

# **2014 Report of the Hopi Long-Term Monitoring Program for Öngtupqa (the Grand Canyon)**

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Hopi 2014 monitoring group



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## INTRODUCTION

This report reflects the sixth 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*. These 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 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 vital aspect 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.

### **2014 Annual River Monitoring Trip**

From May 9<sup>th</sup> through May 17<sup>th</sup>, 2014, eleven Hopi cultural consultants, one boatmen, and two Hopi Cultural Preservation Office researchers participated in the annual Hopi monitoring river trip. The nine-day trip ran from Lees Ferry to Diamond Creek, on the Hualapai Indian Reservation, and was conducted by motor rig. 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:

Clark Tenakhongva	Tobacco/Rabbit Clan	Hotevilla village
Rex Talayumtewa	Sun Forehead Clan	Sipaulovi village
Trevor Reed	Iswungwa Clan	Hotevilla village
Troy Honanie, Jr.	Iswungwa Clan	Hotevilla village
Filmer Kewanyama	Sun Forehead/Eagle Clan	Shungopavi village
Carliss Siquah	Badger Clan	Hotevilla village
Gilbert Naseyouma	Sun Clan	Moencopi village
Jimmie Lucero	Raven	Hotevilla village
Charleston Lewis	Water	Shungopavi village
Emery Kyasyousie	Sun Forehead/Eagle	Hotevilla village
Michael Johnson	Coyote	Kykotsmovi village

The staff and crew on the trip were:

Lynn Roeder	Boatman
Kristin Harned	Co-PI
Michael Yeatts	Co-PI

### **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, 231 surveys have been completed and entered into the database and form the basis for this analysis. This includes information from 129 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
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
<b>Total Hopi</b>	<b>129</b>	<b>218</b>
<b>Total people including non-Hopi</b>	<b>140</b>	<b>231</b>

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 of the 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 (see Table 1). This is due to changes in questions as the protocols were developed; some questions were added or dropped during the development of the survey program and others had 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. The questions asked have remained the same since 2008.

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	125	15	9	54	6	209
Q02 Hopi involvement	196	1	1	6	5	209
Q03 Importance of information	204	1	0	2	2	209
Q04 Relation to cultural teachings	182	3	1	2	3	191
Q05 Recent changes positive	106	0	0	49	2	157
Q06 Marshes	113	29	4	21	8	175
Q07 Birds	141	8	1	22	3	175
Q08 Recreation	86	55	33	19	16	209
Q09 Trout removal	72	67	6	9	11	165
Q10 Non-native species	101	57	4	8	5	175
Q11 Archaeological sites	98	49	6	16	6	175
Q14 Öönga, Hopi Salt Mines	75	13	2	10	1	101
Q15 Willow	74	8	3	13	3	101
Q16 Animals	79	3	0	15	4	101
Q17 Native fish	40	19	0	34	8	101
Q18 Snakes	60	4	0	27	10	101
Q19 Insects	78	4	0	15	4	101
Q20 Springs and seeps	71	10	5	11	4	101
<b>Total Cumulative Percentages (inclusive of 2014)</b>	68.98%	12.55%	2.72%	12.08%	3.66%	<b>Total 2756</b>
<b>Results of 2014 only</b>	65.20%	16.93%	3.45%	10.97%	3.45%	

As can be seen, over the life of the monitoring program, Hopis continue to believe that the monitoring work is important and that the tribe should continue to participate. Further, the general condition of the resources continues to be viewed as positive (a “**Yes**” response). The management issues of **Recreation** and **Trout Removal** are the only categories that fall well below (more than 20% less) the average response of 69% **Yes**. This indicates that there is 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. Unlike last year, the responses for 2014 are slightly more negative than the overall average response pattern.

### 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 for which data has been collected 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 [(number of responses in category)/(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*

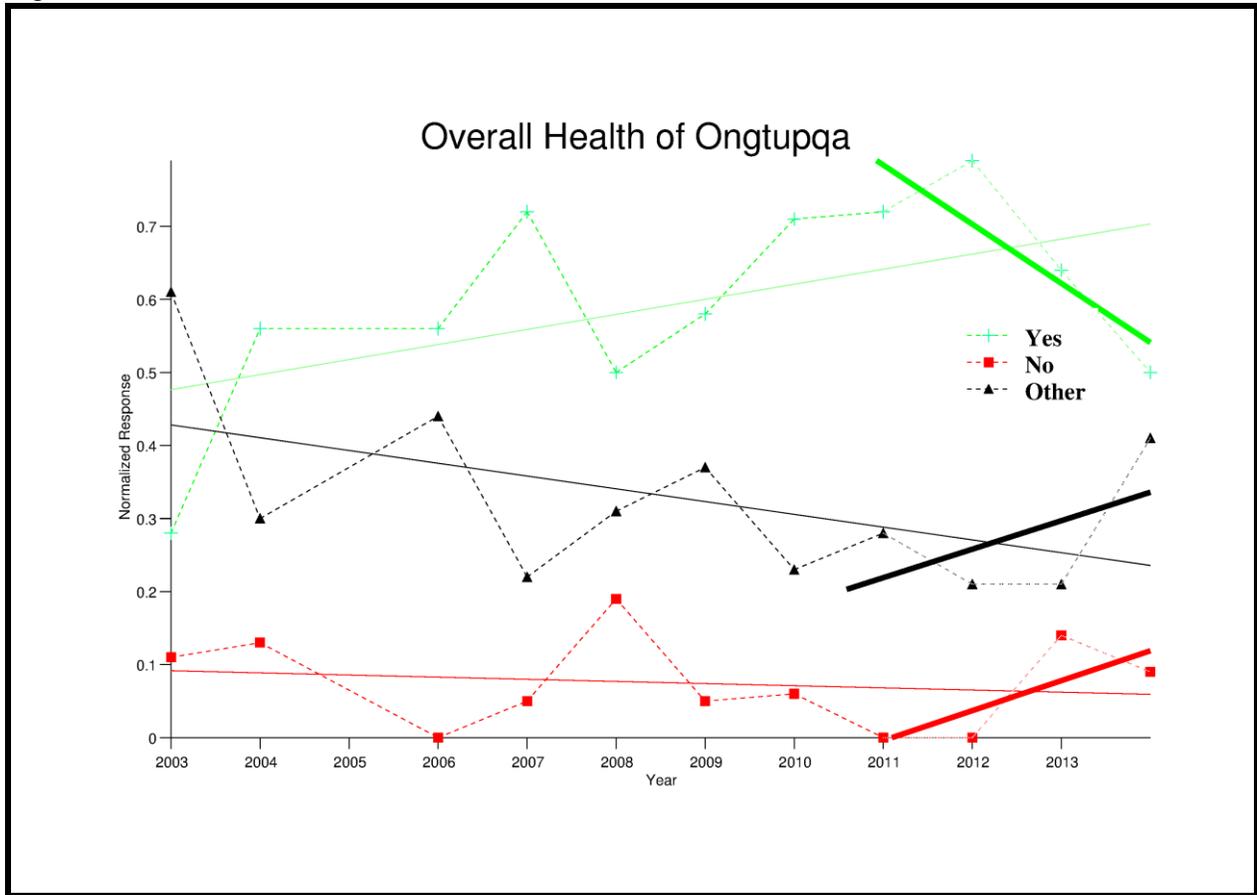
Survey Question:

-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
2003 surveys	5	2	1	8	2
2004 surveys	13	3	1	5	1
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
<b>Total</b>	<b>114</b>	<b>13</b>	<b>7</b>	<b>47</b>	<b>6</b>
<b>Percent</b>	60.96%	6.95%	3.74%	25.13%	3.21%

Figure 1. Trends for Overall Health



This year, the decrease in the short-term “Yes” trend line (and offsetting increase in the “No” and “Other” lines) has continued, with the positive assessment of the overall health reaching the lowest point since 2008. A large reason for the decrease in the positive assessment is because a larger proportion of the respondents were unsure of health, as compared to most previous years. A number of respondents elaborated on this uncertainty by noting that since the Grand Canyon is managed by the Park Service and there is more science, monitoring, and regulation, it should be better cared-for. On the other hand, all of this involvement may be leading to less beneficial actions because of political gridlock.

### *Recent changes*

This question serves as a baseline indicator: if *Ongtupqa* 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.

