Recommending actions to reduce the mortality and morbidity of California condors that results from lead poisoning

A Case Study from the Structured Decision Making Workshop
February 3-7, 2014
National Conservation Training Center, Shepherdstown, WV

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Decision Problem

The California condor is listed as endangered under the Endangered Species Act. The U.S. Fish and Wildlife Service (USFWS) is responsible for its conservation and recovery, but despite over forty-five years of legislated protections and implementation of recovery actions, the condor has not recovered sufficiently to consider delisting or downlisting. Information regarding continuing threats to the California condor developed though on-going management of the existing population by the USFWS and numerous partners in condor recovery, as well as in the scientific literature, have demonstrated that lead poisoning is the primary factor preventing the development of a self-sustaining condor population. Further, scientific evidence suggests that the primary source of lead being acquired by condors comes from ammunition used by hunters. Hunters and the ammunition industry contribute immensely to wildlife conservation, and both likely will play pivotal roles in implementation, so it is in the best interest of USFWS and its partners to try to find solutions that do not burden them unnecessarily. To address this lead issue (as well as secondary condor mortality factors such as DDT/DDE and microtrash), the regional director of USFWS Region 8 (Southwest) established the California Condor Contaminants Work Group (Work Group) to provide science-based guidance regarding the risks of contaminants to California condors and to recommend actions that can be taken to minimize these risks. The Work Group used the Structured Decision Making process to specifically address the lead poisoning issue.

Problem Statement: Identify the most effective recommendations that the Work Group can make to the regional director of USFWS Region 8, which if implemented, would result in the reduction of mortality and morbidity of California condors as a result of lead poisoning.

Background

Legal, regulatory, and political context

California condors are protected under a variety of federal and state laws, the foremost federal law being the Endangered Species Act, which has provided protection since the species' listing as endangered in 1967.

However, in 1996, the FWS, in cooperation with the Arizona Game and Fish Department and the U.S. Bureau of Land management, established a plan to reintroduce condors into a new range that included Arizona, Utah and Nevada. These birds were designated as a nonessential, experimental population under section 10(j) of the ESA, and as such are treated as if they are proposed for listing, but not listed. So, although these birds are still protected by various state and federal laws, they do not have the full protection of the ESA that the non-captive population in California has. Thus, the management options for and regulatory constraints on the nonessential, experimental population are quite different from those on the California population.

In addition, in 2013, the California legislature passed AB711, which eliminates the use of lead ammunition in any hunting activity in California, including varmint control and depredation. The law will be phased in by 2019, providing hunters and ranchers to use up the lead-based ammunition they currently have.

The state wildlife agencies in Arizona and Utah have implemented programs that urge hunters to adopt voluntary measures to reduce the availability of lead to condors, and survey results from Arizona suggest a high compliance rate by hunters in condor areas. However, given the communal feeding habits of condors, even a single carcass with high lead concentration could have a relatively large impact on the condor population.

Ammunition manufacturers and a variety of hunting- and firearms-related organizations are opposed to the regulatory prohibition of lead ammunition. They question the need for a regulatory solution, and argue that it is a tactic by the anti-hunting and anti-gun community to restrict hunting and shooting.

Ecological context

California condors are large, long-lived birds that are obligate scavengers, feeding primarily on large mammals such as deer, elk, pigs and livestock (and large marine mammals for those near the coast). They often find and utilize unrecovered game animals and dead livestock for food. They have large, wide-ranging foraging patterns, and often travel large distances searching for carrion. Because of their tremendous range, it is impractical to keep them in areas where the food sources can be completely controlled. Condors are very social, and often forage together on a single carcass. This feeding strategy makes them very susceptible to poisoning events, as a single bad carcass can poison an entire group of condors.

Condors are slow to mature and slow to reproduce. A breeding pair will only lay a single egg, and may only nest every other year. Only 30-50% of eggs laid will result in successfully fledged chicks, and a successfully fledged condor typically won't begin to breed until it is 6-8 years old. This slow reproduction means it takes a long time to recover the population, and because overall population numbers are still low, the loss of even a single reproductive adult can have large impacts on the time required for population recovery.

Condors are highly susceptible to lead poisoning. They have a highly acidic digestive system, which dissolves ingested lead particles. And unlike some other carrion feeding birds, condors do not cast or regurgitate indigestible foods, so the lead remains in the system much longer than it might in another species. A condor does not have to ingest much lead to cause lead poisoning, which can lead to death, either directly or as a result of sublethal effects (loss of appetite, lethargy, etc.).

