that AM is one more tool in the toolbox – don’t make it out to be more than it is.

Finding 13.1 Adopting AM Could Add Considerable Overhead to the MRGESCP: *The version 1.0 AM Plan is over one hundred pages long and, even at this length, it is not much more than a template for how to do AM step-by-step using one project example. Will the MRGESCP have the money, time, energy, enthusiasm and understanding to create version 2.0 and then maintain a continuously evolving program? The draft AM work group charter, if finalized as written, would create more MRGESCP meetings and a more complex organizational chart, both of which will likely be populated by mostly the same people as now support current MRGESCP activities. The MRGESCP has been in existence for ten years and, in that time, has developed its own processes (whether written down or not) as to how it goes about its business. Since the contractor-delivered AM Plan is comprehensive for all phases of managing a project, many steps inevitably overlap the MRGESCP’s own project management process.*

Recommendation 13.1 Incorporate AM Processes into Current MRGESCP Processes when Possible: *The MRGESCP should incorporate the key AM principles into its standard processes and not create a whole new AM process. If personnel and management structure changes are required, they should be done simultaneously and in consonance with any such changes required in the*

MRGESCP's transformation to becoming a RIP. Current MRGESCP processes should be supplemented with AM processes/steps as required. If the MRGESCP's current processes are not (or are poorly) documented (as one MRGESCP member suggested), then the contractor-delivered AM Plan provides an opportunity to correct the situation. However, if this is the case, the version 2.0 plan should be modified in light of the MRGESCP's current processes such that the final product reflects the MRGESCP's operating procedures with AM incorporated. In addition, instead of building and maintaining what could become a massive plan if all the MRGESCP's AM-candidate projects are included to the same detail as the current example, a better strategy might be to keep the AM Plan as primarily a template or "how to" book for designing, planning, and implementing a MRGESCP project when using AM. Then, each project lead would reference the AM Plan to create his or her own AM project plan, which would be a working document based on the AM Plan template.

Conclusion

Will the Middle Rio Grande Endangered Species Collaborative Program successfully implement the adaptive management process (such that the minnow and flycatcher are kept from jeopardy and eventually recovered)? The answer is: not likely. While some facets of the goal of preserving the minnow, flycatcher, and their habitats would greatly benefit from the application of the AM cycle, many factors are working against it. First, there are the natural impediments to any new management initiative when introduced into a bureaucracy. With the MRGESCP, this problem is compounded; not only are MRGESCP members conditioned into their own organization's culture, but the MRGESCP itself has evolved its own corporate culture during the past ten years. In addition are problems specific to AM, primarily dealing with its spotty record in the courts. Overriding these concerns, though, is the MRG community's own set of barriers unique to this place and time. While each of these areas has been considered in some

detail in the Results section above, the primary reasons for the “not likely” verdict are summarized below:

- The iterative, long-term nature of the AM process does not fit well in the increasingly short-term focused world we live in. The federal government’s annual budget cycle makes shambles of longer term research projects forcing inefficiencies and bad decisions. While work-arounds and compromises can be constructed, they require innovative, persuasive project leads and managers willing to buck the system to be successful. The very nature of AM will require a change in the MRGESCP’s (and member organizations’) normal processes. This creates a substantial barrier to AM’s success.
- Not all stakeholders on the MRG are signatories in the MRGESCP – the environmental community is particularly conspicuous by its absence. The lack of involvement of environmental advocates could increase the likelihood of the Program being sued. As previously noted, the response to AM in the courts has been mixed, so the Program might not be successful in its defense of AM in the courts. A full complement of stakeholders could be considered a prerequisite to a successful AM program; moving forward in the absence of all stakeholders is courting failure.
- The level of understanding of and enthusiasm for AM within the MRGESCP is not adequate to inculcate it into the MRGESCP’s culture. AM was introduced to the MRGESCP by the ESSA and Headwaters contractors over a period of about seven months. AM training to MRGESCP members was gained through participation on work groups during the development of the AM Plan. Currently

no mechanism is in place, excepting perhaps self study, to train new MRGESCP members. No aggressive AM champions have emerged as most motivated MRGESCP members already have multiple MRGESCP tasks and nearly all members also have primary duties within their organizations. AM seems to be moving forward through the action item list as if it is just one more thing to be checked off as having been done, not because it has become the new way of approaching the MRGESCP's mission. It is unlikely that AM will "take" under these circumstances.