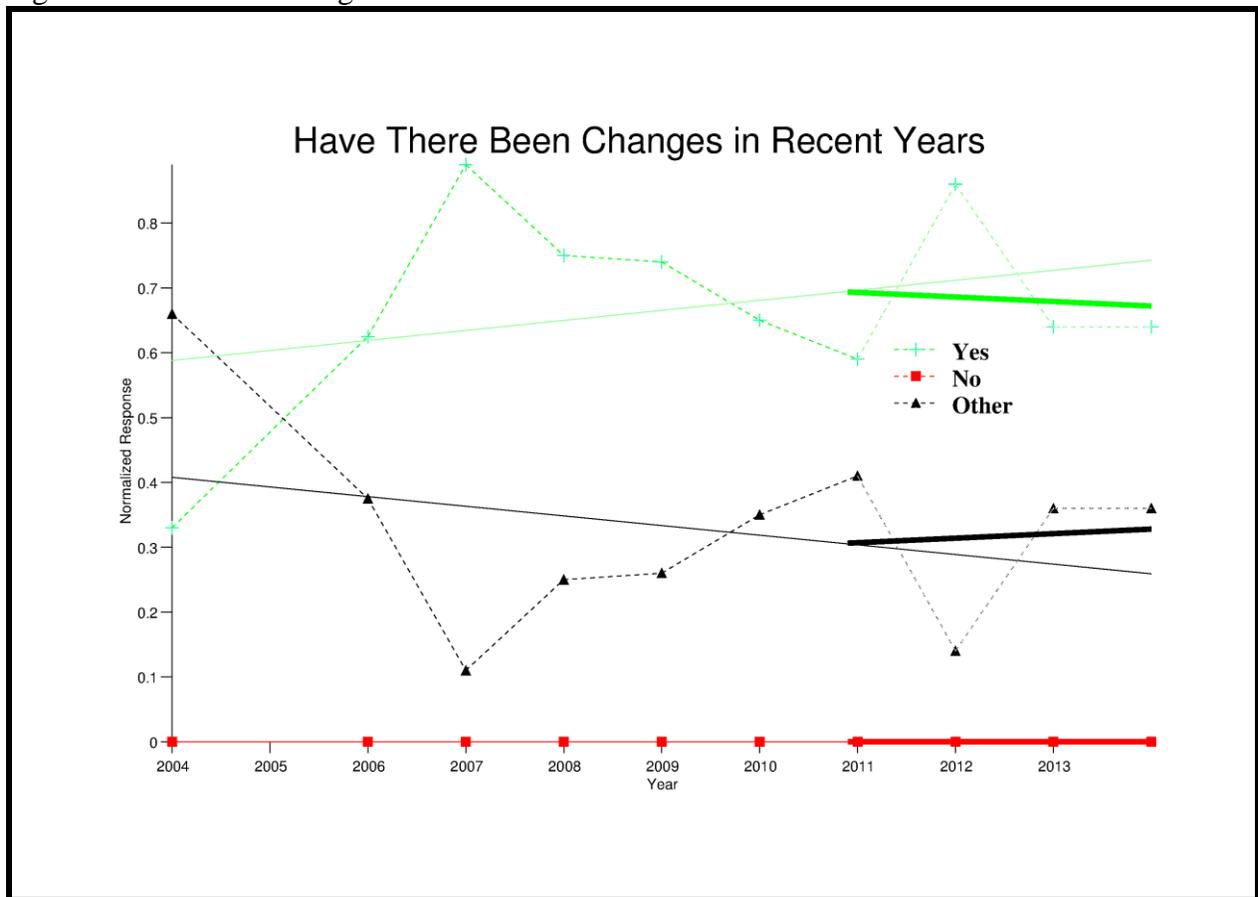
### Survey Question:

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

Table 4. Have There Been Changes in Recent Years

	Yes	No	Yes and No	Don't Know	Blank
2004	2	0	0	4	0
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
<b>Total</b>	<b>106</b>	<b>0</b>	<b>0</b>	<b>49</b>	<b>2</b>

Figure 2. Trends for Changes in Recent Years



There were no respondents who felt that change did not occur in *Öngtupqa* (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. Several respondents noted that people were having an effect on *Öngtupqa*, both through increased presence and through management activities. This was viewed as both good and bad, with tourism often being viewed negatively whereas management for the benefit of the resources a positive action. The possible construction of a tramway into *Öngtupqa* was cited as an example of a negative change.

### 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
2003	4	7	0	7	0
2004	2	0	0	4	0
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
<b>Total</b>	<b>98</b>	<b>49</b>	<b>6</b>	<b>16</b>	<b>6</b>

This year there was a significant decrease in the number of respondents who thought that the archeological sites were healthy and a concomitant increase in the “**Other**” responses (Table 5, Figure 3). Because the “**No**” responses (unhealthy) remain essentially unchanged from last year, it is clear that the decline in positive responses is driven by people not knowing enough about the state of the sites to confidently identify them as healthy.

### 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 recently in the AMP, 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.

#### 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?

Figure 3. Trends in Archaeological Site Health

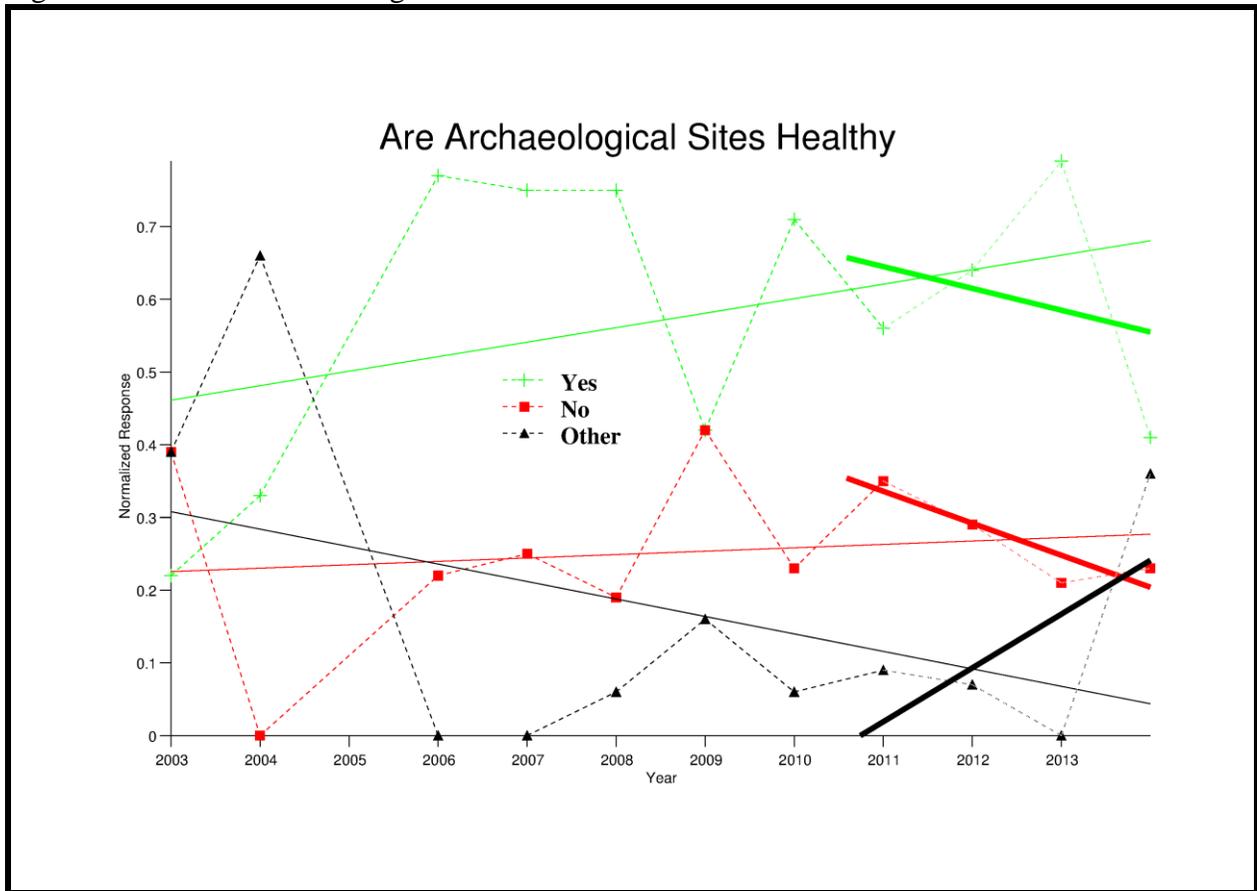
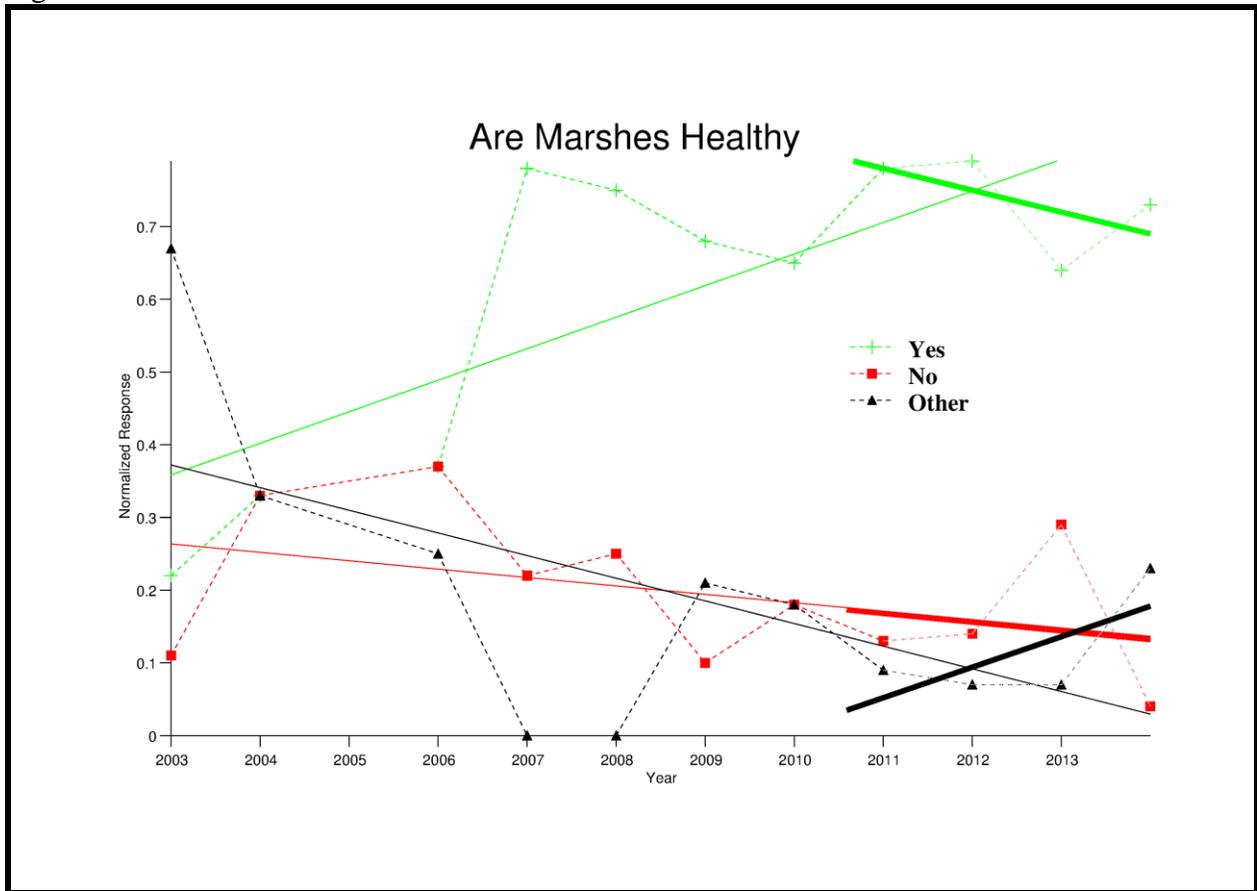


