

2015 Report of the Hopi Long-Term Monitoring Program for Öngtupqa (the Grand Canyon)

**Prepared by:
Michael Yeatts and Kristin Harned**

**Produced by the Hopi Cultural Preservation Office
P.O. Box 123
Kykotsmovi, Arizona 86039**

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Hopi 2015 monitoring group

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INTRODUCTION

This report reflects the ninth year of implementing the Hopi Long-term Monitoring Program protocols (Yeatts and Huisinga, 2007) for the Glen Canyon Dam Adaptive Management Program (AMP). Since 1993, the Hopi Tribe has been documenting the resources of cultural value in *Öngtupqa* (the Grand Canyon). Beginning in 2003, protocols for explicitly monitoring the health of these resources from the unique cultural perspective of the Hopi people was undertaken, with formal adoption of these protocols by the AMP occurring in 2007. During development of the monitoring program protocols, culturally appropriate approaches were explored and tested, interview questions were refined, and ongoing resources monitoring was conducted using interim procedures during the annual Hopi river trips. With the continued implementation of the now standardized procedures, the Hopi Long-term Monitoring Program is evolving into a mature project with the focus on maintaining a consistent evaluation of Hopi values for the health on *Öngtupqa* through time.

Guiding Philosophy

Öngtupqa is an extremely important place in Hopi culture because of the integral role it plays in Hopi history, the many Hopi deities that reside in and are associated with it, and its function in the Afterlife of Hopi people and spirits. Plants, birds, and animals in the Grand Canyon are imbued with the sacred character of *Öngtupqa*, and are linked with all aspects of Hopi life through the philosophical concept of *Soosoy Himu Naanamiwiwyungwa*, wherein all things in the cosmos are connected. Hopi people have a spiritual obligation to serve as stewards of *Hopitutskwa* (Hopi land) and this responsibility extends to caring for the native plants, birds, and animals found in the Grand Canyon. The Hopi Tribe's desire to be a fully engaged partner in the adaptive management and long-term monitoring of the Grand Canyon stems from this spiritual and historical commitment of Hopi religious people to *Öngtupqa* (Yeatts and Huisinga 2007:1).

Given this overarching philosophical guidance, the Hopi Long-term Monitoring Program seeks to address this stewardship role in a culturally appropriate manner, recognizing both the cultural and logistical constraints associated with working in *Öngtupqa*. This means that:

- Integration of Hopi traditional values and knowledge into a Western science program would need to occur primarily at the level of data analysis, not at the data collection stage;
- Data collection and data analysis do not necessarily need to be conducted by the same entity once appropriate procedures are developed;
- Duplication of the field efforts of other researchers should be avoided where possible;
- Some data can only be collected by knowledgeable Hopi people;
- Components of the ecosystem are interconnected and cannot be viewed in isolation;
- Hopi cultural mandates greatly restricts who can or should enter *Öngtupqa*;
- Hopi traditional knowledge is not uniformly distributed among the Hopi people;
- Methodologies that can evaluate the resources of *Öngtupqa* without actually having to take large numbers of Hopi people into *Öngtupqa* would be the only approach that could adequately sample and provide representative data on the health of the resources from a broad Hopi perspective;
- Traditional scientific presentations of data are generally not the best mechanism for conveying information, particularly to a different culture.

A key assertion of the Hopi Long-term Monitoring Program is that the physical “state” of a resource and its “health” are two separate concepts, and it is towards the measurement of the second

that this program directed. The “state” of the resource can easily (sometimes) be measured through the western scientific approach; how many fish there are, their size, the temperature of the water, its clarity, how many millions of tons of sand are in the system, the amount of vegetation coverage, *et cetera*. Whether a given resource “state” is “healthy,” however, is a cultural evaluation, drawing on the cultural understanding of the ecosystem and the roles the resource plays within the ecosystem and the society; in this case the Hopi society. The long-term goal of the program is to measure resource health through time in a way that illuminates Hopi cultural values and their understanding of the ecosystem, is scientifically defensible, and in the future, can be statistically evaluated.

Protocols

The philosophy, design, and protocols to implement the Hopi Long-term Monitoring Program are presented in detail in Yeatts and Huisinga (2007); the following summarizes some of the key methodologies. The foundation of the Hopi Long-term Monitoring Program is a survey-based approach to record Hopi impressions of resource health. Standardized survey instruments are used to record the opinions of Hopi informants about the health of culturally important resources in *Öngtupqa*. The general surveys are conducted subsequent to a standardized presentation about the current states of the culturally important resources (primarily as documented through western scientific studies), the perceptions of Hopis involved in previous monitoring episodes, and any management actions that are being undertaken or proposed.

In addition to the general surveys, a more detailed survey is completed following direct examination of the resources in *Öngtupqa* by a subset of Hopi people who can participate in the annual resource monitoring river trips. To the greatest extent possible, the Hopi Long-term Monitoring Program relies on information about the resource states obtained through the Grand Canyon Monitoring and Research Center (GCMRC) scientific studies, Grand Canyon National Park Service monitoring, and any other relevant research. This approach seeks to minimize the impacts to the resources from multiple, overlapping field studies of the same resources and to recognize the spiritual danger of entering *Öngtupqa* for the Hopi people. In the development of this monitoring approach, the Hopi Tribe worked with other researchers conducting monitoring in order to maximize the relevance of their data to the Hopi analysis (Huisinga and Yeatts 2003).

Specifically, data about the status and trends of culturally important resources is annually summarized into a standardized presentation that is presented to various constituencies of the Hopi Tribe (the full presentation format is provided in Yeatts and Huisinga 2007; see also Appendix 1). Following the presentations, written surveys are completed which assess resource health based on the information provided during the presentation. The surveys include categories for narrative, yes/no, and demographic response data. This information provides the basis for the resource health assessment. In addition, supplemental interviews and discussions provided further detail to better understand the responses and to expand on cultural values underlying the responses. These can also provide management recommendations that don't necessarily get coded in the surveys.

A key component of the Hopi Long-term Monitoring Program is the annual resource monitoring trip, undertaken by a small number of Hopi consultants who travel into *Öngtupqa*. The same surveys that are given to the larger Hopi public are conducted pre-trip and then an additional post-trip survey is administered to ascertain changes in responses that direct interaction with the resources may produce (referred to as “**general**” and “**post-trip**” surveys hereafter). During the development of the survey instrument, it became apparent that for a number of the resources, Hopi people did not feel confident in making a health assessment without actually seeing the resource. Therefore, the general

survey contains a subset of the questions that are asked on the post-trip survey. Finally, the Hopi monitoring trip provides for monitoring of resource attributes that cannot be accomplished by western scientists (eg. spiritual/cultural values).

All of the data that is collected is entered into a database utilizing Nvivo 10® software (Qualitative research software from QSR International) for summarization and analysis. Data can also be exported from this software in order to be analyzed by other statistical methods not contained within the software suite.

2015 Annual River Monitoring Trip

From August 27th through September 04th, 2015, eleven Hopi cultural consultants, one boatman, and two Hopi Cultural Preservation Office researchers participated in the annual Hopi monitoring river trip. The nine-day motorized trip ran from Lees Ferry to Pearce Ferry. The trip was planned to end at Diamond Creek, on the Hualapai Reservation, but the access road was in poor shape and GCMRC could not get trucks into the takeout location. Therefore, a couple of very long travel days were necessary to complete the trip in the allotted time. While the Hopis participating on the monitoring trips have long stated a preference for the row trips, funding realities have dictated a shift to motor trips in most years.

During the trip, numerous resources including archaeological sites, cultural sites, vegetation, animals, springs, minerals, sediment, and the general environment were examined. Discussions about the scientific research, management activities and issues, and the AMP in general were held. Formal surveys were conducted prior to and at the end of the trip; other interview data was collected during the trip.

Hopi participants on the trip were:

Lyle Balenquah	Greasewood Clan	Bacavi village
Rex Talayumtewa	Sun Forehead Clan	Sipaulovi village
Elmo Nevayaktewa	Corn Clan	Misongnovi village
Troy Honanie, Jr.	Coyote Clan	Hotevilla village
Nuvadi Dawahoya, Jr.	Parrot/Katsina Clan	Tewa village
Ian Masayesva	Coyote Clan	Hotevilla village
Clay Hamilton	One-horn Clan	Sichomovi village
Darrick Howard	Water Coyote Clan	Moencopi village
Shawn Namoki, Sr.	Bear Clan	Sipaulovi village
Marvin Talayumtewa	Sun Forehead Clan	Sipaulovi village
Jamey Tewahongtoma	Bamboo Clan	Moencopi village

The staff and crew on the trip were:

Laura Fallon	Boatman
Kristin Harned	Co-PI
Michael Yeatts	PI

Elmo Nevayaktewa was unable to participate in the full trip due to a medical condition that necessitated evacuation at Phantom Ranch.

DATA ANALYSIS

Data collected in the form of surveys or interviews is entered into the Nvivo 10® database for further processing, consolidation, trend analysis, pattern searching, and ultimately statistic analysis. Since the beginning of the monitoring program, 262 surveys have been completed and entered into the database and form the basis for this analysis. This includes information from 148 Hopi individuals, and 11 non-Hopis (only the information collected from Hopi participants is included in the subsequent analyses in this report). Table 1 summarizes this information.

Table 1. Summary of all Survey Data.

	Number of people	Total # of surveys
GC River Trip 2003	8	16
GC River Trip 2004	6	9
GC River Trip 2006	8	16
GC River Trip 2007	9	18
GC River Trip 2008	9	16
GC River Trip 2009	8	14
GC River Trip 2010	9	17
GC River Trip 2011	11	22
GC River Trip 2012	7	14
GC River Trip 2013	7	14
GC River Trip 2014	11	22
GC River Trip 2015	11	21
SJ River Trip Women 2009	9	13
CRATT	12	12
Hopi Natural Resources	3	3
Hopi Tribal Council	9	9
Misc Hopi participants	3	3
Non-Hopi participants	11	13
Total Hopi	148	249
Total people including non-Hopi	159	262

Table 2 presents a summation of all the responses to the questions asked on the survey. This information provides snapshot of the overall distribution of responses and serves as an introduction to the response categories that are used throughout this document. In general, a “Yes” response indicates that a resource is considered healthy, a “No” response that it isn’t, and the remaining responses indicate that the respondent was uncertain about the resource health or had a more nuanced assessment

Table 2 also highlights some issues that are a byproduct of the iterative process by which the survey instrument (questionnaire) was developed. First, the number of responses to any given question are always less than the total number of surveys that have been completed by Hopi participants (compare with Table 1). This is a result of some questions being added or dropped during the development of the survey program, or having wording changes to make them more understandable to the Hopi respondents. If the questions through time solicited the same fundamental resource information, the responses were retained; otherwise they were not included in the analysis. This year, it was decided that the first two years (2003 and 2004) would not included in

the individual resource analyses. During this time the survey instrument and monitoring protocols were in flux, so the data is less comparable to that collected later. Since 2006, the survey questions and monitoring protocols have asked have remained constant.

Additionally, there were a number of questions asked during the development of the survey that were focused on the survey instrument itself (as feedback in order to improve it). Most of these are no longer included on the survey. Questions Q02, Q03, and Q04 are somewhat in this category, but are retained on the questionnaire as an ongoing assessment of the relevance of the Hopi Long-term Monitoring Program to the tribe (they are addressed in the “management” section of the report).

Table 2. Summary of Responses

	Yes	No	Yes and No	Don't Know	Blank	Total responses
Q01 Overall health	135	16	10	63	6	230
Q02 Hopi involvement	216	1	1	7	5	230
Q03 Importance of information	224	1	0	3	2	230
Q04 Relation to cultural teachings	203	3	1	2	3	212
Q05 Recent changes positive	122	0	0	53	3	178
Q06 Marshes	122	37	6	23	8	196
Q07 Birds	154	13	2	24	3	196
Q08 Recreation	98	63	33	20	16	230
Q09 Trout removal	75	79	10	11	11	186
Q10 Non-native species	114	63	4	9	6	196
Q11 Archaeological sites	107	58	7	18	6	196
Q14 Öönga, Hopi Salt Mines	78	20	2	10	1	111
Q15 Willow	78	13	3	14	3	111
Q16 Animals	86	6	0	15	4	111
Q17 Native fish	44	21	1	37	8	111
Q18 Snakes	66	5	1	29	10	111
Q19 Insects	88	4	0	15	4	111
Q20 Springs and seeps	75	14	6	12	4	111
Total Cumulative Percentages (inclusive of 2015)	68.20%	13.64%	2.85%	11.94%	3.37%	Total 3057
Results of 2015 only	61.13%	23.59%	3.99%	10.63%	0.66%	

Broadly, Table 2 shows that the condition of the resources overall continues to be viewed as positive (a “Yes” response) and that there is strong support for continuance of the monitoring program. 2015 did show a significant increase in the percentage of responses indicating a not healthy resource condition when compared to the long-term percentage. This trend will be discussed further in the individual resource sections below. Further, there is considerable less uncertainty expressed in the form of no responses (“Blank”) in 2015.

The management issues of **Recreation** and **Trout Removal** remain the primary categories that do not have a significantly more positive response than negative, indicating less agreement that these are the correct actions to be taking. Among the resources, the Native Fish also fall well below the average positive response with only 39% of the Hopi responses being affirmative.

Resource Trends

While a summary of all of the data provides a good broad-brush snapshot of what the data tells us, it is the temporal trends for the individual resources and activities that are important in assessing whether ongoing management of *Öngtupqa* is being implemented successfully. A resource that appears healthy when all data is averaged may in fact be trending towards decreasing health, and this is important to know in order to effect a management change before the situation becomes irreversible. Therefore, the next two sections of the report look specifically at the resource trends in the monitoring data. The first section looks at the results for each individual resource or resource class that has been identified as culturally important to the Hopi people. The second section addresses the Hopi perception of activities that could be classified as “management” in nature. These include things such as recreation, data recovery at archaeological sites, and non-native removal activities.