Since reintroduction began in 1992, causes of condor death in the wild have been closely documented. Despite extraordinary measures to mitigate the impacts of lead (all condors are captured and tested twice a year; birds with high lead levels are given chelation therapy; some birds have lead fragments surgically removed, etc.), lead poisoning is still the leading cause of death among free flying condors.

Their feeding strategy and susceptibility to lead poisoning, coupled with their slow reproductive potential, makes management of the lead issue of critical importance to condor recovery. Without continuing capture and treatment of exposed birds and continuing release of captive-

reared birds into the wild population (or some other solution not yet envisioned), California condors will not survive in the wild.

Decision Structure

During the months leading up to the workshop at NCTC, the team met multiple times via teleconference and webinar to discuss condor biology, as well as, the political, legal, regulatory, and logistical landscapes of condor management. The team discussed a wide variety of objective concerns and developed a problem statement from which to begin. As we moved through the workshop week, the team developed its first working prototype of the problem.

Problem Statement – Prototype 1

What are the most effective recommendations that the team can make to the RD, which if implemented, would result in the reduction of mortality and morbidity of CA condors as a result of lead poisoning.

Objectives – through an iterative process the team arrived at the following objectives

- Minimize Mortality and Morbidity
  - % Mortality due to Lead (Pb)
- Minimize Condor Recovery Program Cost
- Minimize impacts to hunting public/ag operators
- Minimize impacts to ammunition industry

Alternative actions

- Status Quo – what condor recovery program looks like now
- "All-In" – Everything (within reason) that we could do.
- Management Heavy – focus on condor management
- Cooperation and Outreach – focus on voluntary efforts

Predictive model

WEIGHTED SCORES		Alternatives				
Objectives	**Goal**	**Status Quo**	**All-In**	**Mgmt Heavy**	**Cooperation and Outreach**	**Weight**
% Mort Due to Lead	Min	0.000	0.345	0.230	0.104	0.345
~~**% Chelated**~~	~~Min~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	
Minimize Cost	Min	0.190	0.000	0.030	0.127	0.19
Minimize Impacts to Hunting Public	Min	0.233	0.000	0.021	0.106	0.2325
Minimize Impacts to Ammunition Industry	Min	0.233	0.000	0.029	0.087	0.2325
~~**Max Partner Support**~~	~~Max~~	~~0.000~~	~~0.000~~	~~0.000~~	~~0.000~~	
Sum of Weights (for all objectives)						1
Sum of weighted scores (for each alternative)		0.66	0.35	0.31	0.42	
Final Score (sum wtd scores/sum weights)		**0.66**	**0.35**	**0.31**	**0.42**	

We used a consequence matrix to evaluate the performance of each alternative on each objective. We found that % Chelated was too difficult to predict under alternative scenarios, so it was dropped as a measurable attribute. We found that there were issues with the partner support measure, as well, so it was also dropped for this prototype. The weighting scheme used represents the weights assigned directly by the group. However, in general, "Status Quo" out - performed other alternatives and was not particularly sensitive to the weight placed on individual objectives. We decided in the 2nd prototype (developed after the initial workshop) to explore alternatives designed around the status quo, as it seemed that the landscape we were working in was already somewhat constrained by the political landscape, previous decisions, and the condor's biology.

Problem Statement – Prototype 2

What are the most effective recommendations that the team can make to the RD, which if implemented, would result in the reduction of mortality and morbidity of CA condors as a result of lead poisoning.

Objectives

- Minimize Mortality and Morbidity - Δ % Mortality due to Lead (Pb)
- Minimize Condor Recovery Program Cost
- Minimize impacts to hunting public/ag operators
- Minimize impacts to ammunition industry
- Maximize partner support

Alternative actions

For reference, the Status Quo currently involves VHF and in some cases GIS tracking of the animals; release of additional condors five locations covering three states and Baja California; capture of released animals 1-2 times per year, blood work, and chelation, if necessary; outreach to retailers, hunters, and landowners in the range; provision of all or a part of the cost of non-lead ammunition in Arizona and Utah; voluntary gutpile removal programs in Arizona and Utah; and evolving legislated and regulatory restrictions on the use of lead ammunition in California.