Table 6. Are Marshes Healthy

	Yes	No	Yes and No	Don't know	Blank
<b>2003</b>	4	2	0	11	1
<b>2004</b>	2	2	1	1	0
<b>2006</b>	3	3	1	1	0
<b>2007</b>	7	2	0	0	0
<b>2008</b>	12	4	0	0	0
<b>2009</b>	13	2	0	3	1
<b>2010</b>	11	3	0	2	1
<b>2011</b>	25	4	0	1	2
<b>2012</b>	11	2	0	0	1
<b>2013</b>	9	4	1	0	0
<b>2014</b>	16	1	1	2	2
<b>Total</b>	<b>113</b>	<b>29</b>	<b>4</b>	<b>21</b>	<b>8</b>

Overall, the responses to this question indicate that the Hopi respondents still view the health of marshes as good (Table 6, Figure 4). The most common response was that the reeds (*Phragmites*) seemed very healthy, but very little cattail (*Typha*) was noted. A similar comment was made last year, but more people noted it this year.

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.

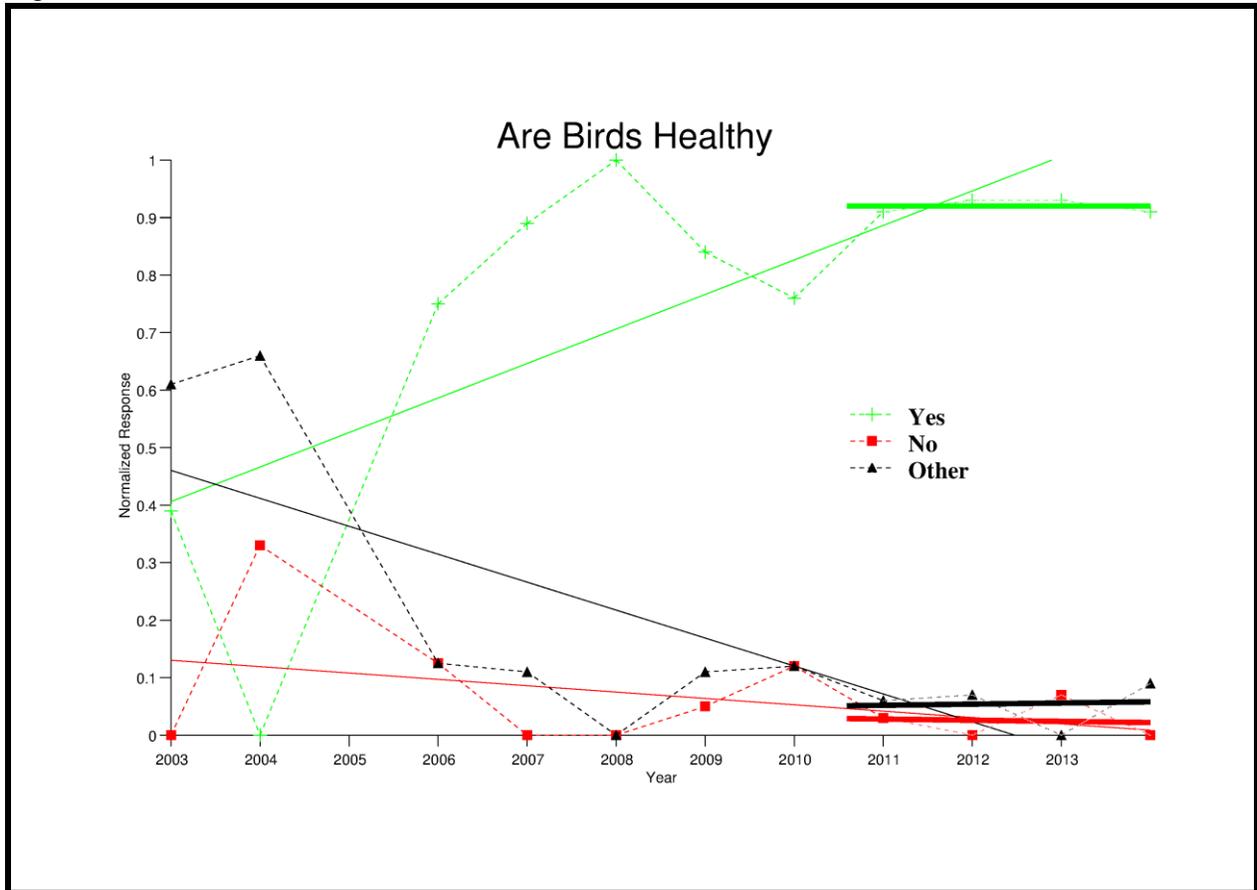
Survey Question:

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

Table 7. Are Birds Healthy

	Yes	No	Yes and No	Don't know	Blank
2003	7	0	0	11	0
2004	0	2	1	3	0
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
<b>Total</b>	<b>141</b>	<b>8</b>	<b>1</b>	<b>22</b>	<b>3</b>

Figure 5. Trends in Bird Health



From the perspective of the Hopis, bird health remains very good. There is almost no change in the response frequency over the last four years (Table 7, Figure 5). Virtually all respondents who provided additional comments on the questionnaires noted that they had seen many birds, including ones not normally seen at the Hopi villages.

*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:

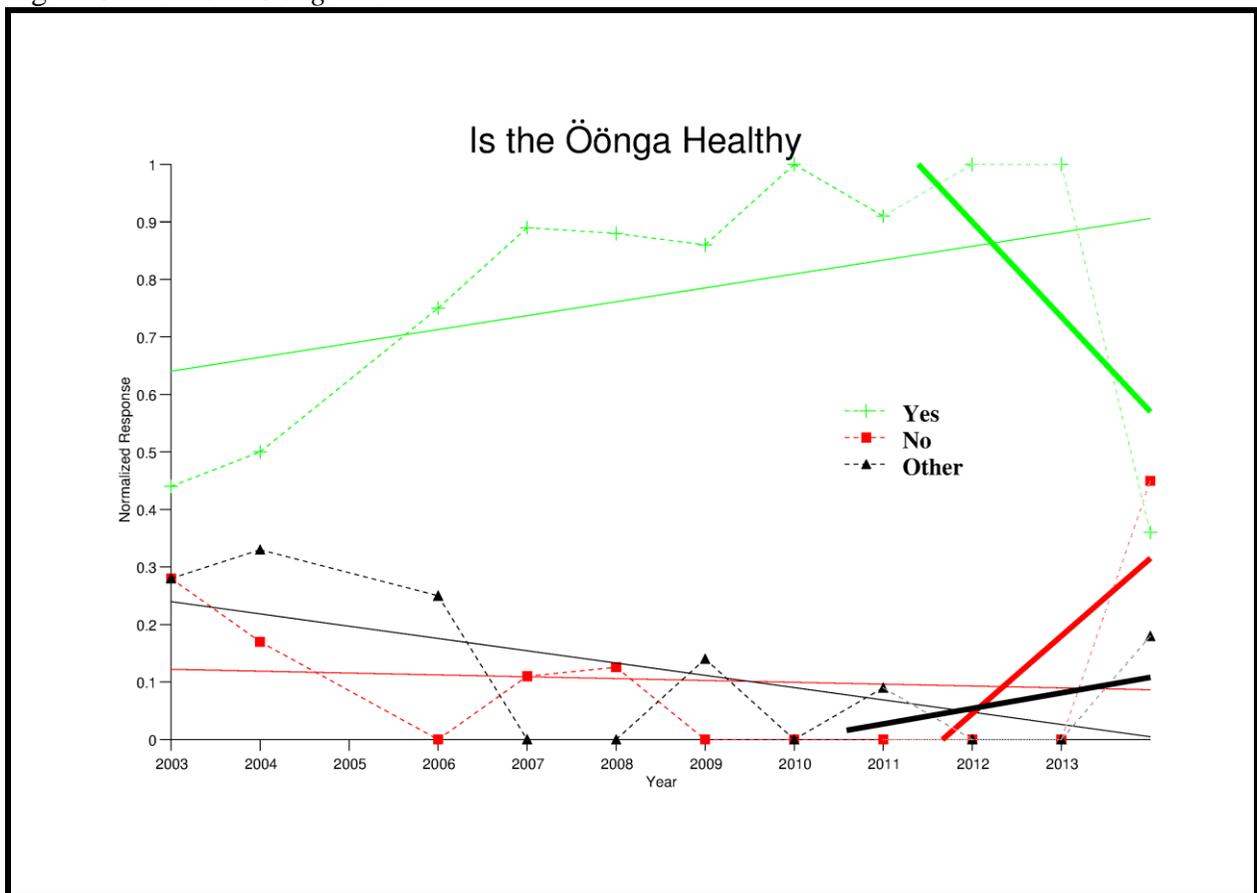
-*Öönga* (Hopi Salt Mines) is healthy?