All figures displaying trend information for the remainder of the report portray two temporal spans. The thin lines represent the best-fit line over the entire period since 2006 and the thick lines are the trend over the last four monitoring episodes. This display format was done to explore any differences in short and long term perspectives. As the temporal span of the data collection gets long enough, it is anticipated that the slopes of the long-term trend lines will tend to center around zero and their relative positions (y-intercept) will stabilize. These will then represent something of a “baseline” condition. On the other hand, the trend line over the previous four monitoring episodes will reflect a more timely assessment of the current system and highlight deviations from the long-term trend. The selection of four years for the duration of the short-term trend is somewhat arbitrary, but is felt to be short enough to capture the recent views as to system health, but at the same time to be long enough to even out stochastic variability. A consistent deviation in the direction of the short-term trend from the long-term trend may indicate that an issue is arising that may need to be addressed and changes in the relative positions of the lines with respect to each other could indicate a fundamental change in how the health of the resource is viewed.

The y-axis in all the following trend figures portrays the normalized response rates for each question [$(\text{number of responses in category})/(\text{total responses to question})$]. This was done to make inter-annual comparisons equivalent given that different numbers of people respond to the survey in different years.

It should also be noted that for the graphical representation of the data, the response categories of “**Don’t Know**,” “**Yes and No**” (when both responses were given to a single question), and “**Blank**” (where no response was given to a question) are grouped together into a single “**Other**” category. This was done because all of these types of responses indicate a hesitancy to evaluate the resource as either good or bad, and therefore can be considered as a similar, separate category of response.

Overall Health

Survey Question:

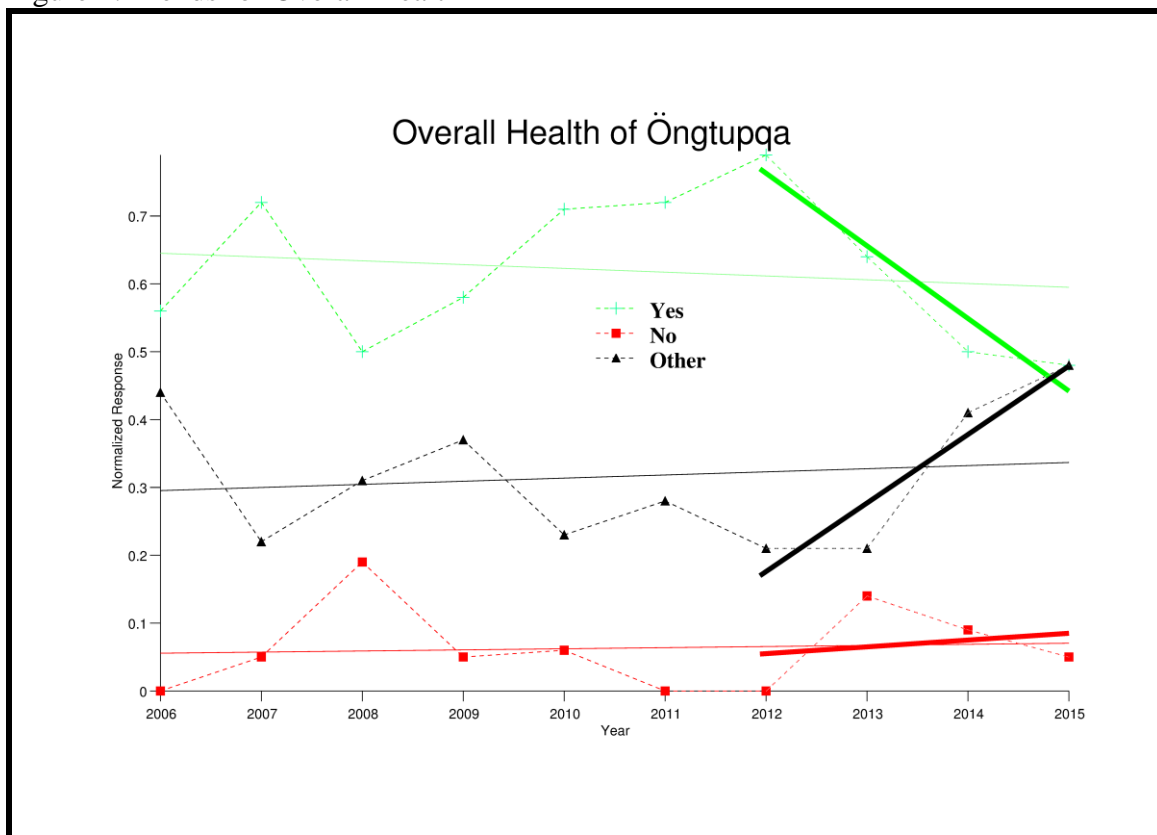
-Do you think *Öngtupqa* (Grand Canyon) is better cared for now than in the past?

Table 3. Is *Öngtupqa* Better Cared for Now than in the Past

	Yes	No	Yes and No	Don't know	Blank
2006 surveys	9	0	0	7	0

2007 surveys	13	1	1	3	0
2008 surveys	8	3	2	2	1
2009 surveys	11	1	0	6	1
2010 surveys	12	1	0	4	0
2011 surveys	23	0	0	9	0
2012 surveys	11	0	1	2	0
2013 surveys	9	2	1	1	1
2014 surveys	11	2	2	7	0
2015 surveys	10	1	1	9	0
Total	117	11	8	50	3
Percent	61.90%	5.82%	4.23%	26.46%	1.59%

Figure 1. Trends for Overall Health



There has been a consistent decrease in the perceived health of *Öngtupqa* for the last four years, with the positive assessment of the overall health reaching the lowest point since 2008 (Table 3, Figure 1). This reaffirms the assessment indicated in the overall summary of the data, provided above. A large reason for the decrease in the positive assessment is because a larger proportion of the respondents were unsure of the system health, rather than an increase in those who stated that the health had decreased. Quite a few people in the pre-trip (“**general**”) survey commented that it was their first trip and that they wanted to learn more before commenting. Most felt that the increased monitoring, concern, and respect for *Öngtupqa* was a sign that it was being better cared for. If the trend line for “not healthy” should start to increase, then there will be more cause for alarm.

Recent changes

This question serves as a baseline indicator: if *Öngtupqa* is perceived as not changing, then any “changes” to the health of the individual resources must be reflecting changing cultural values for what is considered healthy rather than being attributable to physical changes occurring to the resources themselves.

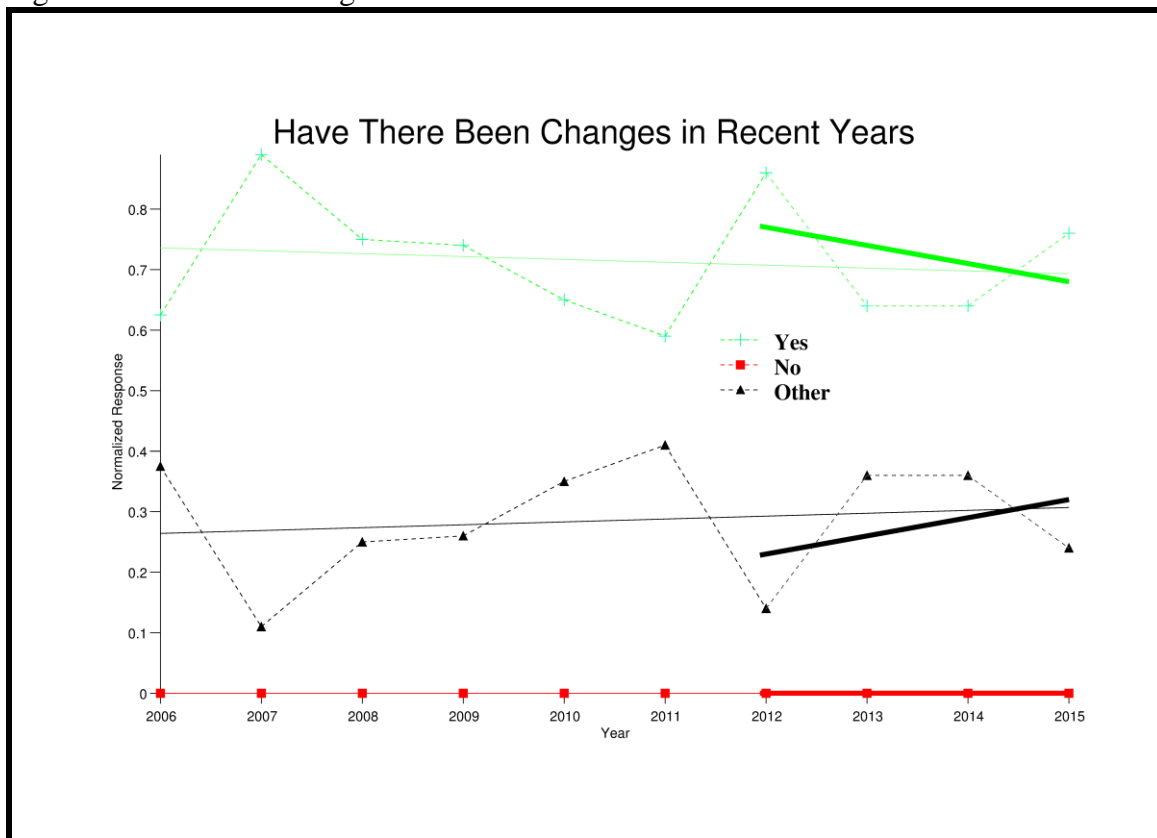
Survey Question:

- Do you think there have been changes in *Öngtupqa* in recent years?

Table 4. Have There Been Changes in Recent Years

	Yes	No	Yes and No	Don't Know	Blank
2006	5	0	0	3	0
2007	8	0	0	1	0
2008	12	0	0	4	0
2009	14	0	0	5	0
2010	11	0	0	6	0
2011	19	0	0	13	0
2012	12	0	0	1	1
2013	9	0	0	4	1
2014	14	0	0	8	0
2015	16	0	0	4	1
Total	120	0	0	53	3
Percentage	68.18%	0.00%	0.00%	29.78%	1.69%

Figure 2. Trends for Changes in Recent Years



There were no respondents who felt that change did not occur in *Öngtupqa* (Table 4, Figure 2). The short-term and long-term trend lines are continuing to be roughly parallel and in the same proportions to each other, indicating that the responses have been consistent through time. Those who didn't know if there had been changes cited that it was their first trip.

Archaeological Sites

Responses to this question reflect both the perceived physical state of the sites themselves as well as the appropriateness of management approaches that are being employed to try to preserve them. Because the state of archaeological resources has not been formally monitored by the AMP program in recent years, these results are based on the few sites that were visited during the Hopi monitoring trip and extrapolation of the trends that were reported during the last time that there was AMP archeological site monitoring.

Survey Question:

- Archaeological sites in Grand Canyon are healthy?

Table 5. Are Archaeological Sites Healthy

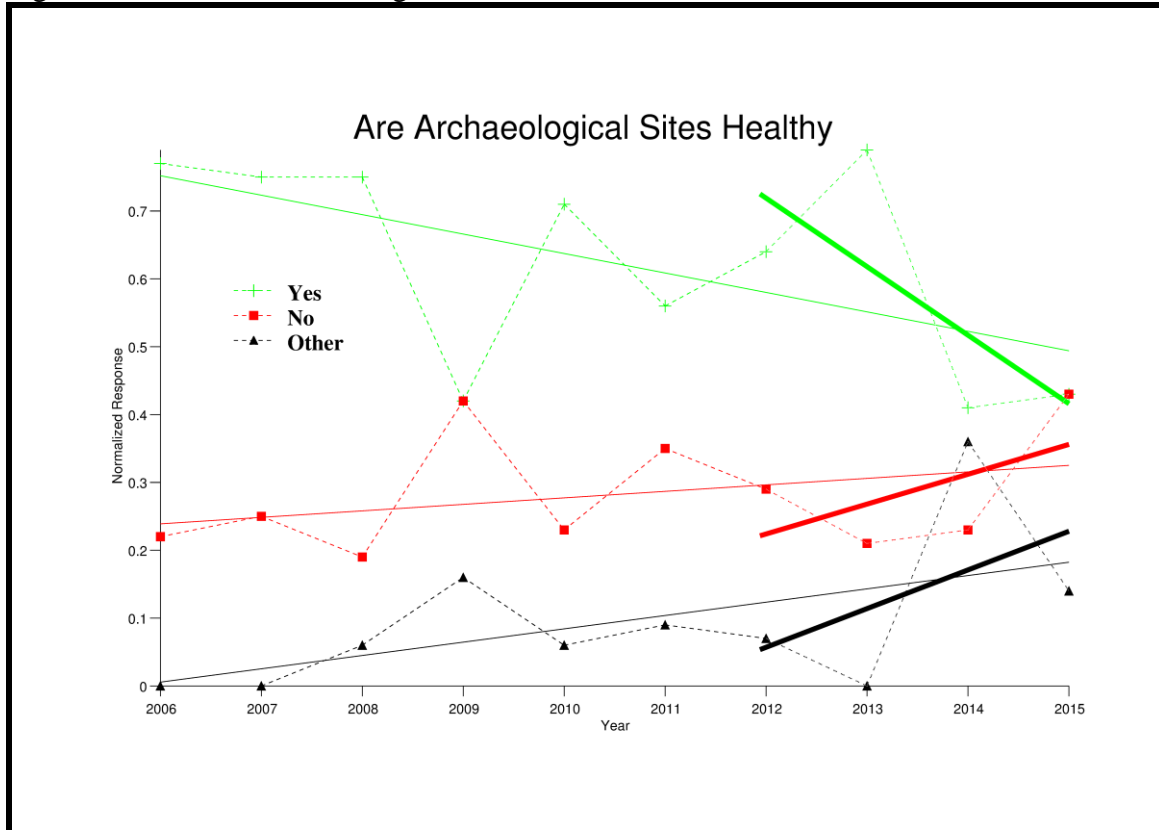
	Yes	No	Yes and No	Don't know	Blank
2006	6	2	0	0	0
2007	7	2	0	0	0
2008	12	3	1	0	0
2009	8	8	1	2	0
2010	12	4	1	0	0
2011	18	11	0	0	3
2012	9	4	0	0	1
2013	11	3	0	0	0
2014	9	5	3	3	2
2015	9	9	1	2	0
Total	101	51	7	7	6
Percentage	58.72%	29.65%	4.07%	4.07%	3.49%

This year the decrease in the number of respondents who thought that the archeological sites were healthy was accompanied by increase in the “No” responses (Table 5, Figure 3). Because the “No” responses (rather than the “Don’t Know”) are responsible for offsetting the “Yes” responses, it is clear that there is concern about the health of archaeological sites (Hopi ancestral sites). Both visitation and erosion (lack of sediment) were cited as reasons for concern about the health of archaeological sites.