Predictive model

WEIGHTED SCORES		Alternatives						
Objectives	**Goal**	**Status Quo +Alt 1**	**Status Quo + Alt 2**	**Status Quo + Alt 3**	**Status Quo + Alt 4**	**Status Quo + Alt 5**	**Status Quo + Alt 6**	**Weight**
% Mort Due to Lead	Min	0.000	0.425	0.532	0.177	0.496	0.319	0.532
Minimize Cost	Min	0.118	0.049	0.049	0.074	0.000	0.118	0.118
Minimize Impacts to Hunters/Ag Operators	Min	0.122	0.136	0.149	0.095	0.149	0.000	0.149
Minimize Impacts to Ammunition Industry	Favor Status Quo (2)	0.041	0.041	0.000	0.027	0.051	0.027	0.051
Max Partner Support	Max	0.142	0.073	0.067	0.150	0.083	0.000	0.150
Sum of Weights (for all objectives)								1
Sum of weighted scores (for each alternative)		0.42	0.65	0.73	0.37	0.70	0.46	
Final Score (sum wtd scores/sum weights)		**0.42**	**0.65**	**0.73**	**0.37**	**0.70**	**0.46**	

The weights in this version of the consequence matrix were directly elicited from the group. Overall scores for the various alternatives are shown along the bottom of the table and no single alternative dominates all of the others, with three alternatives in an upper tier and three in a lower tier.

Decision Analysis

Prototype 1

This is likely a highly-constrained landscape – that is, many previously made decisions have already limited the options available and we may be optimizing around a small set of alternatives – or improving, as we can, around the status quo… (as an example, the possibility of a lead ban throughout the range is limited by the 10(j) designation; however, it is bolstered and further confined by the current bill in Congress, the position of State partners and the opposition to such a ban by multiple other stakeholders). The team quickly solidified around this perspective during the workshop and stopped considering a full lead ban as an alternative.

Prototype 2

As stated previously, the group decided to focus on modifications to the status quo in the second prototype. Three of the alternatives entered a top tier of consideration. There was some discussion that implementation of certain options might be sequential, for instance a communication strategy might be helpful in moving forward with both with future ammunition programs and with educating the public about a move to specific release sites.

Uncertainty

While there are many sources of potential uncertainty in this sort of decision, there were some that were substantially clarified during the weeks leading up to and during the workshop. California passed a full lead ban shortly before the workshop. While a number of industry representatives were approached about taking part in the effort, they universally declined. When discussion of a possible lead ban (even on Federal land) occurred within the group, it quickly became clear that it would meet resistance among several partner and user groups – making it

effectively a non-option. Understanding these elements of the problem were clarifying and guided further discussion, but there is still considerable uncertainty in how response to various alternatives may play out. For instance, maximizing partner support as an objective reflects the collective reactions of partner organizations in condor recovery and management, of which there are dozens.

Other potential sources of uncertainty also came up either in group discussion or model development. With regard to reducing uncertainty in estimation of model parameters the group discussed:

- How much lead might need to be removed from the landscape before a population-level reduction in mortality could be realized?
- The effectiveness of voluntary and regulatory efforts in reducing mortality.
- Predicting how % chelation might change under various scenarios.

Discussion

The structured decision-making process served to clarify the decision-problem, focusing on those actions that were within the authority of the responsible regional director of the Service, or which he could significantly influence, rather than the broad range of possibilities outside of his authority. The highly constrained legal, political and practical landscape in which condor recovery operates served to limit the options available to the group. As an example, our initial rapid prototyping resulted in an objective ("ban lead ammunition") that was outside of the evident authorities of the Service, was not supported by the participant organizations, and which was in violation of existing constraints (The 10(j) rule and related agreements). So while those not directly involved in the structured process expected a rather simple and direct recommendation to ban lead, it was obvious through the structured process that such a solution was neither viable nor practical.

Further, the initial scoring made evident that the existing complex of activities associated with condor recovery, including voluntary programs, outreach and education efforts, nest guarding, tracking, testing and treating ill condors, recovering of carcasses and determining causes of mortality were all necessary parts of a successful program. The alternatives that were developed in the second prototyping all reflected a continuation of and a building upon the status quo program – enhancements necessary to help to meet the objectives. After several rounds of alternative development, the list of alternatives became a list of practical enhancements to the status quo; generally, program expansions in education, outreach, training and other recovery efforts.