Table 8. Is *Öönga* Healthy

	Yes	No	Yes and No	Don't Know	Blank
2003	8	5	0	5	0

2004	3	1	0	2	0
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
<b>Total</b>	<b>75</b>	<b>13</b>	<b>2</b>	<b>10</b>	<b>1</b>

Figure 6. Trends in *Öönga* Health



This year has seen a drastic shift in the evaluation of the health of *Öönga* (Table 8, Figure 6). For the first time since monitoring has occurred, slightly more Hopi respondents felt that *Öönga* was in an unhealthy state than those who thought that it was healthy. Based on the narrative comments, it is clear that there is concern about over-collection. While most of the negative responses also recognized that the salt will replenish itself, there was the fear that *Öönga* was not being shown the proper respect and that it was being used inappropriately. A couple of people noted the lack of “icicles” and the amount of dirt in the salt. Some of the perception of over-collection was likely due to the scheduling of a number of the tribal monitoring trips at almost the same time; the Zuni trip was just a couple of days ahead of the Hopi trip.

## Willows

Willows are a culturally important species in their own right and they serve as an indicator species for the post-dam riparian zone. As noted above for the Marshes, monitoring of this component of the ecosystem has not been recently undertaken by 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.

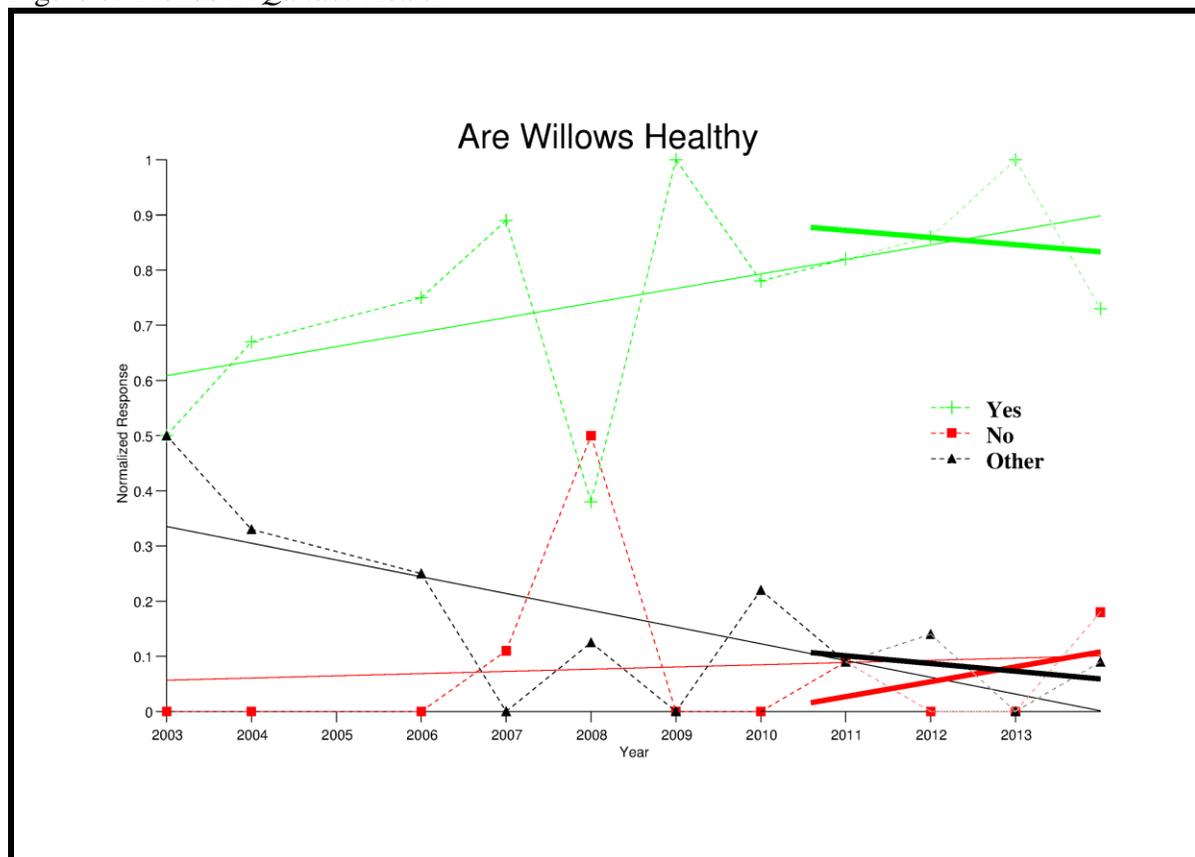
### Survey Question:

-*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
2003	9	0	1	8	0
2004	4	0	1	1	0
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
2012	6	0	0	0	1
2013	7	0	0	0	0
2014	8	2	0	1	0
<b>Total</b>	<b>65</b>	<b>7</b>	<b>3</b>	<b>13</b>	<b>2</b>

Figure 7. Trends in *Qahavi* Health



Overall the Hopi view the willows as being healthy (Table 9, Figure 7), though there is a slight drop from the previous years. Several people commented that as long as they got sufficient moisture, they should remain healthy.

### *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
2003	8	0	0	9	1
2004	4	1	0	1	0
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
<b>Total</b>	<b>79</b>	<b>3</b>	<b>0</b>	<b>15</b>	<b>4</b>

While there has been an ongoing decline in the view of animal health since 2007 (Table 10, Figure 8), it is a relatively minor decrease and overall, animals are viewed as being healthy. Almost all respondents commented on the number of bighorn sheep they saw, including babies, and that they looked healthy. In addition, several people noted that if the vegetation (food) and water are maintained in a good state, then the animals will benefit.

### *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

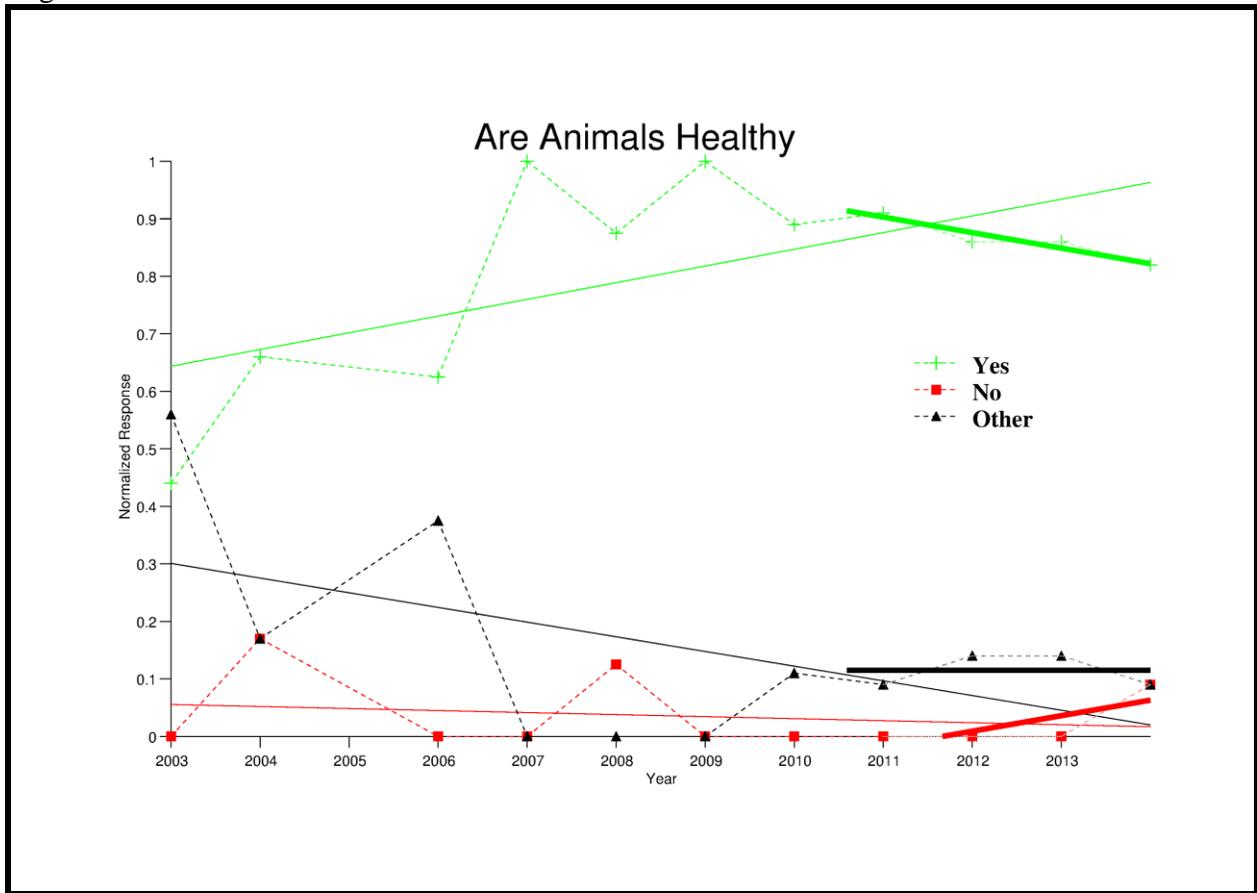
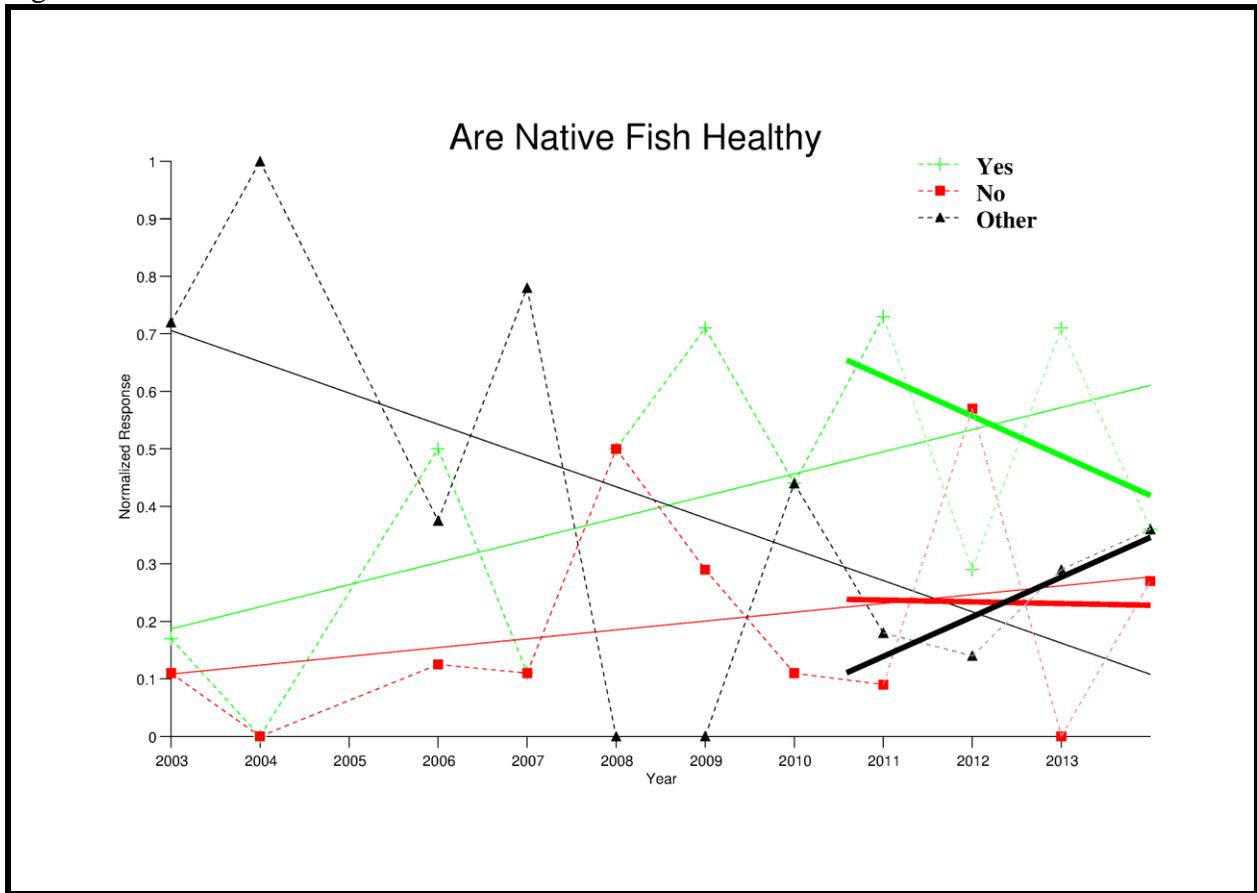