Marshes

The health of two proxy species is used to gage the health of marsh habitats: cattails (*Typha* spp.) and reeds (*Phalaris* spp.). Because monitoring of this component of the ecosystem has not been specifically undertaken in the AMP in recent years, assessment is being made primarily on the basis of field observation by the Hopis and an understanding of possible succession scenarios of marsh habitats under current flow regimes.

Figure 3. Trends in Archaeological Site Health



Survey Question:

- From what you have heard, *Wipho 'qölö* (patches of *wipho* or cattail) and *paaqap 'qölö* (patches of *paaqavi* or reed) in Grand Canyon exist in a healthy state?

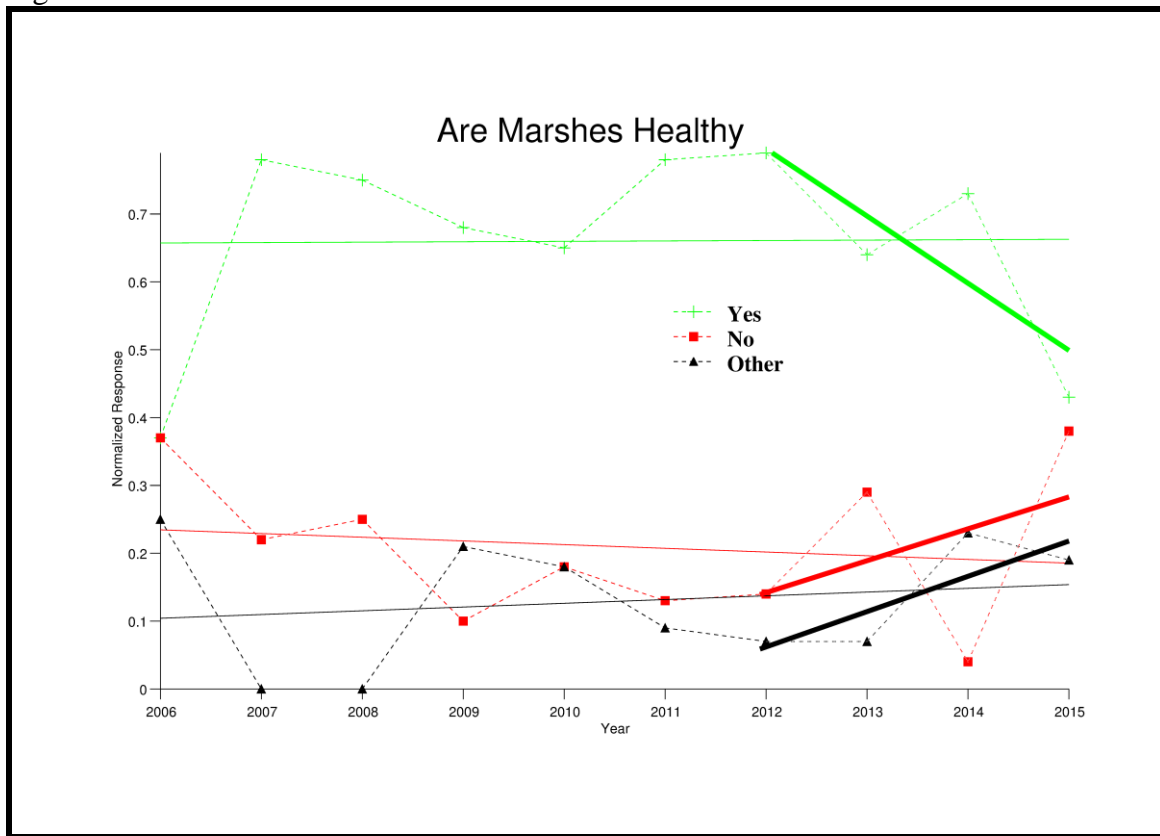
Table 6. Are Marshes Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	3	3	1	1	0
2007	7	2	0	0	0
2008	12	4	0	0	0
2009	13	2	0	3	1
2010	11	3	0	2	1
2011	25	4	0	1	2
2012	11	2	0	0	1
2013	9	4	1	0	0
2014	16	1	1	2	2
2015	9	8	2	2	0
Total	116	33	5	11	7
Percentage	67.44%	19.19%	2.91%	6.40%	4.07%

This year, there was a steep decline in the proportion of responses identifying the health of marshes as good and an increase in those who felt that the health was bad (Table 6, Figure 4). This is a considerable change from last years response pattern. The most frequent opinions given for why

the marsh plants were not in good health were that they seemed relatively scarce (although people noted that reeds (*Phragmites*) seemed to be doing well), and that non-native plants were replacing them. Some people, however, did think they were doing as well or better than in previous years.

Figure 4. Trends in Marsh Health



Birds

Bird species, particularly some the migrants figure prominently in Hopi culture. Unfortunately, in recent years the monitoring of birds by the AMP has been nonexistent. Therefore, the interpretation of health is informed solely by birds observed during the monitoring trip.

Survey Question:

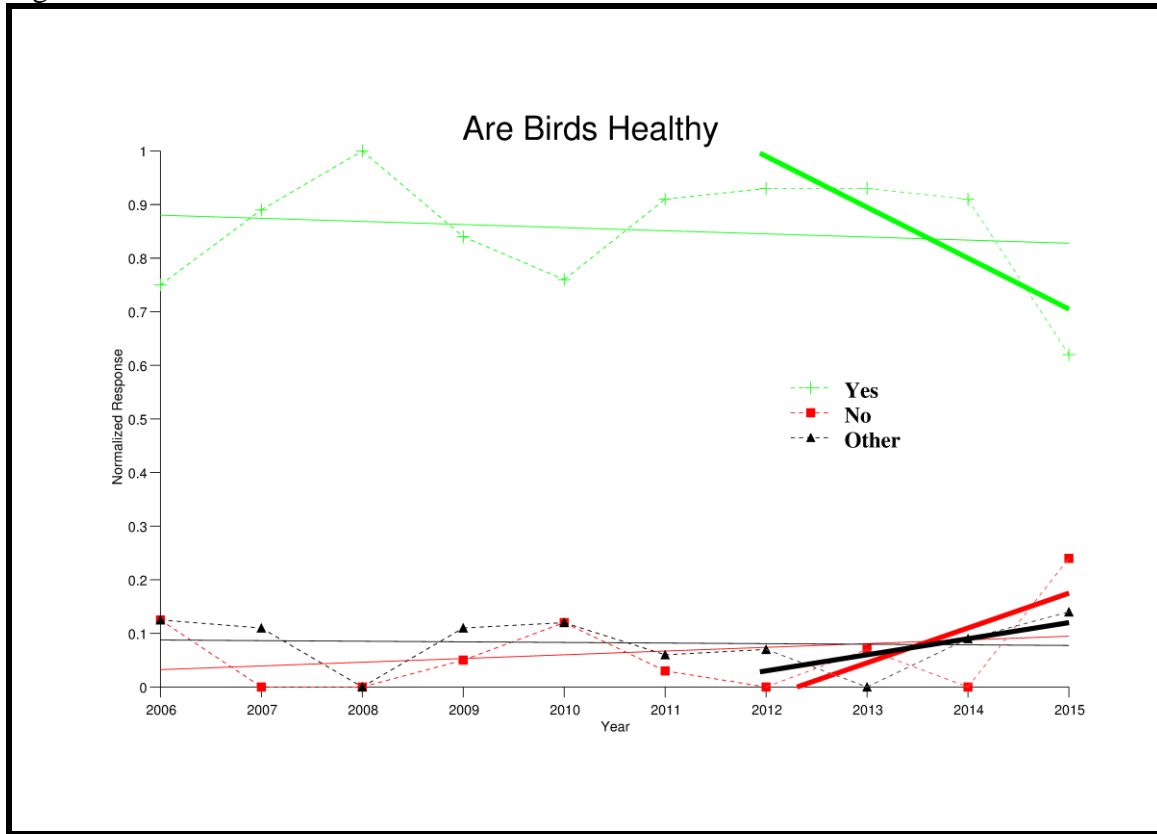
- *Tsirot* (birds) in Grand Canyon exist in a healthy state?

Table 7. Are Birds Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	6	1	0	1	0
2007	8	0	0	1	0
2008	16	0	0	0	0
2009	16	1	0	1	1
2010	13	2	0	1	1
2011	29	1	0	2	0
2012	13	0	0	0	1
2013	13	1	0	0	0

2014	20	0	0	2	0
2015	13	5	1	2	0
Total	147	11	1	10	3
Percentage	85.47%	6.40%	0.58%	5.81%	1.74%

Figure 5. Trends in Bird Health



From the perspective of the Hopis, bird health remains very good, though there is significant drop in this perspective for 2015 to the lowest level seen (Table 7, Figure 5). Many respondents noted that a wide variety of birds seen, though others commented on the small total numbers that were seen during the trip.

Öönga (Hopi Salt Mines)

The status of *Öönga* is one of the key indications to the overall health of *Öngtupqa*. Not only are there the physical processes that occur at this location, but also ceremonial activities that occur at the Hopi villages and by Hopis when in *Öngtupqa* also affect the health of *Öönga*. Because it was determined during the development and earlier implementation of the Hopi Long-term Monitoring Program that Hopis were generally unwilling to answer this question unless they had actually visited the location, this question (and all subsequent resource questions) are only asked of people who have been to the site.

Survey Question:

-*Öönga* (Hopi Salt Mines) is healthy?

Table 8. Is *Öönga* Healthy

	Yes	No	Yes and No	Don't Know	Blank
2006	6	0	1	1	0
2007	8	1	0	0	0
2008	7	1	0	0	0
2009	6	0	1	0	0
2010	9	0	0	0	0
2011	10	0	0	0	1
2012	7	0	0	0	0
2013	7	0	0	0	0
2014	4	5	0	2	0
2015	3	7	0	0	0
Total	67	14	2	3	1
Percentage	77.01%	16.09%	2.30%	3.45%	1.15%

Figure 6. Trends in *Öönga* Health



Over the last two years, there has been a radical shift in perspective about the health of *Öönga* (Table 8, Figure 6). Significantly more Hopi respondents felt that *Öönga* was in an unhealthy state than those who thought that it was healthy, and no one was undecided about their position. Based on the narrative comments, it is clear that the concern continues to be about over-collection and allowing time for *Öönga* to replenish. One person noted that it seems to be taking longer to replenish and many people commented that it appeared “dirty” (due to recent rains and no new deposits). As called for in the past, discussions among the tribal stakeholders need to occur.

Willows

Willows are a culturally important species in their own right and they serve as an indicator species for the post-dam riparian zone. Monitoring of this component of the ecosystem is beginning under a new protocol and results have not yet been reported to the AMP. Therefore, assessment is being made primarily on the basis of field observation and an understanding of the general trend in riparian plant succession scenarios.