Value of decision structuring

This structured approach provided a mechanism to incorporate the varied interests of the participant groups. We gathered state and federal officials with direct knowledge of and

experience with condor recovery, other recovery efforts, and lead and its effects on wildlife. As noted we attempted for over one year to garner the participation of the ammunition industry or the shooting sports without success. However, the structured process worked to force the participants to consider the concerns of those stakeholders, and in fact our objectives reflect both ammunition industry and hunter/shooter interests as two of the measurements of the value of the alternatives identified.

The decision process also forced us to be transparent in our deliberations, and all interests were considered as a part of the deliberative and ranking processes. While we ultimately determined that reflecting the interests of other condor partner organizations really didn't contribute to the determination of the best alternatives, we did attempt to ensure that those perspectives were included in the deliberations.

Finally, it became evident through the process that the values brought to the table by the organizations and personnel that participated were often controlling despite the necessity to continue to use resources, time and money, and expend condor lives; the process revealed the prioritization of principals as opposed to practicalities. The principle example of this was the conflict between the voluntary hunter outreach programs conducted by Arizona and Utah, and the regulatory and legislative program in California. Simply put, other states have indicated a resistance to any mandatory programs. That conflict between values and the practicality of condor recovery will certainly slow down the process of change necessary to ensure condor recovery.

Further development required

Following the structured on-site process, the group continued to meet and refine the alternatives that would be utilized to provide recommendations to the Regional Director. Since all of the recommendations included retaining the status quo, which was defined and assumed – so that we were just talking about the program enhancements that were required or best suited to address the presenting problem of lead's effects on condors. Some of the initial less practicable ideas and suggestions were discarded as not credible, and the language associated with each alternative was considered, clarified and re-approved by the group.

A final decision matrix was developed and ranked, and weights were determined by a group voting process. The weighting process provides the most direct way in which the values of the participants are reflected, and the importance of considerations other than direct condor mortality that participants weighed reflects the many interests and important consideration with which the group was burdened, and which constrain condor recovery.

The final recommendations from that process are reflected below.

Recommendations in priority order

- Status Quo + Alt 3 – Ammunition Programs - *Working with the ammunition industry, national and state level sporting interest groups (e.g., Mule Deer Association, Rocky Mountain Elk Foundation, Pheasants Forever, etc.), retail organizations and others, encourage the shooting public's use of non-lead ammunition through clearly marked packaging, preferential market locations, retail employee training, financial incentives (coupons), lead ammunition exchange programs, etc. Both federal and state level approaches would be necessary and should be coordinated and cooperative*

- Status Quo + Alt. 5 – Release Sites – *Develop additional condor release sites in locations with large foraging areas where the use of lead ammunition is prohibited (parks, private lands with non-lead hunting programs, etc.). It is understood that condors will migrate naturally beyond any established boundaries, but large, clean release sites may be more successful than ones close to areas of known lead exposure. Over time, shift condor release and management efforts to release sites that show the greatest successes.*

- Status Quo + Alt. 2 – Communication Strategy - *Develop a comprehensive communication strategy based on human dimensions research to deliver key messages to target key audiences (hunters, shooters, landowners, and the public). Develop materials to assist with implementation of the communication strategy (could include informational materials, articles, brochures, web-sites ("Hunting with Non-lead"), editorials, earned and social media, etc.). Through the use of surveys and/or focus groups, investigate the current level of knowledge, interest and concern in these communities to inform decision makers about the best ways to communicate with the different groups, the sources of information about lead that are used by the buying public, and the resistance or willingness of the consuming public to changing marketplace behavior.*

- Status Quo + Alt. 6 – Educate on Federal Lands *Prohibit the use of lead ammunition on Fish and Wildlife lands for hunting, shooting or animal control purposes after 3 years of active communication with the public. The communication should inform hunters and shooters of the advantages of non-lead ammunition for hunting and the secondary mortality effects of lead ammunition to non-target wildlife.*

- Status Quo + Alt. 1 – Hunter Education Curriculum – *add information on issues of lead and wildlife and the advantages/disadvantages of various types of ammunition to existing curricula for hunter education.*

- Status Quo + Alt. 4 – Shooting Clinics - *Encourage cooperative ventures among federal and state agencies, non-profit groups, hunting and shooting sports enthusiasts and public and private ranges to expand the conduct of shooting clinics, providing opportunities for hunters and the interested public to actually shoot non-lead ammunition and compare its performance with lead ammunition. Follow up with clinic participants to see if the clinic changed their usage behavior.*

Literature Cited

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Tables

Figures