Table 11. Are Native Fish Healthy

	Yes	No	Yes and No	Don't know	Blank
2003	3	2	0	12	1
2004	0	0	0	6	0
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
<b>Total</b>	<b>40</b>	<b>19</b>	<b>0</b>	<b>34</b>	<b>8</b>

There is still a lot of variability in responses about the health of the humpback (Table 11, Figure 9). It seems that more of the respondents are uncertain, in part because no humpback chub were seen. We were able to watch nets being examined in the Little Colorado River, but no humpback chub were present. Many comments were very supportive of the monitoring 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:

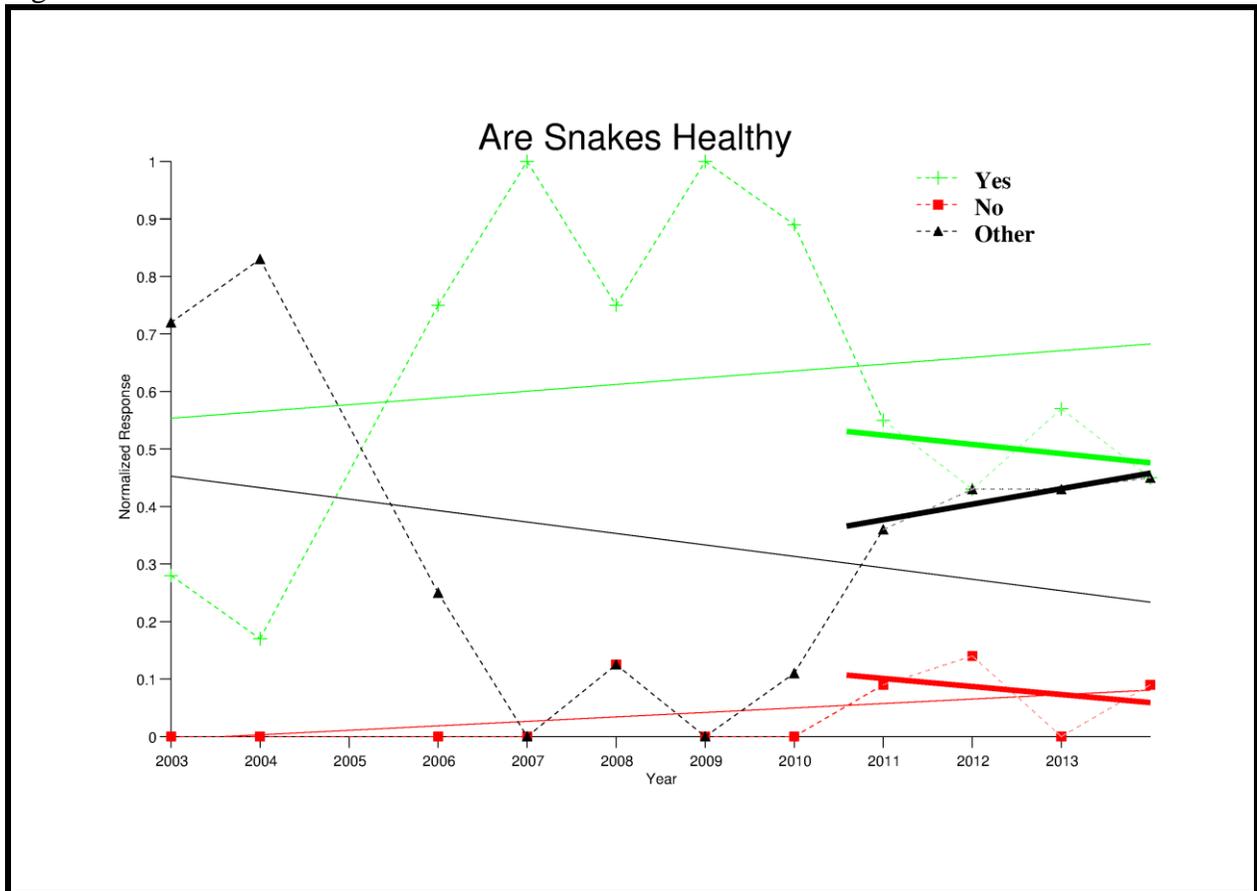
-Snakes in Grand Canyon exist in a healthy state?

Table 12. Are Snakes Healthy

	Yes	No	Yes and No	Don't know	Blank
2003	5	0	0	12	1
2004	1	0	0	5	0
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
<b>Total</b>	<b>60</b>	<b>4</b>	<b>0</b>	<b>27</b>	<b>10</b>

Figure 10. Trends in Snake Health



The proportion of people who feel that snakes are healthy and those who do not know are becoming roughly the same (Table 12, Figure 10). Many of the respondents commented that they did not see any, so their assessment was based on what they heard. One person noted that he had seen their tracks. Some of the Hopis were glad they did not see any.

### *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 no longer does any type of invertebrate monitoring. Therefore, Hopi responses are based principally on field observations during the monitoring trips and older monitoring data.

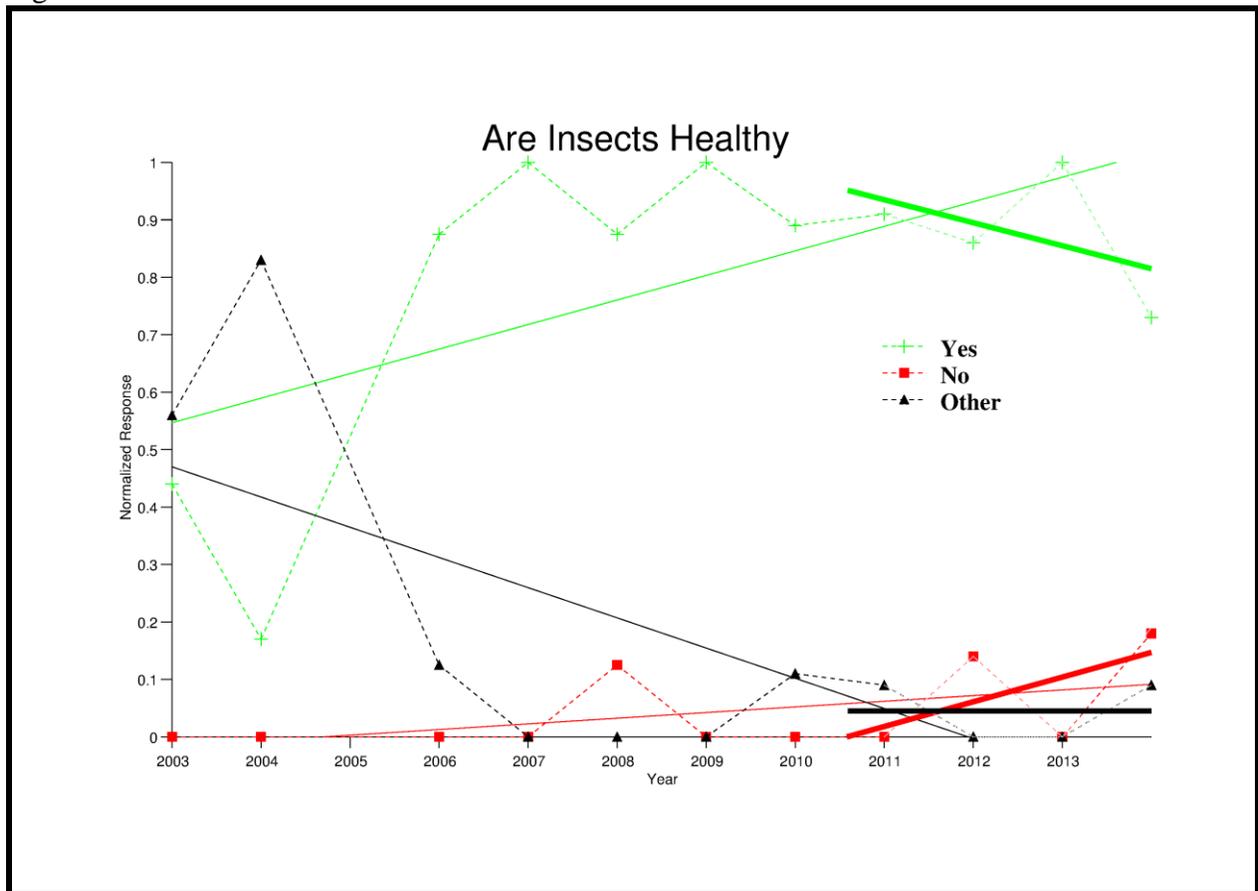
### Survey Question:

-Insects in Grand Canyon exist in a healthy state?

Table 13. Are Insects Healthy

	Yes	No	Yes and No	Don't know	Blank
2003	8	0	0	9	1
2004	1	0	0	4	1
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
<b>Total</b>	<b>78</b>	<b>4</b>	<b>0</b>	<b>15</b>	<b>4</b>

Figure 11. Trends in Insect Health



Insect health has consistently viewed as positive since 2006 (Table 13, Figure 11). Virtually all people commented that they had seen numerous insects and that they appeared to be doing well. One person noted that they seemed to be more numerous in the western portion of the canyon, particularly below RM 150. A number of people also commented on the number of mosquitoes.

*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.

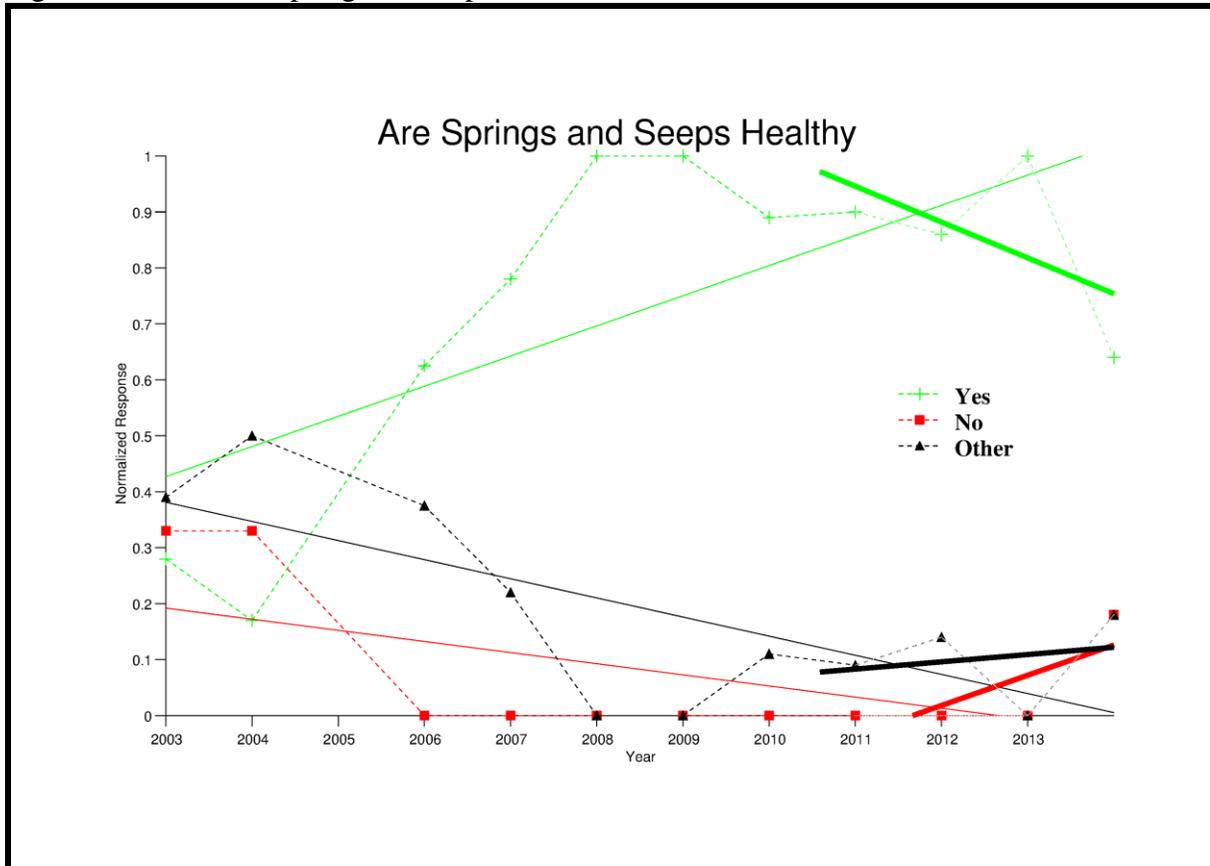
Survey Question:

-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
2003	5	6	0	6	1
2004	1	2	2	1	0
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
<b>Total</b>	<b>71</b>	<b>10</b>	<b>5</b>	<b>11</b>	<b>4</b>

Figure 12. Trends in Spring and Seep Health



Overall, the springs and seeps continue to be viewed as healthy (Table 14, Figure 12). For the first time since 2004, a couple of respondents did not feel that the springs were healthy because of their low flows. Numerous responses indicated that drought was seen as responsible for the lower flows.

### **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 609 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 209 total responses, only 1 indicated that Hopi should not be involved and 12 were unsure. In 2014, everyone said Hopi should be involved. As to the second question (again out of 209 total responses), 204 responses have identified that the information about *Öngtupqa* is important to them; only one response said that it wasn't and 4 were uncertain. In 2014, all respondents said the information was important. The responses to the third question are similar: out of 191 total responses, 182 said that the information is relevant to their cultural teachings, 3 responses were negative, and 6 were uncertain. In 2014, 2 of the 22 responses indicated that the information did not relate to their teachings. These both came from the same person who qualified the response by noting that he was unfortunately not part of the religious fraternity and therefore did not possess the high religious knowledge to which the information could contribute.

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 trailing, 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:

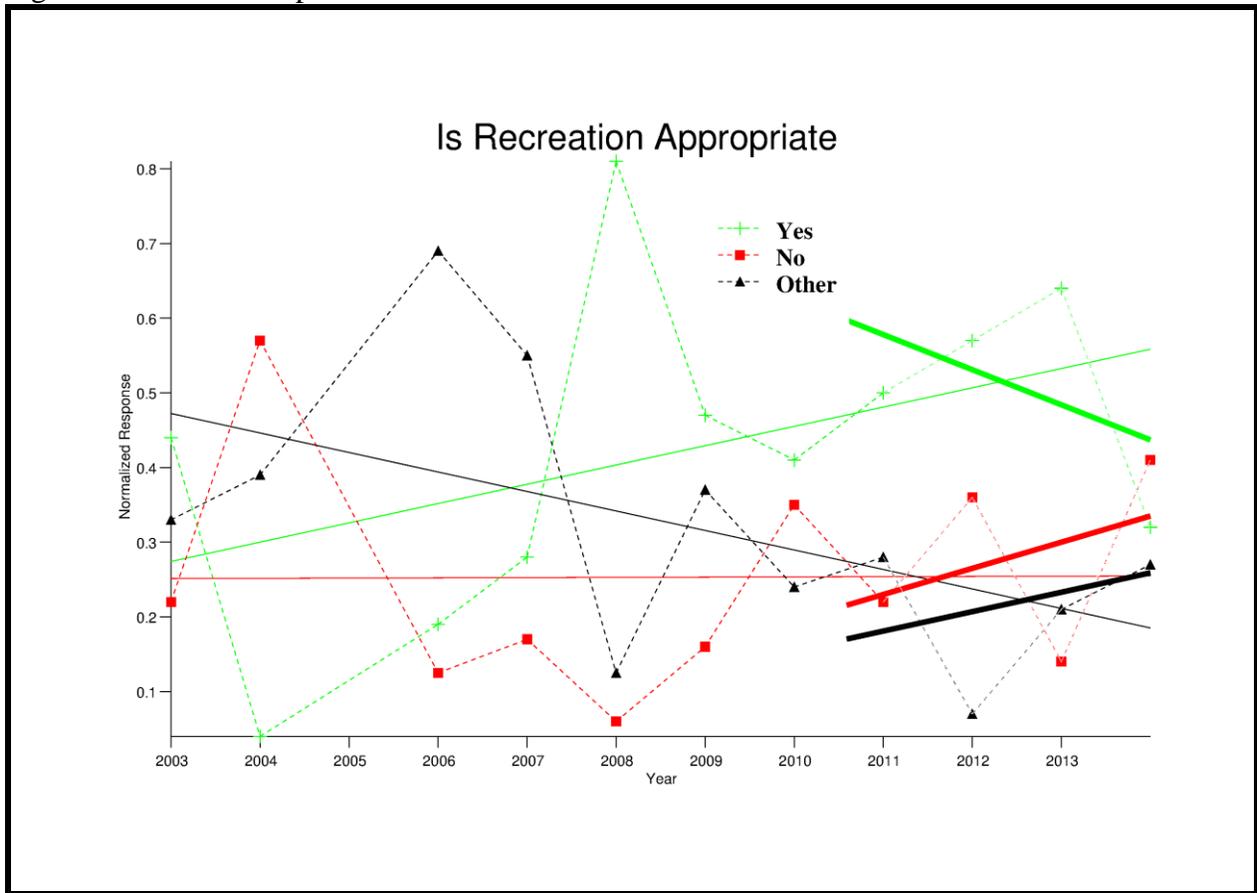
-The National Park Service allows recreational visitation in *Öngtupqa* (Grand Canyon) on river trips. From your perspective, is this right or wrong?