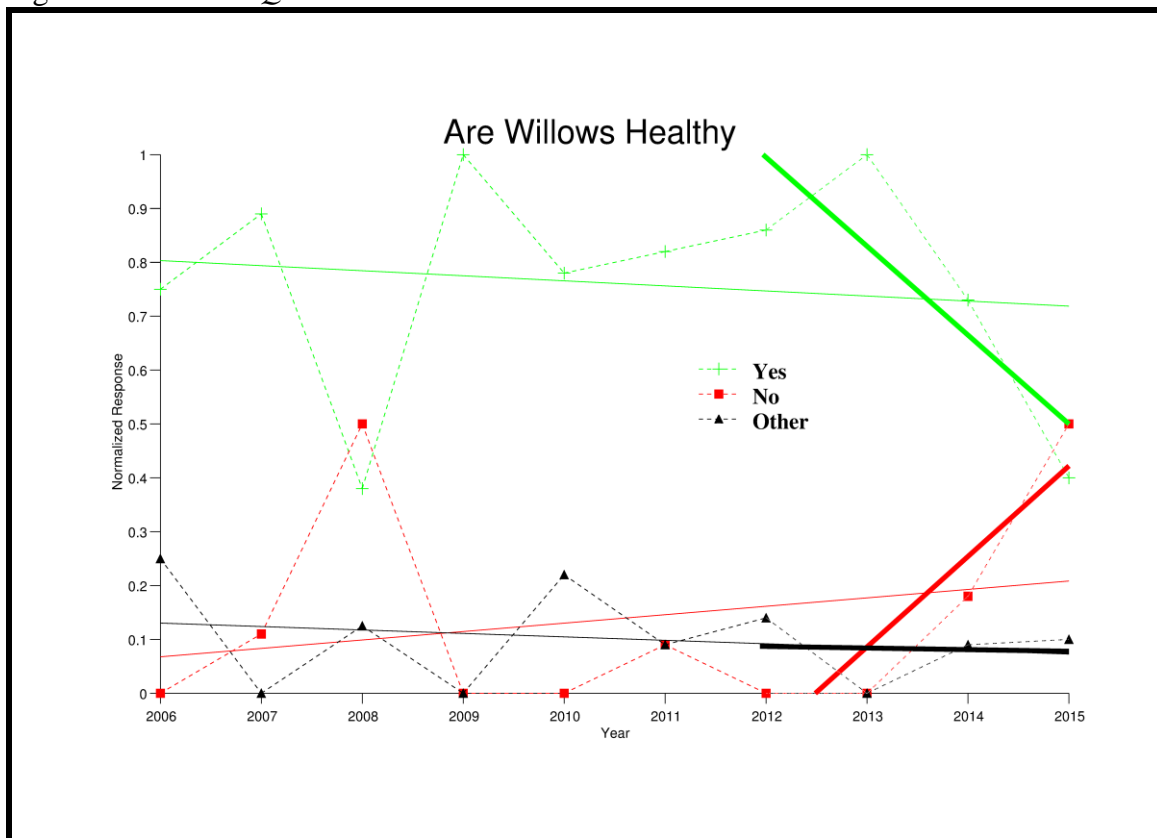
Survey Question:

-*Qahavi* (willow plants) in Grand Canyon exist in a healthy state?

Table 9. Is *Qahavi* Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	6	0	0	2	0
2007	8	1	0	0	0
2008	3	4	1	0	0
2009	7	0	0	0	0
2010	7	0	0	1	1
2011	9	1	0	0	1
2012	6	0	0	0	1
2013	7	0	0	0	0
2014	8	2	0	1	0
2015	4	5	0	1	0
Total	65	13	1	5	3
Percentage	74.71%	14.94%	1.15%	5.75%	3.45%

Figure 7. Trends in *Qahavi* Health



While the long-term trend suggests that the willows are generally healthy (Table 9, Figure 7), there has been a relatively sharp decrease in this viewpoint, starting in 2013 and reaching new low in 2015. The common concern was that willows were being replaced by non-native or other plants and being seen less frequently.

Animals

Because there is no systematic data collection for animals in the river corridor by the AMP, the results are purely based on field observations made by Hopi monitors while on the river trip (that is why the question has only been part of the post-trip surveys since 2004). This resource category includes primarily large and small mammals. Other animals such as fish, birds, and insects are addressed through separate questions.

Survey Question:

-*Tuutuvost* (animals) in Grand Canyon exist in a healthy state?

Table 10. Is *Tuutuvost* Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	5	0	0	3	0
2007	9	0	0	0	0
2008	7	1	0	0	0
2009	7	0	0	0	0
2010	8	0	0	1	0
2011	10	0	0	0	1
2012	6	0	0	0	1
2013	6	0	0	0	1
2014	9	1	0	1	0
2015	7	3	0	0	0
Total	74	5	0	5	3
Percentage	85.06%	5.75%	0.00%	5.75%	3.45%

While there has been an ongoing slow decline in perceived health of animals since 2009 (Table 10, Figure 8), it is a relatively minor decrease and overall, animals are still viewed as being healthy. A number of the comments noted that not many large animals were seen, but those that were, seemed to be doing well. A couple of people suggested that with all of the rain that had occurred, the deer and sheep might have been up higher, not needing the river for water.

Native Fish

While the intent of this question is to get at the health of all native fish, it specifically keys in on the humpback chub, as this is the species has the most scientific data available. The humpback chub is also the fish that the general public, including those at Hopi, are most likely to have heard about.

Survey Question:

-Native fish called the Humpback chub exist in a healthy state in Grand Canyon?

Figure 8. Trends in *Tuutuvost* Health

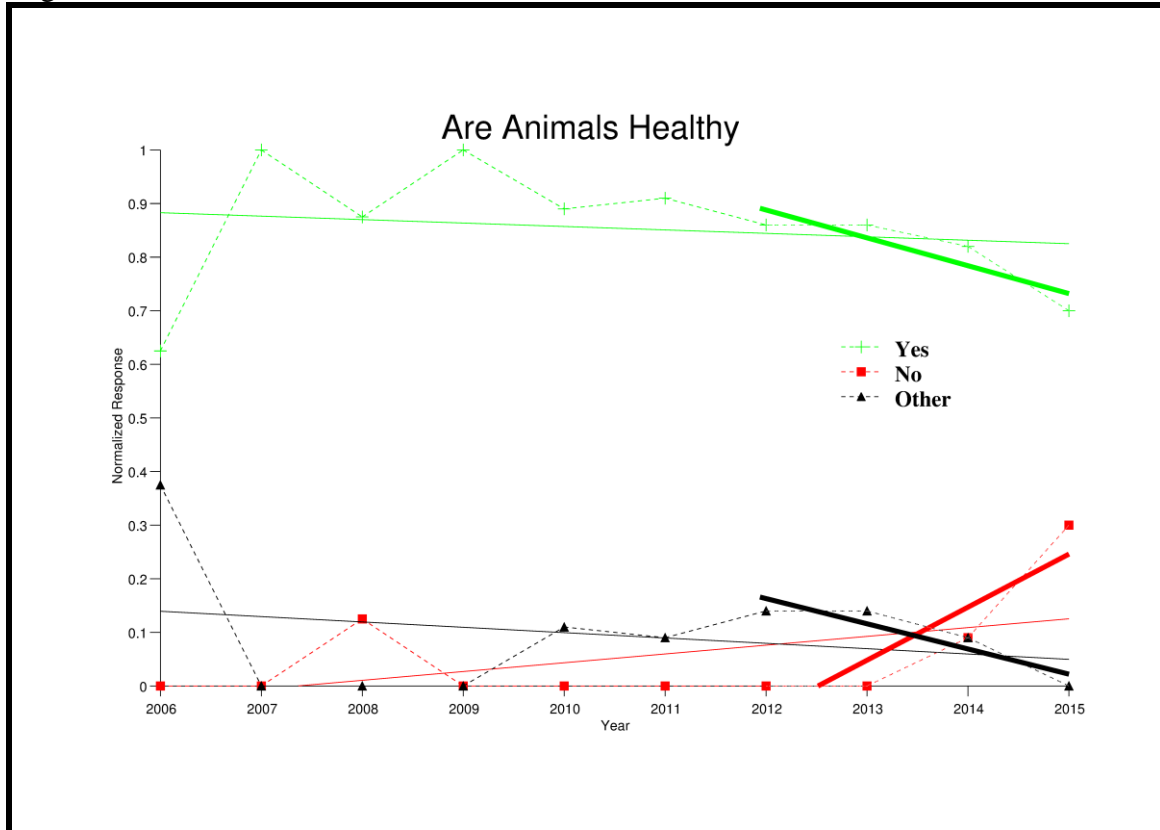
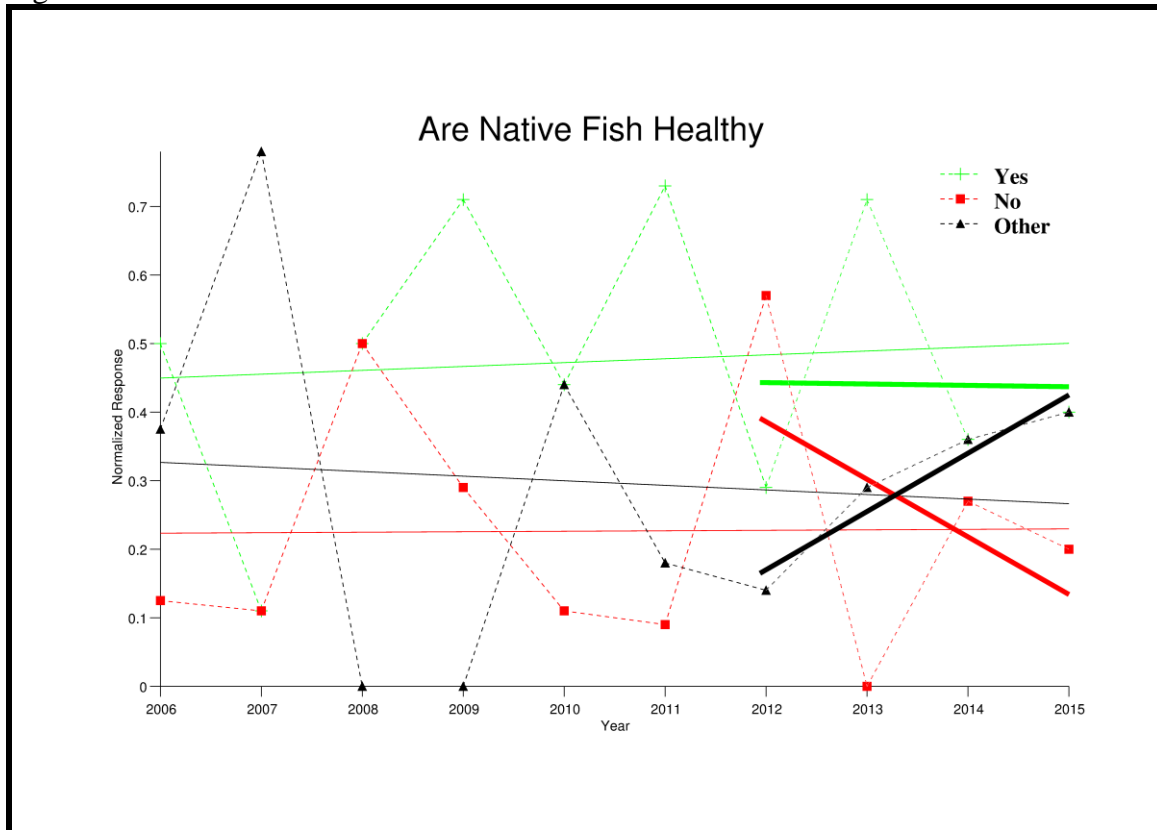


Table 11. Are Native Fish Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	4	1	0	3	0
2007	1	1	0	6	1
2008	4	4	0	0	0
2009	5	2	0	0	0
2010	4	1	0	2	2
2011	8	1	0	0	2
2012	2	4	0	0	1
2013	5	0	0	1	1
2014	4	3	0	4	0
2015	4	2	1	3	0
Total	41	19	1	19	7
Percentage	47.13%	21.84%	1.15%	21.84%	8.05%

The issue driving the perception of native fish health down is the amount of uncertainty due to not seeing any humpback chub this year. (Table 11, Figure 9). In other years, fish were noted at some of the stops or while observing biologists examine the nets. People responding that the native fish were doing well often clarified that this was what they had heard based on the fish monitoring science. Comments indicate a strong support for the fish monitoring work and efforts to help increase the numbers of the humpback chub.

Figure 9. Trends in Native Fish Health



Snakes

Snakes play an important, ongoing role in Hopi culture and society. As with a number of the other terrestrial resources, observations by Hopis during the monitoring trips and old monitoring data forms the sole data set for this resource as the AMP no longer monitors this culturally important group.

Survey Question:

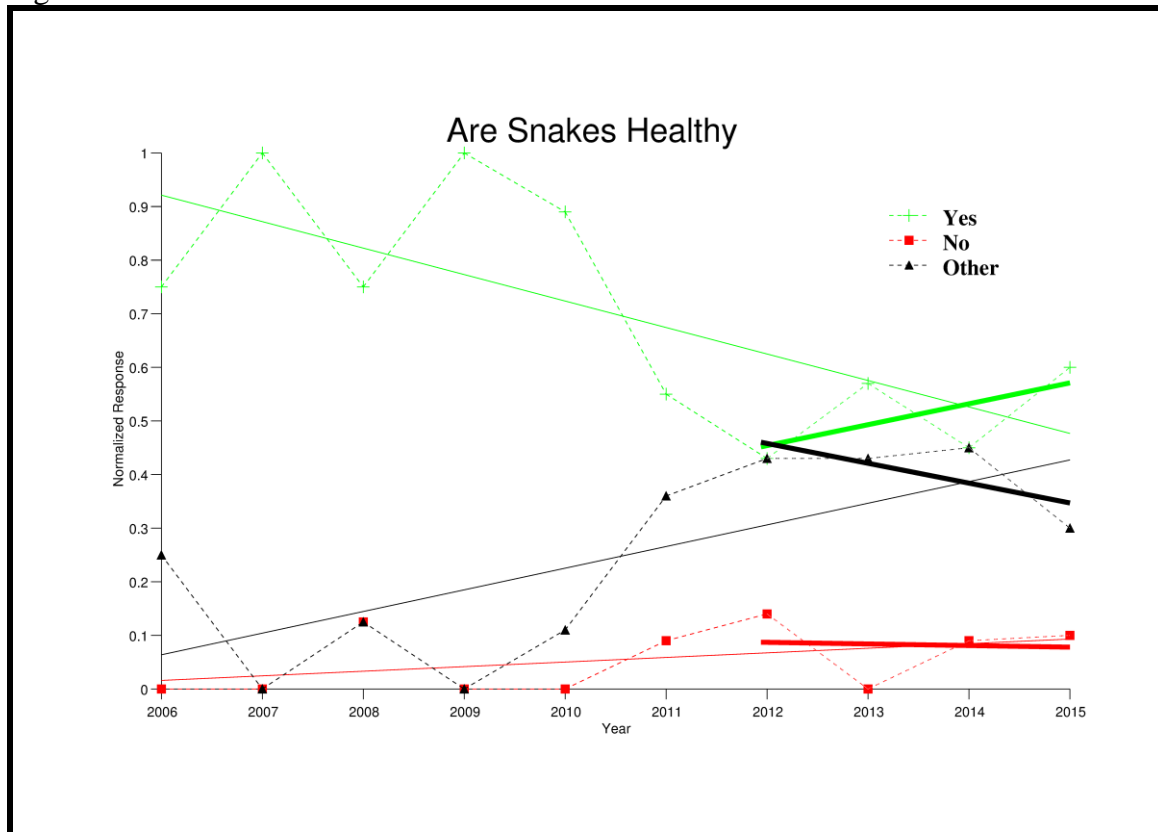
-Snakes in Grand Canyon exist in a healthy state?