- Even without a full stakeholder complement, the MRGESCP is not acting collaboratively. This doesn't seem to surprise anyone since, regardless of the MRGESCP's good intentions, the dilemma of not enough water on the MRG has caused conflict among the river's stakeholders throughout the region's long history, and the MRGESCP is not likely to be the vehicle to force all parties to cooperate. In one of the break-out groups at the November 3-4, 2011 EC off-site meeting, a MRGESCP member quipped, "we don't want to be rearranging the deck chairs [on the titanic]." Unfortunately, this is an apt metaphor for the current situation. The MRGESCP does not have the authority, or evidently the persuasiveness, to get the prime stakeholders to the table to finally confront the "elephant in the room" which is shared water management on the MRG. The facts are these:

- 1) historically the river's flow has fluctuated greatly, causing floods and droughts at irregular and unpredictable intervals;

2) anthropogenic changes on the river have significantly altered the river's ecosystem and flow patterns;

3) recent flow trends and disturbing future looks both point to reduced flows in the near future;

4) the watershed is not adjudicated and many, if not most, stakeholders feel the river is over-allocated; and

5) populations along the MRG are growing and will require water from somewhere.

- Into this already dire scenario, two species dependent on the river's ecosystem were added to the Endangered Species List. A "collaborative" program was assembled with the very stakeholders who are already fighting for their survival on the river all of whom know full well that, in order to remove the species from jeopardy and place them on a path to recovery, river water will be a key factor – possibly some of *their* river water – and the requirements for these actions are backed by the full weight of the federal government through the ESA. True, a "collaborative" approach is likely the only way such a dilemma can be tackled, but it is not yet happening.

Some members of the MRGESCP have compared the silvery minnow to a canary in a coalmine. However, the canary is a delicate bird expected to show distress in time to allow coal miners to escape the toxic environment. The silvery minnow, by comparison, having evolved on a river system that bounces pretty regularly between flood and drought, is a tough little fish which survived everything that nature threw its way for thousands of years and, so far, has survived even the more drastic last hundred years of a

human-managed river system. The fact that this robust fish is now endangered is a telling indicator of the health of the river's ecosystem.

One of the heartening findings from this project, based on discussions, interviews, and hours of observation at MRGESCP meetings, is that MRGESCP members all seem to truly value the river ecosystem and the culture that has evolved around it, and they are passionate about keeping both healthy and vibrant. However, as population centers grow along the river, water to support them must come from somewhere. Except for the important exception of the San-Juan Chama diversion which brings water to the Rio Grande basin from outside its watershed, most water for the new population comes from buying and selling water rights. The big water buyers are those stakeholders who support growing population centers (e.g., the city of Albuquerque), and the water sellers are mostly farmers whose land is then retired from farming and changes from predominately green to predominately brown (unless they find water by another means). However, what is not as obvious is that stakeholders who supply population centers with water are buying up more water than is currently necessary as they plan for the future population growth they know is coming. This water is often leased back to farmers who continue to farm, but someday, when the water is needed for that future population, this land will also go fallow and turn from green to brown. One is reminded of the frog placed in a pot of water on the stove. As the water heats up, the frog just sits there adjusting to the gradual heat increase. Too late it realizes its peril as the water begins to boil. The Middle Rio Grande is being destroyed a little bit at time. Growth cannot continue in the face of a limited resource. The Collaborative Program has most of the right stakeholders sitting at the table. It has a federal mandate that focuses members' attention on two species that

represent the health of the river's ecosystem. All the members know what is at stake, and they also understand what they must do –“collaboratively” manage the water on the river. It might not be sufficient in and of itself to the recovery of the species, but it is most certainly necessary. If this is not done, nothing else will suffice and the MRGESCP's goals cannot be met. However, if true collaboration can be attained, then adaptive management, if properly applied, is an effective tool to help in the recovery of the minnow and the flycatcher.

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Appendix A: Interview instrument

Interview Questions

1. Do you see adaptive management (AM) providing a more scientific approach to the Collaborative Program's efforts since its introduction in 2010?
2. Do you feel that the members of the Collaborative Program are all 'on the same page' with respect to AM? What are the disconnects, if any?
3. How do you see the AM Plan benefiting/hindering the Collaborative Program in achieving its goals?
4. How do you think the AM Plan will be managed after version 1.0 is delivered by ESSA/Headwaters?
5. What do you think the greatest challenges will be in fully developing the AM Plan?
6. What important stakeholders are not 'at the table' or need to be engaged in a more complete way? Why are they not engaged fully now? Is this a problem?
7. In your opinion, has AM been worth the time and effort so far? Why or why not?