Table 15. Should Recreation be Allowed in *Öngtupqa*

	Yes	No	Yes and No	Don't know	Blank
2003	8	4	1	5	0
2004	1	13	5	2	2
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
<b>Total</b>	<b>86</b>	<b>55</b>	<b>33</b>	<b>19</b>	<b>16</b>

This year there was a strong decline in support for recreation in *Öngtupqa*, reversing the trend of the previous four years (Table 15, Figure 13). Out of all the issues, recreation tends to garner the most extensive comments, and this year was no exception. Whether people supported recreation or not, there was a common theme of having the proper respect for *Öngtupqa* as a sacred, cultural location. One supporter of recreation noted “Everybody has the right to see what the river has to offer, even tho [sic] it is a sacred place. Just be respectful and don’t destroy or disrupt the [Salt] mine.” Another stated “people should see the grandeur of the Canyon and maybe they could get a better understanding of how revered and spiritual for [the Hopi] places and sites that dot the Canyon.” For people against recreation, the sacred nature was similarly cited. One respondent put it this way: “It has come to the point of no respect for our religion’s home. You don’t have a recreation party in a church. Sites and other areas are being overused, visited.” Concern was also expressed about the commercialization aspect and the role money plays in creating more tourism in the Canyon. This concern seemed mostly focused on the proposed Escalade development at the Confluence and to air tours.

Figure 13. Trends in Opinion About Recreation



### *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 operations and management 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:

#### 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**

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	35	53	39	7	6	1	5	2	5	4	1	0
Q13 Human caused erosion	35	32	59	0	10	0	4	2	10	4	0	1

It should be noted that respondents often selected more than one of the three specified responses to each question, and in one case, added their own response category (**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 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 fourth, **Other** column was added for the **Blank**, **Don't know**, **Monitor**, and **Educate the Public** responses. 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	52 (33.12%)	53 (33.76%)	42 (26.75%)	10 (6.37%)
Q13 Human caused erosion	49 (31.21%)	32 (20.38%)	61 (38.85%)	15 (9.55%)

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 closely by **Excavating** it, and then **Reburying** it. Comments regarding the preference for letting the site erode expressed the view that nature was proceeding as appropriate and that the sites should be left alone. A number of people did note that the decision should be done on a case-by-case basis and would depend on what type of information would come from excavation.

When the erosion was caused by human activities, preferences shifted 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** dropped significantly. 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.

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 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  $\chi^2$  goodness-of-fit analysis conducted on the distribution of responses between these two questions, it indicates that there is a statistically significant difference in the response patterns ( $\chi^2=9.78$ ,  $p=0.0205$ ). This provides some confidence that the root causes of erosion are 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:

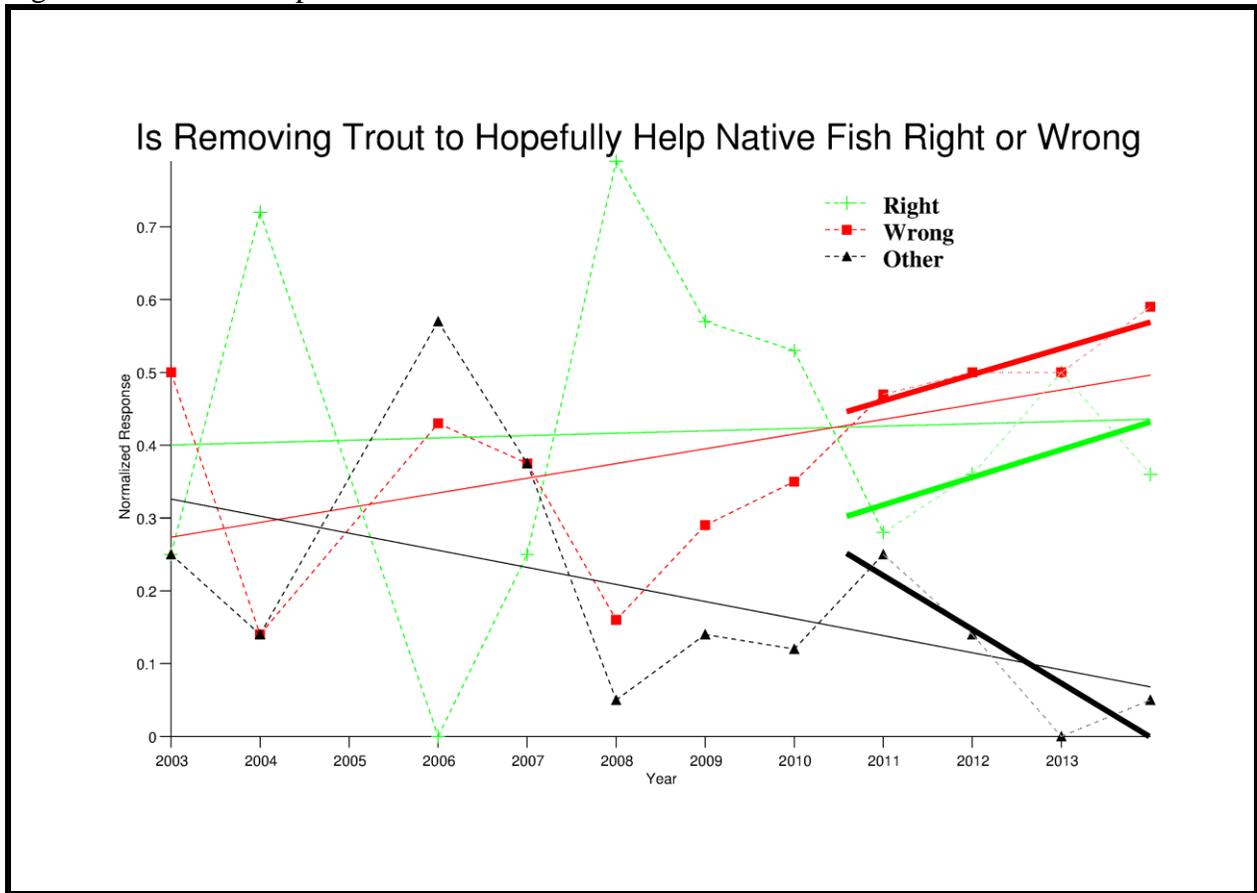
-Non-native trout and other fish are being killed to hopefully help native fish. From your perspective, is this **Right** or **Wrong**

Table 18. Mechanical Removal of Non-native Fish

	Right	Wrong	Right and Wrong	Don't know or Blank
2003	2	4	0	2
2004	5	1	1	1
2006	2	3	1	4
2007	0	3	0	3
2008	15	3	0	1
2009	12	6	0	3
2010	9	6	1	1
2011	9	15	1	7
2012	5	7	1	1
2013	7	7	0	0
2014	8	13	0	1
<b>Total</b>	<b>74</b>	<b>68</b>	<b>5</b>	<b>24</b>

The feeling that killing trout is not an appropriate management approach has been growing since a low in 2006, with as many or more people feeling that it is wrong, rather than right, for the last four years (Table 18, Figure 14). One respondent summed up the situation by stating: “The damage is already done by unclear thinking. Why hurt the fish [trout] now, it was not their choosing.” Another expressed the Hopi philosophy by noting that: “all living things should be left alone, mother

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



earth has its own way of taking care of things like this. It is not man’s duty/responsibility to do this.” Another said that it is wrong, “unless it is a definitive cause,” referring to the trout’s potential negative impact on humpback chub.

In a qualified support of mechanical removal, one person said: “As long as it helps the cycle of life, then Yes [to mechanical removal] to preserve native fish.” Another said that as a native fish, it “has every right to be in its own waters.”

*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.