Table 12. Are Snakes Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	6	0	0	2	0
2007	9	0	0	0	0
2008	6	1	0	1	0
2009	7	0	0	0	0
2010	8	0	0	1	0
2011	6	1	0	0	4
2012	3	1	0	2	1
2013	4	0	0	0	3
2014	5	1	0	4	1
2015	6	1	1	2	0

Total	60	5	1	12	9
Percentage	68.97%	5.75%	1.15%	13.79%	10.34%

Figure 10. Trends in Snake Health



The short-term trend-line is showing a slight increase in the view that snakes are healthy (Table 12, Figure 10). Based on the comments, it is clear that if people saw any snakes, then they reported that they were healthy; otherwise, they were generally unsure.

Insects

Insects form an important component of the ecosystem, serving as food for other culturally important resource such as birds, reptiles, amphibians, and fish. Like numerous other components of the terrestrial zone, the AMP has only monitored them infrequently in the past and while there is now a strong “citizen science” project collecting insects, results have not been synthesized regarding any population trends. Therefore, Hopi responses are based principally on field observations during the monitoring trips and older monitoring data.

Survey Question:

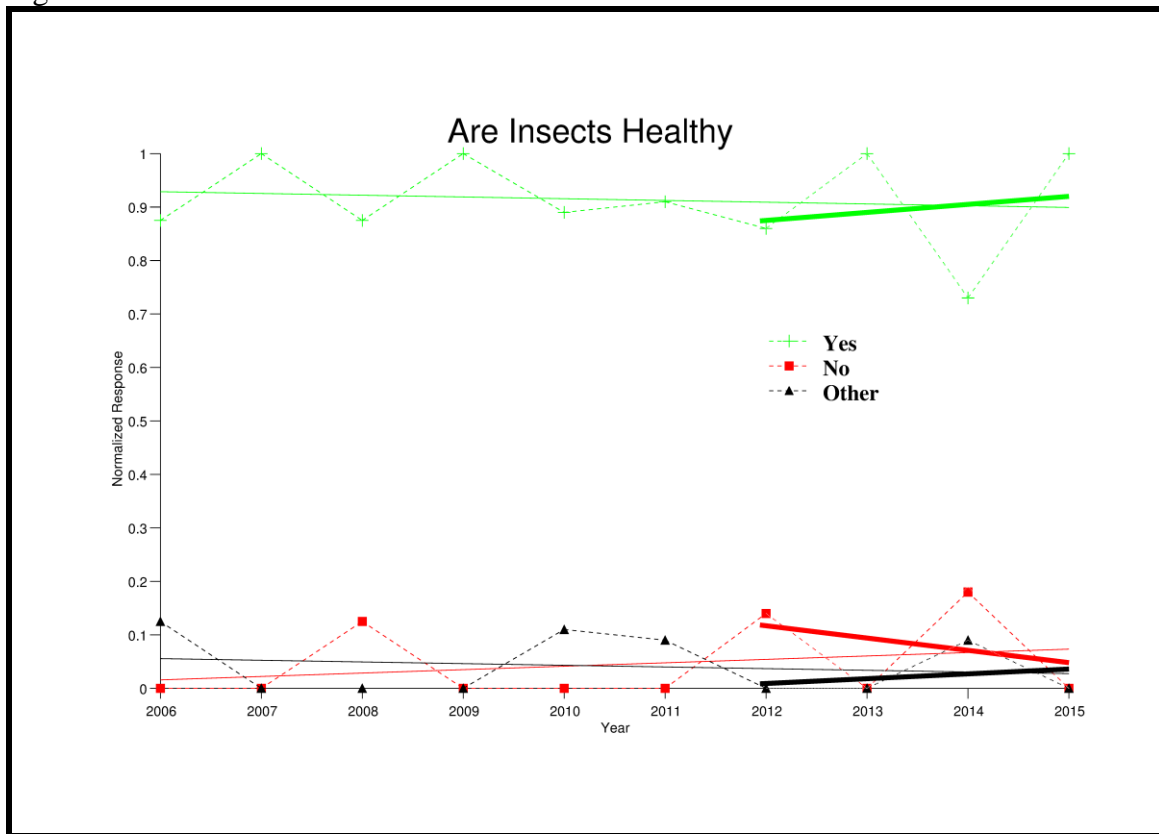
-Insects in Grand Canyon exist in a healthy state?

Table 13. Are Insects Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	7	0	0	1	0
2007	9	0	0	0	0

2008	7	1	0	0	0
2009	7	0	0	0	0
2010	8	0	0	1	0
2011	10	0	0	0	1
2012	6	1	0	0	0
2013	7	0	0	0	0
2014	8	2	0	0	1
2015	10	0	0	0	0
Total	79	4	0	2	2
Percentage	90.80%	4.60%	0.00%	2.30%	2.30%

Figure 11. Trends in Insect Health



Insect health has consistently viewed as positive since the beginning of the monitoring (Table 13, Figure 11). Virtually all people noted that they had seen numerous insects and that they appeared to be doing well. A number of people also commented about the diversity of insects, including seeing ones they had never seen before. One person made the linkage between insects and lizards.

Springs and seeps

Springs and seeps are extremely important within the Hopi culture. Because they are essentially unaffected by most current operations of Glen Canyon Dam, they can somewhat serve as a control within the survey methodology.

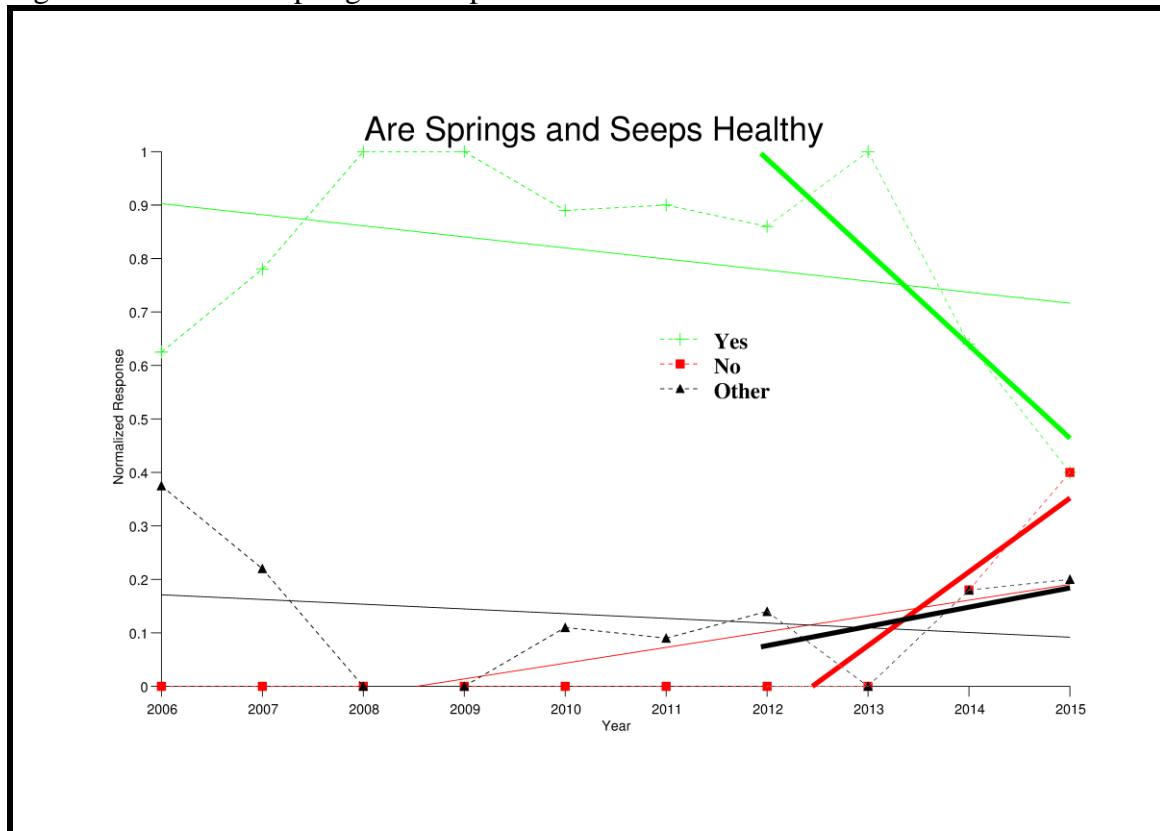
Survey Question:

-Springs and seeps in Grand Canyon exist in a healthy state?

Table 14. Are Springs and Seeps Healthy

	Yes	No	Yes and No	Don't know	Blank
2006	5	0	0	3	0
2007	7	0	2	0	0
2008	8	0	0	0	0
2009	7	0	0	0	0
2010	8	0	1	0	0
2011	10	0	0	0	1
2012	6	0	0	0	1
2013	7	0	0	0	0
2014	7	2	0	1	1
2015	4	4	1	1	0
Total	69	6	4	5	3
Percentage	79.31%	6.90%	4.60%	5.75%	3.45%

Figure 12. Trends in Spring and Seep Health



There has been a sharp decline in spring health over the last three years (Table 14, Figure 12). This is directly attributable to the low flows seen at many springs (in fact Dutton Spring was not flowing when observed). A number of people cited the lack of rain as the fundamental cause for low spring flows. One person was curious about the linkage to climate change.

Trends for Management Activities

The next set of questions deal with activities associated with the management of resources in *Öngtupqa* rather than the resources themselves. These are used to track whether management activities that are occurring or are proposed are viewed as appropriate from the Hopi perspective.

Hopi Involvement in the AMP

Three questions are asked that assess the relevance of Hopi participation in the AMP and monitoring of resources in *Öngtupqa*. They are:

Survey Question 1:

-Should Hopi be involved in stewardship and Management of *Öngtupqa* (Grand Canyon)?

Survey Question 2:

-Is this information about *Öngtupqa* important to you?

Survey Question 3:

-Does this information about *Öngtupqa* relate to your cultural teachings?

These questions are used to track a couple of issues, foremost of which is whether the Hopi consider it appropriate that they remain involved in the AMP. Because there are very real cultural, spiritual, and political ramifications associated with *Öngtupqa* for the Hopi people, it is appropriate to identify whether participation is still considered important enough to outweigh the potential negative aspects of involvement. Additionally, responses are used to gauge whether the monitoring program is continuing to collect the “right” information. Said another way, is the Hopi Long-term Monitoring Program addressing the correct Hopi concerns or are there other resource issues that need to be examined? These questions are more for internal evaluation of the Hopi Long-term Monitoring program rather than to track the health of any given resource.

Since these three questions have been asked, we have received a total of 672 responses, all of which have been overwhelmingly positive (see Table 2). To the first question, regarding whether Hopi should be involved in the management of *Öngtupqa*, out of 230 total responses, only 1 indicated that Hopi should not be involved and 13 were unsure. For 2015 specifically, all but one person said that Hopi should be involved, and the person who did not respond affirmatively was unsure. As to the second question (again out of 230 total responses), 224 responses have identified that the information about *Öngtupqa* is important to them; only one response said that it wasn't and 5 were uncertain. In 2015, all but one respondent said the information was important and the one who didn't was unsure. The responses to the third question are similar: out of 212 total responses, 203 said that the information is relevant to their cultural teachings, 3 responses were negative, and 6 were uncertain. In 2015, all responses confirmed that the information was relevant to their cultural teachings.

Overall, there continues to be overwhelming support for the Hopi tribe to continue its participation in the AMP and that the work being conducted is culturally relevant and important to the Hopi people.

Recreation

Recreational use of *Öngtupqa* is a contentious issue from the perspective of the Hopi Tribe. It has two principle impacts. First, there are the actual physical impacts that can occur to resources from trampling, vegetation damage, introduction of exotic species, damage to archaeological resources, littering, etc. Second, the Hopi feel that it is inappropriate and even dangerous for non-initiated people to venture into *Öngtupqa*. The correct spiritual preparations must be made before such a journey is undertaken and appropriate behavior must be followed. Without doing this, people are placing themselves in a risky situation, and this is troubling to the Hopi.

Survey Question:

-The National Park Service allows recreational visitation in *Öngtupqa* (Grand Canyon) on river trips. From your perspective, is this right or wrong?

Table 15. Should Recreation be Allowed in *Öngtupqa*

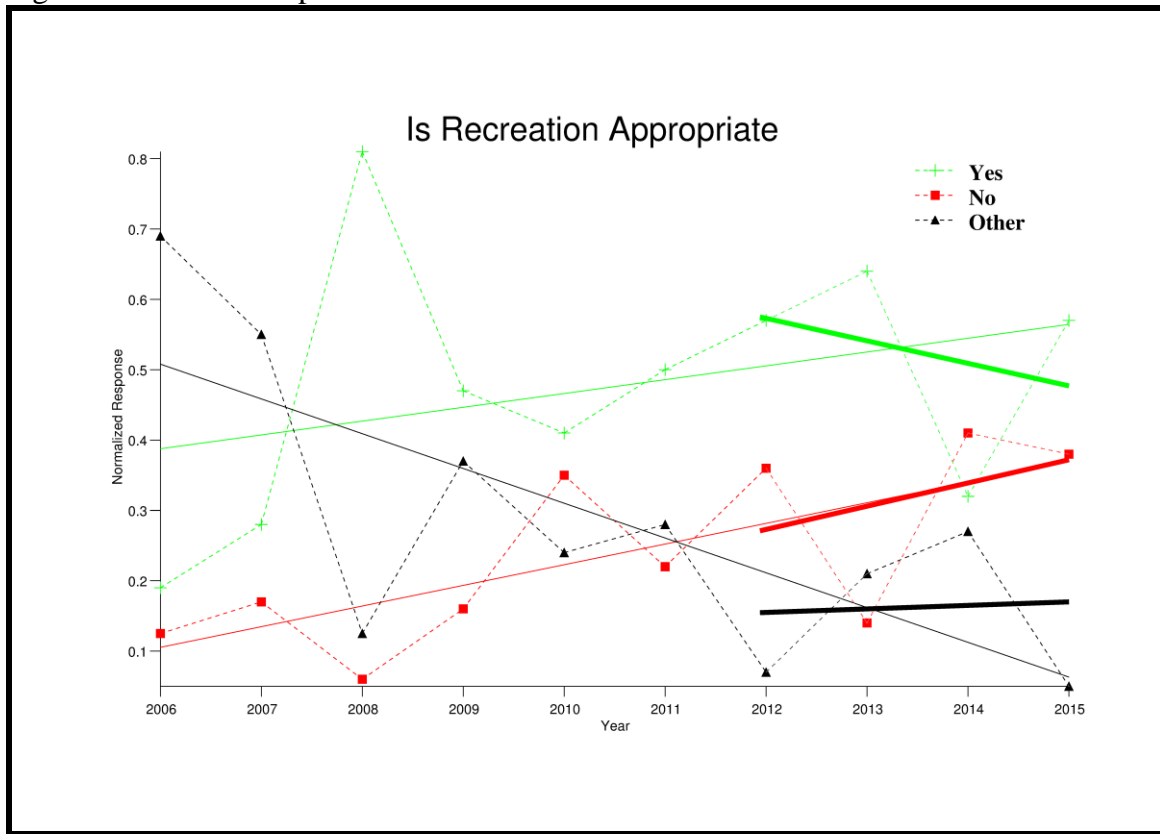
	Yes	No	Yes and No	Don't know	Blank
2006	3	2	6	5	0
2007	5	3	5	5	0
2008	13	1	2	0	0
2009	9	3	4	1	2
2010	7	6	0	1	3
2011	16	7	5	0	4
2012	8	5	0	0	1
2013	9	2	1	0	2
2014	7	9	4	0	2
2015	12	8	0	1	0
Total	89	46	27	13	14
Percentage	47.09%	24.34%	14.29%	6.88%	7.41%

This year, the sharp drop in support seen last year was mostly reversed with all categories of response essentially falling on their respective long-term trend lines (Table 15, Figure 13). There is still slightly more support for allowing recreation than opposition, but the support has been decreasing over the last four years while opposition has been rising. Interestingly, regardless of whether people considered recreation to be appropriate or not, the concerns and comments voiced tended to be very similar. There is overwhelming agreement that people recreating in *Öngtupqa* must take care of the place and treat it with appropriate respect. Education of the significance of the place must be part of the experience.

Treatment of Eroding Archaeological Sites

Because archaeological sites are the “footprints” left by the Hopi ancestors, site preservation has been a concern of the Hopi Tribe ever since it became involved in the management activities surrounding the operations of Glen Canyon Dam. The overwhelming consensus is that archeological sites should be preserved in place, if possible. In situations where this is not possible, there is more divergence of opinion on what should be done. When the survey questions were being developed, it was noted that a distinction was sometimes made between human caused impacts to archaeological sites and those that are due to “natural” processes. Therefore, two separate questions are posed on the questionnaire:

Figure 13. Trends in Opinion About Recreation



Survey Question 1:

-Should eroding archaeological sites be: a). **left to erode** b) **be reburied** c) **be excavated**

Survey Question 2:

-If an archaeological site is impacted because of human actions, it should be: a). **left to erode** b) **be reburied** c) **be excavated**

It should be noted that respondents often selected more than one of the three specified responses to each question, creating various combinations of treatments, and in two cases, added their own response category (**Monitor** and **Educate the Public**). Table 16 shows the various combinations of responses that have been received for all of the monitoring that has occurred. The colors in the table group categories of responses that represent the same philosophical approach to site management.

Table 16. Total Responses for Treatment of Archaeological Sites

	Excavate	Let erode	Rebury	Excavate & let erode	Excavate & rebury	Rebury & let Erode (added 2014)	Excavate, rebury & let erode	Preserve	Blank	Don't know	Monitor (added 2013)	Educate Public (added 2014)
Q12 Eroding arch sites	38	61	42	7	7	4	7	2	4	5	1	0
Q13 Human caused erosion	37	38	68	0	11	0	6	2	10	5	0	1

Table 17 takes the data from Table 16 and consolidates it back into the three categories queried in the original questions: **Excavate**, **Let erode**, or **Rebury**. For grouping purposes, the assumption is made that a recommendation combining **Excavation** with some subsequent action is still a recommendation for excavation (blue columns in Table 16). Similarly, **Preserve** was combined with any form of **Rebury** that did not include excavation (green columns in Table 16) A forth, **Other** column was added for the those responses that don't identify any form of treatment to the site and includes the responses of **Blank**, **Don't know**, **Monitor**, and **Educate the Public**. Regrouping the data was done in order to more easily examine whether there are significant differences in responses between the treatment of sites eroding due to human causes versus those viewed as “natural” erosion.

Table 17. Treatment of Archaeological Sites

	Excavate	Let erode	Rebury	Other
Q12 Eroding arch sites	59 (33.14%)	61 (34.27%)	48 (26.97%)	10 (5.62%)
Q13 Human caused erosion	54 (30.34%)	38 (21.35%)	70 (39.32%)	16 (8.99%)

When the erosion is not specifically identified as being caused by human actions, there is a slightly greater preference for letting the site **Erode**, followed very closely by **Excavating** it, and then **Reburying** it.

When the erosion was caused by human activities, preferences shift with the majority seeking to stem the impacts through **Reburial**, followed next by **Excavation**. The number of respondents who still did not want to intervene and just let the site **Erode** is considerably lower than for the generic case of site erosion. The preference for reburial seemed to be predicated on the view that if people were causing the impact, then they were responsible and capable of ending it. A perspective expressed by many respondents was that “mother nature” should be allowed to take care of the sites.

Several trends are apparent in this data. First, whether erosion is attributed to human agency or not, only about one-third of the Hopi respondents recommend that excavation be employed to recover information that would otherwise be lost. When the responses of **Excavate** and **Rebury** are viewed as a call for management intervention (as opposed to **Let Erode**, which is a hands-off approach), then about 60% of the responses call for some form of intervention in the case of a generic eroding site and nearly 70% feel some form of intervention is appropriate when the erosion is attributed to human causes. This continues the response trend seen in previous years. A χ^2 analysis conducted on the distribution of responses between these two questions, indicates that there is a statistically significant difference in the response patterns ($\chi^2=11.01$, $\rho=0.011$). This provides some confidence that what is causing erosion is being considered by the Hopis when making management recommendations and that the recommendations are different for different erosion scenarios.

Mechanical Removal

Mechanical removal of trout was tested as an approach for reducing trout populations beginning in 2002 and then later proposed as a management action, a question concerning whether this is appropriate in the context of benefiting the native species has been included on the questionnaire. Because mechanical removal is now an aspect of the Non-Native Fish Control EA, a part of the Park Services' Comprehensive Fisheries Management Plan, and will likely be adopted in the Long Term

Experimental and Management Plan EIS, this question is still very relevant, particularly in light of the affect its implementation has on *Öngtupqa* as a Hopi Traditional Cultural Property.

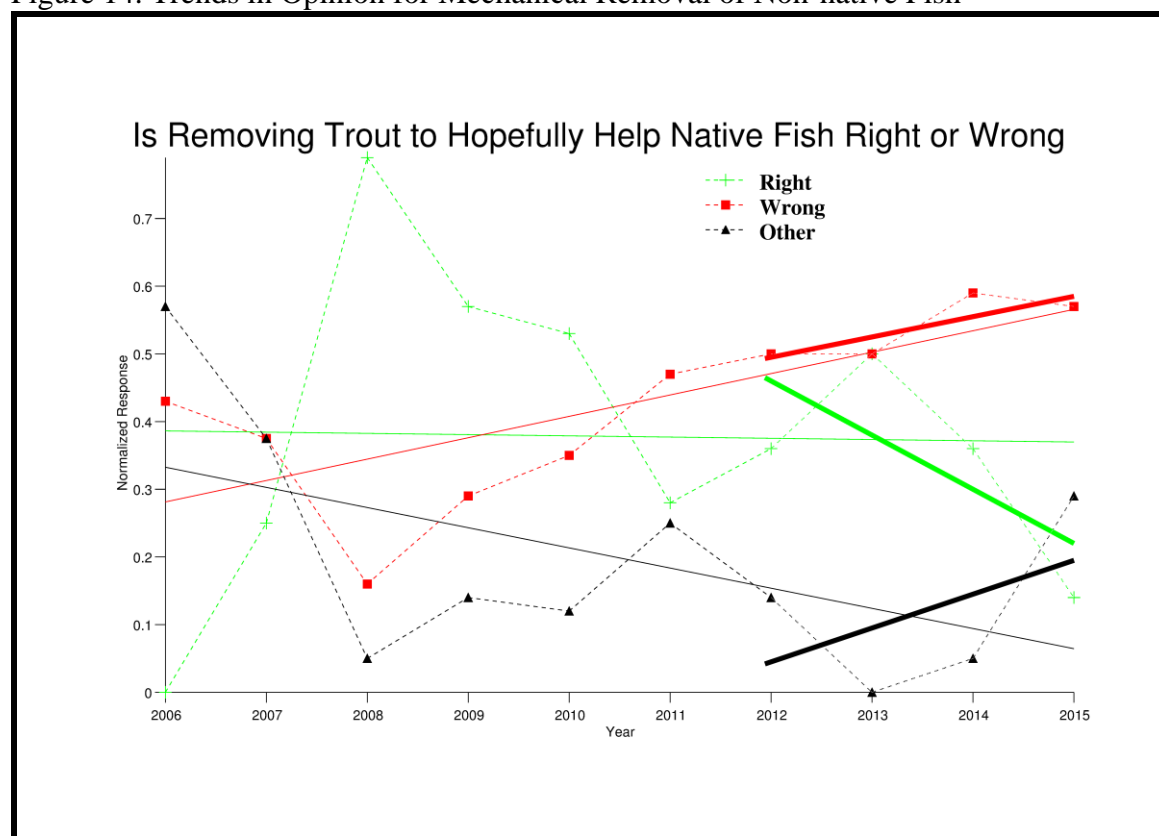
Survey Question:

-Non-native trout and other fish are being killed to hopefully help native fish. From your perspective, is this **Right** or **Wrong**

Table 18. Mechanical Removal of Non-native Fish

	Right	Wrong	Right and Wrong	Don't know	Blank
2006	1	4	2	0	1
2007	3	4	0	0	2
2008	13	2	0	1	0
2009	11	5	0	2	1
2010	9	6	1	1	0
2011	9	15	1	3	4
2012	5	7	1	0	1
2013	7	7	0	0	0
2014	8	13	0	0	1
2015	3	12	4	2	0
Total	69	75	9	9	10
Percentage	40.12%	43.60%	5.23%	5.23%	5.81%

Figure 14. Trends in Opinion for Mechanical Removal of Non-native Fish



The feeling that killing trout is not an appropriate management approach continues to grow, with those supporting this management approach now being even lower than those who don't know

(Table 18, Figure 14). Many people said that all life is important and that there should be balance, with “mother nature” allowed to operate. One person summed it up by saying: “The environment should be allowed to take its course – but again human impact is needed to reverse human error.”