Survey Question:

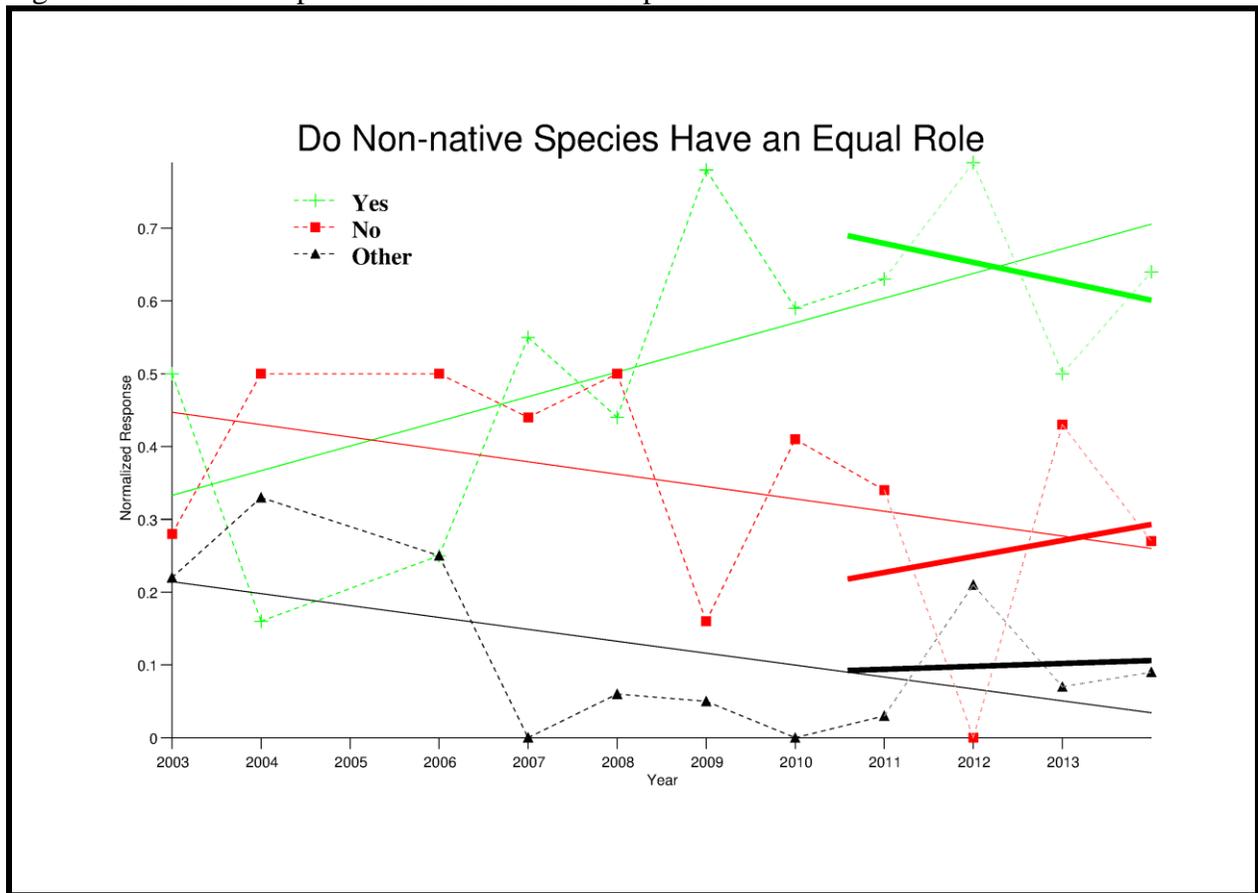
-Non-native species (such as tamarisk) and native species (such as cottonwood) have an equal role in the balance of the natural world?

Table 19. Do Non-native Species Have A Role

	Yes	No	Yes and No	Don't know	Blank
2003	9	5	0	3	1
2004	1	3	1	1	0

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
<b>Total</b>	<b>101</b>	<b>57</b>	<b>4</b>	<b>8</b>	<b>5</b>

Figure 15. Trends in Opinion About Non-native Species



This year, the trend of support for all life, both native and non-native, to have a right to exist and play roll in the world continues. (Table 19, Figure 15). The long-term trend continues to show the view that non-native species play a role in the current ecosystem, and although variable from year-to-year, it has remained well above the **No** responses since 2009. As was eloquently stated by one respondent, “All living things, even humans, animals, all have a role in the balance of the natural world. We all have a purpose in life, all living things have a “spirit” – otherwise they wouldn’t be ‘living’.” Echoing this view, another stated: “Every living/non-living thing has a purpose. If they [were] brought here by man, again it was due to unwise thinking.” A few of the respondents did comment specifically on the amount of tamarisk, noting that there was too much and was likely

displacing native plants and using too much water. Even this view was tempered by the recognition that tamarisk provides “habitat for birds, reptiles, [and] also to hold the beach sediment.”

### 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.

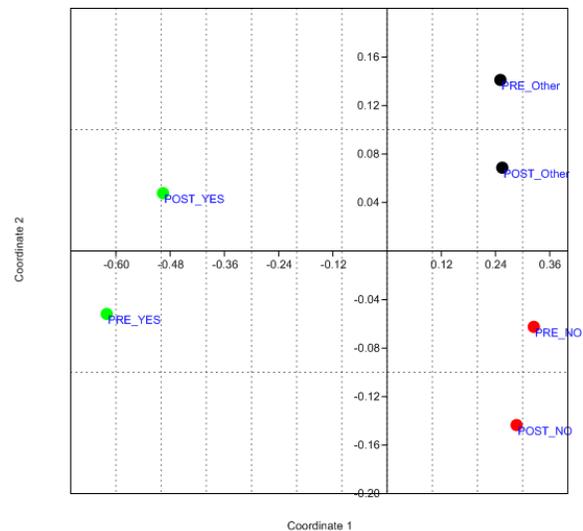


Figure 16. MDS Scoring of Responses from Before and After River Trips.

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	83	12	47	42	3	22
Q02 Hopi Involvement	137	0	5	59	1	7
Q03 Importance of Information	140	1	1	64	0	3
Q04 Relates to Cultural Teachings	129	1	1	53	2	5
Q05 Recent changes	71	0	34	35	0	17
Q06 Marshes	77	20	19	36	9	14
Q07 Birds	93	7	16	48	1	10
Q08 Recreation	60	39	43	26	16	25
Q09 Trout removal	53	43	13	19	24	13
Q10 Non-natives	72	33	11	29	24	6

Q11 Archaeological Sites	62	34	20	36	15	8
Q14 Ööngä	45	7	7	30	6	6
Q15 Willow	43	4	12	31	4	7
Q16 Animals	50	1	8	29	2	11
Q17 Native fish	23	13	23	17	6	19
Q18 Snakes	35	2	22	25	2	15
Q19 Insects	42	4	13	36	0	6
Q20 Springs	42	6	11	29	4	9

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.

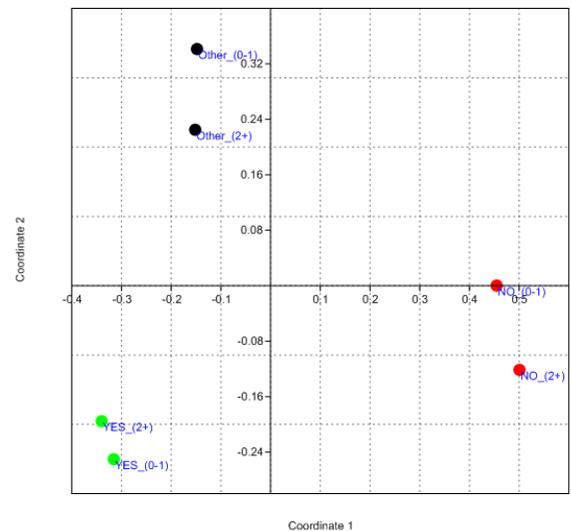


Figure 17. Single/Multiple Trip MDS Plot

## 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 even 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.

There is 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. A number of people commented on the intrusive nature of tourist airflights occurring over sections of *Öngtupqa*. Similarly, there was unanimous agreement that there should be no new developments in *Öngtupqa* and in particular, the proposed Navajo Escalade (Confluence “tramway project”) development was viewed as wholly inappropriate. *Öngtupqa* is a sacred space and developments aimed at making money are sacrilegious.

Educational activities, both aimed at the public and internally for Hopi tribal members, continue to be identified as an essential aspect of appropriately managing *Öngtupqa*. 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 and that an ownership interest in river running companies by the Hopi Tribe could lead to better management. Another recommendation was to formally change the names of places in *Öngtupqa* to those traditionally used by the Hopi. This would help demonstrate the intimate association of the Hopi people to *Öngtupqa*. One intriguing suggestion was to have some Hopis live in *Öngtupqa* during the farming season to show visitors how life used to be, including the farming that took place.

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.

Finally, there is growing concern that collection of resources by the tribes during their monitoring trips does not become a negative impact in its own right. Several people suggested that the participating tribes should convene a meeting among themselves to discuss the issue.

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## **APPENDICES**

### **General and post-trip survey instruments from 2014**

## Hopi Long-Term Monitoring Program (May 2014 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 and the numbers are still increasing. Other native fish are also increasing in numbers. But so are the non-native rainbow trout, which spawn above Lees Ferry, but then move downstream. The affect that trout have on the Chub population 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 it is still under investigation whether it is enough sand to offset the erosion. There is 10-year commitment to conducting high flows as an experiment. The beaches along the river are used by river runners for camping, for areas for plant growth, and might help protect archaeological sites..

**Archaeological sites:** Archaeological sites along the river are continuing 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 natural floods, native and non-native plants have greatly increased along the shoreline. The most obvious plant, tamarisk, is a non-native. A non-native beetle is now killing them. Plants are now growing in areas that used to be open sand (which reduces camping areas). Scientists have greatly reduced the number of studies of the plants and animals that live around them.

**Wipho'qölö, Cattail marsh and Paaqap' qölö, Reed marsh:** Marshes have decreased in number and size with current operations of Glen Canyon Dam. 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 (September 2014 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 and the numbers are still increasing. Other native fish are also increasing in numbers. But so are the non-native rainbow trout, which spawn above Lees Ferry, but then move downstream. The affect that trout have on the Chub population 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 it is still under investigation whether it is enough sand to offset the erosion. There is 10-year commitment to conducting high flows as an experiment. The beaches along the river are used by river runners for camping, for areas for plant growth, and might help protect archaeological sites..

**Archaeological sites:** Archaeological sites along the river are continuing 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 natural floods, native and non-native plants have greatly increased along the shoreline. The most obvious plant, tamarisk, is a non-native. A non-native beetle is now killing them. Plants are now growing in areas that used to be open sand (which reduces camping areas). Scientists have greatly reduced the number of studies of the plants and animals that live around them.

**Wipho'qölö, Cattail marsh and Paaqap' qölö, Reed marsh:** Marshes have decreased in number and size with current operations of Glen Canyon Dam. 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 \_\_\_\_\_