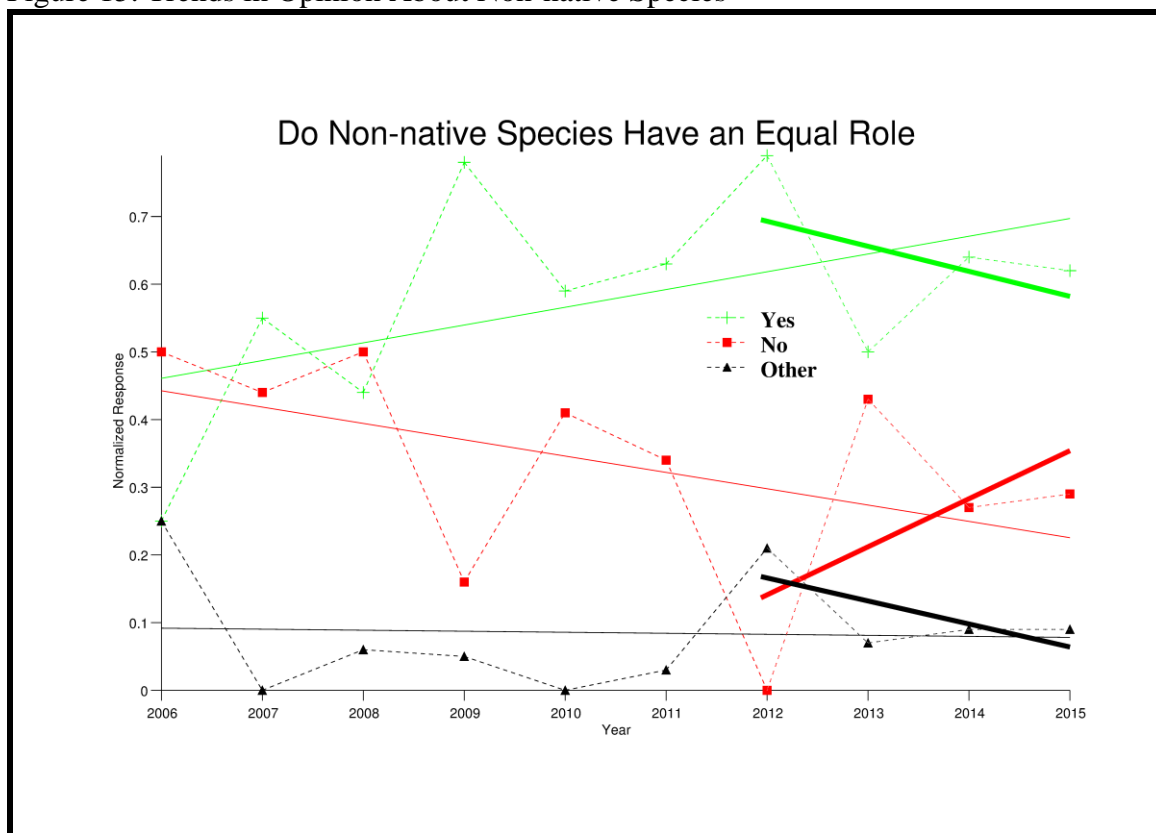
Non-native species

While the previous question targeted management primarily for an individual species, this question seeks to understand the broader perspective with respect to the values for native and non-native species in general.

Table 19. Do Non-native Species Have A Role

	Yes	No	Yes and No	Don't know	Blank
2006	2	4	0	2	0
2007	5	4	0	0	0
2008	7	8	0	1	0
2009	15	3	1	0	0
2010	10	7	0	0	0
2011	20	11	0	0	1
2012	11	0	1	0	2
2013	7	6	0	1	0
2014	14	6	1	0	1
2015	13	6	0	1	1
Total	104	55	3	5	5
Percentage	60.47%	31.98%	1.74%	2.91%	2.91%

Figure 15. Trends in Opinion About Non-native Species



Survey Question:

-Non-native species (such as tamarisk) and native species (such as cottonwood) have an equal role in the balance of the natural world?

The response pattern this year is very similar to last year, with the majority reporting that all life, both native and non-native, to have a right to exist and play roll in the world (Table 19, Figure 15). In the last four years, there has been a sharp increase in the number of respondents that feel that non-native species are not as important as native ones, but this is largely a consequence of the 2012 data point. The concerns expressed tend to focus on the replacement of native species by invasive non-natives rather than an intrinsic intolerance for the native species itself.

Demographic Analyses

Since the Hopi Long-term Monitoring program is drawing conclusions from a sample of Hopi individuals that are not necessarily randomized across the entire population, it is important to understand some of the biases that may be occurring in the data. Because the data set is still relatively small, the analytic focus is initially on a couple potential biases with the greatest implications for the overall monitoring methodology: 1.) whether responses are systematically different before and after taking a river trip; 2.) whether there is systematic change in response when multiple river trips are taken by an individual.

The first hypothesis is particularly important given the key assumption for implementing the Hopi survey methodology is that visitation is not required by Hopis to make a valid cultural assessment of the health of *Öngtupqa*. Because river trip participants complete surveys following the standardized presentation (as is the protocol for surveys carried out at Hopi), but prior to the monitoring trip, an assessment can be made of changes in responses due to direct interaction with the resource versus only having heard about in the presentation. Finally, it is anticipated that as more surveys are completed, issues of age, clan, society, village, or other demographic variables will be analyzed. The use of Cultural Consensus Theory analysis may be applicable for addressing the data set and identifying underlying commonalities for better data interpretation (eg. see Romney et. al. 1986).

General versus Post-trip comparison

Because only a limited subset of Hopis are permitted to enter *Öngtupqa* and directly examine the resources, it is important to understand whether their view is fundamentally different from those who complete the questionnaire but have not been in *Öngtupqa*. Therefore, this sections looks at the responses supplied by people who completed the questionnaire both before and after a monitoring trip. As with previous sections, “**Blank** and “**Don’t know**” were grouped together under “**Other**.” Differently however, in those cases where both “**Yes**” and “**No**” were checked, the numbers were added to both the “**Yes**” and “**No**” categories. While this doesn’t affect the yes-to-no ratio, it does incorporate the fact that the respondent did have an opinion (as opposed to stating “don’t know”) – they just did not make a value judgment. In addition, only questions 1 through 11 are included in this analysis as they are the only ones which area asked both before and after a trip. The raw data from all trips is presented in Table 20.

Table 20. Response Frequencies from Before and After a Monitoring Trip

	Yes (PRE)	No (PRE)	Other (PRE)	Yes (POST)	No (POST)	Other (POST)
Q01 Overall health	68	9	39	57	6	30
Q02 Hopi Involvement	112	0	4	84	1	8
Q03 Importance of Information	113	1	1	91	0	3
Q04 Relates to Cultural Teachings	102	2	2	80	1	4
Q05 Recent changes	44	0	28	62	0	23
Q06 Marshes	53	11	19	60	18	14
Q07 Birds	67	3	12	74	5	14
Q08 Recreation	42	35	40	44	20	28
Q09 Trout removal	38	26	10	34	41	16
Q10 Non-native species	52	26	5	49	31	12
Q11 Archaeological sites	42	25	16	56	24	12

As a visual representation of the data in Table 20, Figure 16 presents the results of a non-metric Multi- Dimensional Scaling of the normalized data using a Euclidean similarity measure. The statistical package “**Past**” was used to conduct the analysis. (Hammer et. al. 2001).

It is apparent that the “Yes”/“No”/“Other” response pattern to all questions is remaining relatively consistent between the Pre-trip and Post-trip surveys.

Single versus Multiple Trips

The second question posed above, whether responses change when a participant conducts multiple monitoring episodes, investigates the role of personal observation in influencing responses to the survey. When a consultant participates on only a single trip, the respondent cannot draw on personal memory to identify changes; they can only evaluate the resources based on what they are told in the standardized presentation about resource conditions through time. When participants complete multiple monitoring trips, they are able to rely on their own memory in addition to the information that is provided to them through the multiple standardized presentations. Therefore, if people who complete more than one trip respond significantly differently than those who only take a single trip, their feedback will need to be considered separately. Table 21 presents the raw numbers, with the “Yes” and “No” and “Other” analyses being combined in the same manner as the previous analysis.

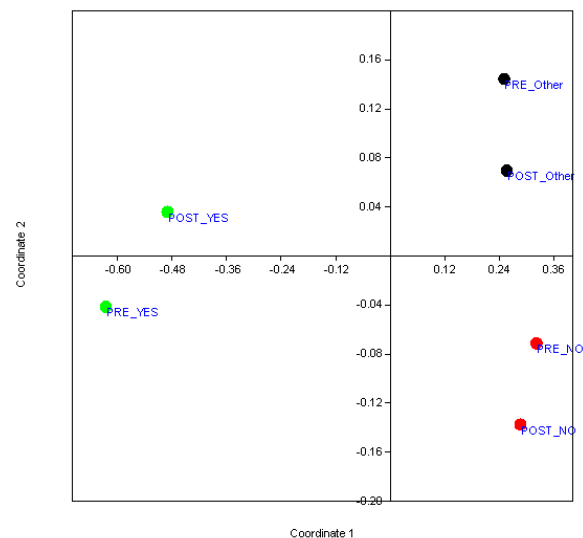


Figure 16. MDS Scoring of Responses from Before and After River Trips.

Table 21. Raw Data for Single and Multiple Trip Responses

	Yes (0-1 trips)	No (0-1 trips)	Other (0-1 trips)	Yes (2+ trips)	No (2+ trips)	Other (2+ trips)
Q01 Overall health	88	12	53	47	4	26
Q02 Hopi Involvement	148	0	5	68	1	8
Q03 Importance of Information	151	1	1	73	0	4
Q04 Relates to Cultural Teachings	140	1	1	63	2	5
Q05 Recent changes	77	0	39	45	0	17
Q06 Marshes	79	27	21	43	10	16
Q07 Birds	99	10	18	55	3	11
Q08 Recreation	67	42	44	31	21	25
Q09 Trout removal	55	49	16	20	30	16
Q10 Non-natives	80	35	12	34	28	7
Q11 Archaeological Sites	65	41	21	42	17	10
Q14 Ööngä	45	11	7	33	9	6
Q15 Willow	43	8	12	35	5	8
Q16 Animals	51	4	8	35	2	11
Q17 Native fish	24	14	25	20	7	21
Q18 Snakes	37	3	23	29	2	17
Q19 Insects	46	4	13	42	0	6
Q20 Springs	43	9	11	32	5	11

Figure 17 shows the Non-metric MDS plot of the standardized data provided in Table 21 based on Euclidian similarity measures. In this case, responses to all of the questions were considered in the analysis as the data is pooled and whether a question was asked only after a trip, or both before and after is irrelevant. Further, data from people who never took a trip and those that took a single trip were also grouped as the analysis of responses from before and after a trip shows a comparable response pattern.

Once again, it is clear that people who never go on the river monitoring trip or who conduct only a single trip are responding in the same manner as those who have had multiple exposures to the resources along the river. Because respondents who have been on multiple trips have also heard multiple standardized presentations and have been involved in discussions that vary from one year to the next during the course of multiple river trips, the consistency in response lends confidence that responses are not being fundamentally altered by variations in how the data is being presented.

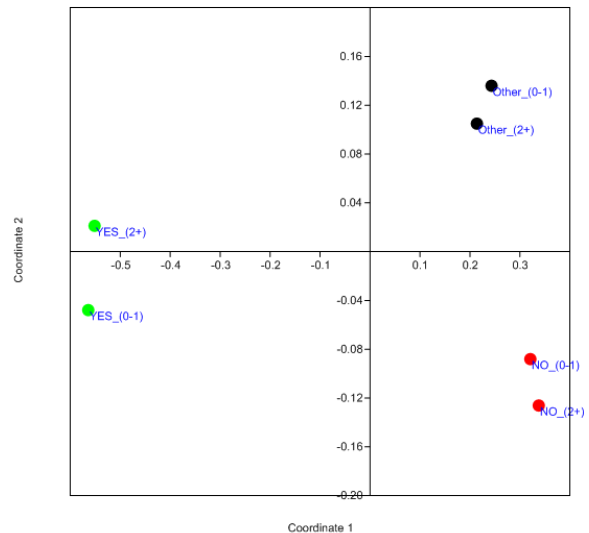


Figure 17. Single/Multiple Trip MDS Plot

DISCUSSION AND RECOMMENDATIONS

As identified in previous years, one of the impediments to the ongoing implementing the Hopi Long-term Monitoring protocols is the limited amount of new information coming out the AMP related to the state of terrestrial resources. During the development of the Hopi monitoring protocols, GCMRC was concurrently developing a monitoring approach for the terrestrial zone along the river. The Hopi Tribe coordinated with the development of GCMRC's approach to ensure that data being collected was relevant to Hopi monitoring needs (Huisinga and Yeatts 2003). Unfortunately, the scope of the GCMRC terrestrial monitoring program has been so scaled back as to be essentially useless for input into the Hopi Long-term Monitoring Program. While the Hopi Tribe can continue to observationally monitor the culturally important resources in this zone, this work will only occasionally be informed by measured resource states as originally envisioned in the Terrestrial Ecosystem Monitoring Program. Therefore, most of the culturally important terrestrial resources will necessarily be discussed as having "not been monitored by the AMP" in the standardized presentations. Vegetation changes such as encroachment on camping areas and other easily observable traits can be conveyed, but the description of vegetation structure and composition changes have not be updated in many years. Likewise, new information regarding avifauna, small mammals, reptiles, amphibians, and insect populations can only be updated if new relevant information becomes available and can be obtained. As also has been stated previously, the Hopi Tribe continues to recommend that more emphasis be placed on monitoring of the terrestrial zone and developing an ecosystem approach that links the terrestrial and aquatic systems more fully.

The Hopi consultants continue to be unanimous in their desire to see the Hopi Tribe continue and expand its role in the monitoring of culturally important resources and to work collaboratively with the federal agencies in management responsibility for *Öngtupqa*. The Hopi were given stewardship responsibility by *Masaw* and a larger role in the management of *Öngtupqa* is seen as a way of furthering this responsibility. *Öngtupqa* is first and foremost a Hopi cultural property and the Hopi would like to assume the primary management authority or ownership of such places as *Öönga* and *Sipapuni*. Overall, cultural sites and resources should be maintained and preserved. More broadly, there is recognition and strong support for the overall monitoring being undertaken by GCMRC and NPS as it shows a commitment for *Öngtupqa* and the resources.

There continues to be concern about the amount of recreational and tourism activity that occurs in *Öngtupqa* and the potential for impacts to cultural sites. Access to these types of important sites should be limited for non-tribal people. Educating the public about the importance of *Öngtupqa* as a cultural property of the Hopi people is seen as a way to help protect it and ensure that visitors behave in an appropriate manner. It was suggested that more Hopi be trained as river guides.

Of particular concern is the proposed Navajo Escalade (Confluence "tramway project") development. The position expressed by participants was that it should not be constructed. *Öngtupqa* is a sacred space and developments aimed at making money are sacrilegious.

Education aimed at informing the Hopi people, broadly, about the issues and participation of the Hopi Tribe in the management of *Öngtupqa* was also highlighted as an important aspect of the tribal participation. The ability to learn about what is happening and to tie it into the cultural teachings and to use the information to help with maintenance of traditional cultural knowledge, traditions, and understanding of Hopi history is considered a key function of the monitoring work.

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APPENDICES

General and post-trip survey instruments from 2015

Hopi Long-Term Monitoring Program (August 27-September 4, 2015 Trip)

Based on research by scientists, this is the current state of things in *Öngtupqa*:

Paakiw, Fish: Native fish have generally decreased in numbers since 1989, reaching a low in 2001, but numbers have greatly increased since 2002. Scientists believe the original decrease has been caused by many factors, including cold water and competition from non-native fish such as trout and catfish. In 2001, there were about 2000 adult Humpback Chub, an endangered native fish. Today there are more than 7000 Chub and the numbers are stable or increasing. Other native fish are also increasing in numbers. They are now the most common fish in the lower part of *Öngtupqa*. The non-native rainbow trout, which mostly spawn above Lees Ferry, are dropping in number over the last year. Some trout move into the Little Colorado River area and may affect the Chub population; the extent of this affect is still uncertain. Large quantities of trout have been killed to hopefully help the Chub.

Yamtaqa, Vasey's Paradise: *Yamtaqa* is a spring that is a traditional cultural property (TCP) for Hopi. Flows from this spring vary from year to year but it is not affected by the operations of Glen Canyon Dam.

Suta, Hematite Mine, Sipapuni, and Öönga, Hopi Salt Mines: Non-tribal groups generally do not visit these sites and are forbidden to visit *Öönga*. Several tribal groups stop at these areas and collect salt and hematite. The salt slowly re-grows and is renewable; the *suta* is becoming much harder to collect and will never be replenished. Before tribes became involved in research in *Öngtupqa*, collection at these areas was likely very limited.

Tsuua, Rattlesnakes and other snakes: Scientists are unsure if the snakes are affected by Glen Canyon Dam operations and do not study them any longer. There are 3 types of *tsuua* in Grand Canyon and 4 other types of snakes.

Sand and beaches: The river and the shores along it have much less sand and mud compared to before the dam was built. The water released from Glen Canyon Dam contains no sand or mud. Most new sand and mud into *Öngtupqa* is now from the Paria River and *Paayu*. Because of limited new sand, when areas along the river erode, they are no longer rebuild like before the dam. Short duration, high flows can put new sand on some areas along the river ("beaches"), but whether it is enough sand to offset the erosion is being studied. There is 10-year commitment to conduct high flow experiments. The beaches along the river are used by river runners for camping, serve as plant and animal habitat, and may help protect archaeological sites.

Archaeological sites: Archaeological sites along the river probably continue to erode as there is limited new sand available to rebury them. In the past, the Park Service has tried to slow erosion at some of the sites using traditional Zuni check dams. The high flow experiments may help protect some archaeological sites. Some archaeological excavation has been conducted at sites where erosion can't be stopped in order to recover information about the past before it is lost. To date, the tribal role in these excavations has been limited. There has been no monitoring of the archaeological sites by the Adaptive Management Program since 2006 and no excavations at eroding sites since 2008.

Tuutuvost, Animals: Scientists know very little about how Glen Canyon Dam operations affect the game animals that are seen along the river. The two most common types are *pangwu* (bighorn sheep) and *sowi'ngwa* (mule deer).

Tsirot, Birds: There are many types of birds that find food and shelter along the Colorado River. The increase in vegetation along the river shore since Glen Canyon Dam was built has caused bird numbers to increase. The birds use both the native and non-native vegetation and use *Öngtupqa* as a migration route. **Eagles:** *Nuva'kwaahu* (bald eagle) and *kwaahu* (golden eagle) are both occasionally seen along the river. Birds are not regularly monitored.

Plants: Without the pre-dam spring floods through *Öngtupa*, native and non-native plants have greatly increased along the shoreline. The most obvious plant, tamarisk, is a non-native. A non-native beetle may now be killing them. Plants are now growing in areas that used to be open sand (which reduces camping areas).

Wipho'qölö, Cattail marsh and Paaqap' qölö, Reed marsh: Marshes have decreased in number and size with current operations of Glen Canyon Dam. *Paaqavi* is increasing and *Wipho* is decreasing in abundance. Woody plants that like drier conditions are moving into the marsh areas.

General Questions

1. Do you think *Öngtupqa* (Grand Canyon) is better cared for now than in the past?

Yes No Don't Know (Circle one)

Comment:

2. Should Hopi be involved in stewardship and management of *Öngtupqa* (Grand Canyon)?

Yes No Don't Know (Circle one)

Comment:

3. Is this information about *Öngtupqa* important for you?

Yes No Don't Know (Circle one)

Comment:

4. Does this information about *Öngtupqa* relate to your cultural teachings?

Yes No Don't Know (Circle one)

Comment:

5. Do you think there have been changes in *Öngtupqa* in recent years?

Yes No Don't Know (Circle one)

Comment:

5a. What changes do you like?

5b. What changes do you dislike?

5c. If you could change something, what would it be?

5d. If you wanted to make sure something stayed the same, what would it be?

Specific Resource Questions

6. From what you have heard, *Wipho 'qölö* (patches of *wipho* or cattail) and *paaqap 'qölö* (patches of *paaqavi* or reed) in Grand Canyon exist in a healthy state.

Yes No (Circle one)

Comment:

7. From what you have heard, *Tsirot* (birds) in Grand Canyon exist in a healthy state.

Yes No (Circle one)

Comment:

8. The National Park Service allows recreational visitation in *Öngtupqa* (Grand Canyon) on river trips. From your perspective, is this: **right** or **wrong (Circle one)**.

Comment:

9. Non-native trout and other fish are being killed to hopefully help the native fish. From your perspective, is this: **right** or **wrong (Circle one)**.

Comment:

10. Non-native species (such as tamarisk) and native species (such as cottonwood) have an equal role in the balance of the natural world.

Yes No (Circle one)

Comment:

11. From what you heard, archaeological sites in Grand Canyon are healthy.

Yes No (Circle one)

Comment:

12. Should eroding archaeological sites be:

a. left alone to erode b. be reburied c. be excavated (Circle)

Why?

13. If an archaeological site is impacted because of human actions, should they be:

a. left alone to erode b. be reburied c. be excavated (Circle)

Why?

Background Information

Village _____ Clan _____

Hopi/Tewa Religious or Cultural Societies _____

Name _____ Age _____

Gender **Male** **Female** (Circle one)

Are you a tribal Employee? Yes No (Circle one)

If yes, what Tribal department _____

Are you a CRATT member? Yes No (Circle one)

Number of visits to *Öngtupqa* (Grand Canyon) on a river trip _____

Other visits to *Öngtupqa*: Canyon Rim _____

Hiking into Canyon _____

Hopi Long-Term Monitoring Program (August 27-September 4, 2015 Trip)

Based on research by scientists, this is the current state of things in *Öngtupqa*:

Paakiw, Fish: Native fish have generally decreased in numbers since 1989, reaching a low in 2001, but numbers have greatly increased since 2002. Scientists believe the original decrease has been caused by many factors, including cold water and competition from non-native fish such as trout and catfish. In 2001, there were about 2000 adult Humpback Chub, an endangered native fish. Today there are more than 7000 Chub and the numbers are stable or increasing. Other native fish are also increasing in numbers. They are now the most common fish in the lower part of *Öngtupqa*. The non-native rainbow trout, which mostly spawn above Lees Ferry, are dropping in number over the last year. Some trout move into the Little Colorado River area and may affect the Chub population; the extent of this affect is still uncertain. Large quantities of trout have been killed to hopefully help the Chub.

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Tsuua, Rattlesnakes and other snakes: Scientists are unsure if the snakes are affected by Glen Canyon Dam operations and do not study them any longer. There are 3 types of *tsuua* in Grand Canyon and 4 other types of snakes.

Sand and beaches: The river and the shores along it have much less sand and mud compared to before the dam was built. The water released from Glen Canyon Dam contains no sand or mud. Most new sand and mud into *Öngtupqa* is now from the Paria River and *Paayu*. Because of limited new sand, when areas along the river erode, they are no longer rebuild like before the dam. Short duration, high flows can put new sand on some areas along the river ("beaches"), but whether it is enough sand to offset the erosion is being studied. There is 10-year commitment to conduct high flow experiments. The beaches along the river are used by river runners for camping, serve as plant and animal habitat, and may help protect archaeological sites.

Archaeological sites: Archaeological sites along the river probably continue to erode as there is limited new sand available to rebury them. In the past, the Park Service has tried to slow erosion at some of the sites using traditional Zuni check dams. The high flow experiments may help protect some archaeological sites. Some archaeological excavation has been conducted at sites where erosion can't be stopped in order to recover information about the past before it is lost. To date, the tribal role in these excavations has been limited. There has been no monitoring of the archaeological sites by the Adaptive Management Program since 2006 and no excavations at eroding sites since 2008.

Tuutuvost, Animals: Scientists know very little about how Glen Canyon Dam operations affect the game animals that are seen along the river. The two most common types are *pangwu* (bighorn sheep) and *sowi'ngwa* (mule deer).

Tsirot, Birds: There are many types of birds that find food and shelter along the Colorado River. The increase in vegetation along the river shore since Glen Canyon Dam was built has caused bird numbers to increase. The birds use both the native and non-native vegetation and use *Öngtupqa* as a migration route. **Eagles:** *Nuva'kwaahu* (bald eagle) and *kwaahu* (golden eagle) are both occasionally seen along the river. Birds are not regularly monitored.

Plants: Without the pre-dam spring floods through *Öngtupa*, native and non-native plants have greatly increased along the shoreline. The most obvious plant, tamarisk, is a non-native. A non-native beetle may now be killing them. Plants are now growing in areas that used to be open sand (which reduces camping areas).

Wipho'qölö, Cattail marsh and Paaqap'qölö, Reed marsh: Marshes have decreased in number and size with current operations of Glen Canyon Dam. *Paaqavi* is increasing and *Wipho* is decreasing in abundance. Woody plants that like drier conditions are moving into the marsh areas.

General Questions

1. Do you think *Öngtupqa* (Grand Canyon) is better cared for now than in the past?

Yes No Don't Know (Circle one)

Comment:

2. Should Hopi be involved in stewardship and management of *Öngtupqa*?

Yes No Don't Know (Circle one)

Comment:

3. Is this information about *Öngtupqa* important for you?

Yes No Don't Know (Circle one)

Comment:

4. Does this information about *Öngtupqa* relate to your cultural teachings?

Yes No Don't Know (Circle one)

Comment:

5. Do you think there have been changes in *Öngtupqa* in recent years?

Yes No Don't Know (Circle one)

Comment:

5a. What changes do you like?

5b. What changes do you dislike?

5c. If you could change something, what would it be?

5d. If you wanted to make sure something stayed the same, what would it be.

*** POST-trip Survey ***
Specific Resource Questions

6. *Wipho* 'qölö (patches of *wipho* or cattail) and *paaqap* 'qölö (patches of *paaqavi* or reed) in *Öngtupqa* exist in a healthy state.

Yes No (Circle one)

Comment:

7. *Tsirot* (birds) in *Öngtupqa* exist in a healthy state.

Yes No (Circle one)

Comment:

8. The National Park Service allows recreational visitation in *Öngtupqa* on river trips. From your perspective, is this **right** or **wrong (Circle one)**.

Comment:

9. Non-native trout and other fish are being killed to hopefully help the native fish. From your perspective, is this **right** or **wrong (Circle one)**.

Comment:

10. Non-native species (such as tamarisk) and native species (such as cottonwood) have an equal role in the balance of the natural world.

Yes No (Circle one)

Comment:

11. From what you heard, archaeological sites in *Öngtupqa* are healthy.

Yes No (Circle one)

Comment:

12. Should eroding archaeological sites be:

a. left alone to erode b. be reburied c. be excavated (Circle)

Why?

13. If an archaeological site is impacted because of human actions, should they be:

a. left alone to erode b. be reburied c. be excavated (Circle)

Why?

14. *Öönga* (Hopi Salt Mines) is healthy.

Yes No (Circle one)

Comment:

15. *Qahavi* (willow plants) in *Öngtupqa* exist in a healthy state.

Yes No (Circle one)

Comment:

16. *Tuutuvost* (animals) in *Öngtupqa* exist in a healthy state.

Yes No (Circle one)

Comment:

17. Native fish called the Humpback chub exist in a healthy state in *Öngtupqa*.

Yes No (Circle one)

Comment:

18. Snakes in *Öngtupqa* exist in a healthy state.

Yes No (Circle one)

Comment:

19. Insects in *Öngtupqa* exist in a healthy state.

Yes No (Circle one)

Comment:

20. Springs and seeps in *Öngtupqa* are healthy.

Yes No (Circle one)

Comment:

21. What should the Hopi role be in the management of resources in the *Öngtupqa*? (Explain in the space below.)

22. Other comments:

Background Information

Village _____ Clan _____

Hopi/Tewa Religious or Cultural Societies _____

Name _____ Age _____

Gender **Male** **Female** (Circle one)

Are you a tribal Employee? Yes No (Circle one)

If yes, what Tribal department _____

Are you a CRATT member? Yes No (Circle one)

Number of visits to *Öngtupqa* (Öngtupqa) on a river trip (including this trip) _____

Other visits to *Öngtupqa*: Canyon Rim _____

Hiking into Canyon _____