

**U.S. DEPARTMENT OF ENERGY  
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**NUCLEAR WASTE TECHNICAL REVIEW BOARD  
ENVIRONMENT AND PUBLIC HEALTH PANEL MEETING**

**SUBJECT: YUCCA MOUNTAIN PROJECT  
DESERT TORTOISE PROGRAM**

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**LAS VEGAS, NEVADA  
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# **YMP DESERT TORTOISE PROGRAM**

- **Program Development**
- **Program Objectives**
- **Studies**

# **PROGRAM DEVELOPMENT**

- 1. History**
- 2. Goal Identification**
- 3. Literature Review**

# **PROGRAM DEVELOPMENT HISTORY**

**Petitioned for Listing in 1984**

**Listed in August 1989**

**Biological Assessment Written in 1989**

**“No Jeopardy” Biological Opinion Rendered in 1990**

**Incidental Take of 15 Tortoises Allowed**

**Terms and Conditions Required the Program**

# **GOAL OF THE YMP DESERT TORTOISE PROGRAM**

**To Conserve the Tortoise Population at  
Yucca Mountain and Ensure Compliance with  
the Endangered Species Act**

# **LITERATURE REVIEW**

- 1. Potential impacts of site characterization activities**
- 2. Efficacy of mitigation techniques for minimizing impacts**
- 3. Ecology of the desert tortoise**

# LITERATURE REVIEW

## 1. Potential impacts of site characterization activities

- **Types of activities**
  - <2 ha disturbed per activity
  - >2 ha disturbed per activity
- **Types of impacts**
  - Direct and/or Immediate
  - Indirect and/or Cumulative

**Conclude: Direct negative effects and subtle cumulative effects must be addressed to achieve the goals of this program**

**Large and small disturbances should be considered**

# LITERATURE REVIEW

## 2. Efficacy of mitigation techniques for minimizing impacts

- **Some information on the impacts of grazing, roads, and off-road driving**
- **No information on impacts similar to Site Characterization**
- **Little information on the efficacy of techniques to mitigate impacts**

**Conclude: It is necessary to study the effectiveness of techniques to be used to mitigate impacts**

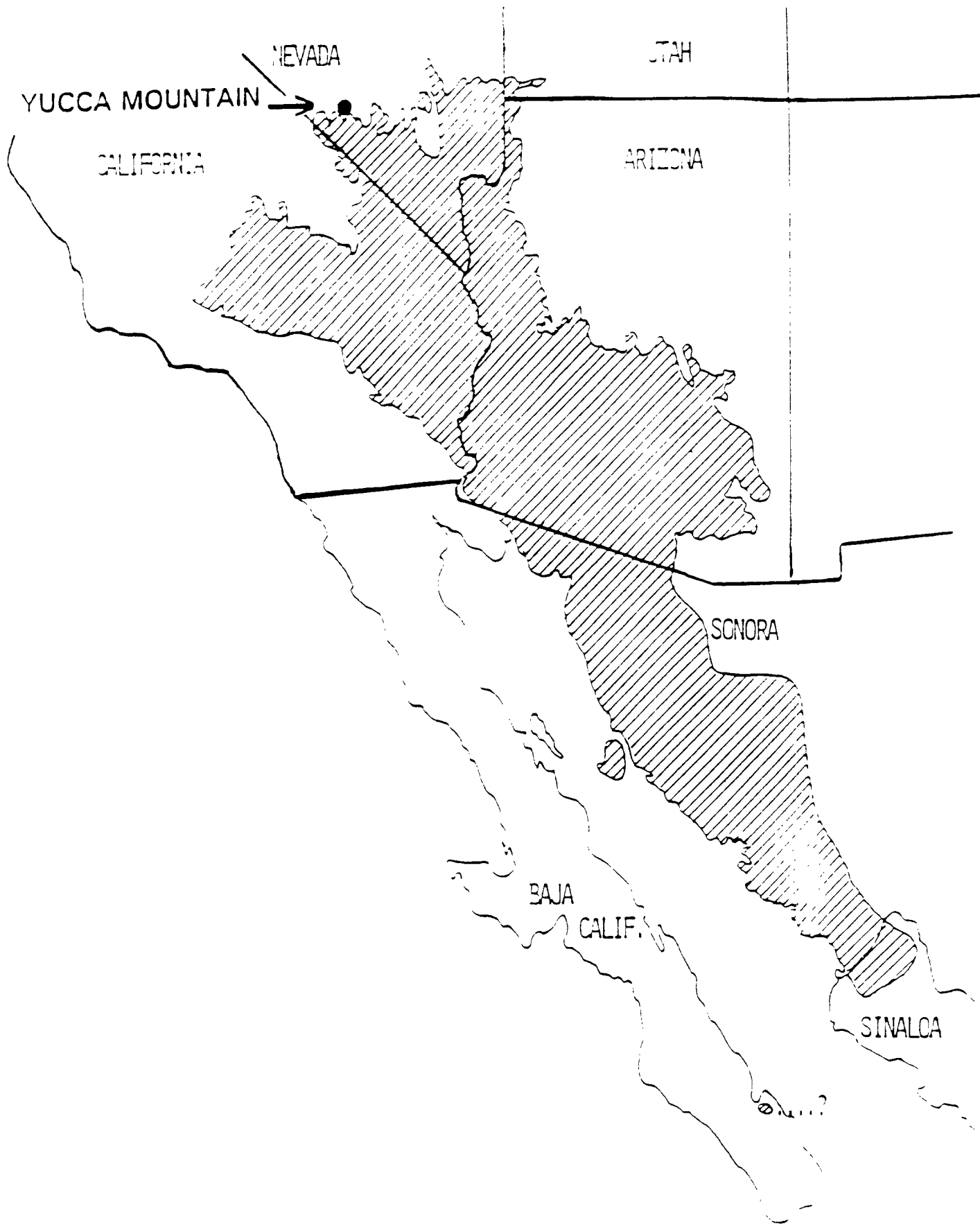


# LITERATURE REVIEW

## 3. Ecology of the desert tortoise

- Information is available on physiology, growth, and relative abundance
- Less known about movements, behavior, and survival, especially of small tortoises
- Tortoises at Yucca Mountain may differ from southern populations

**Conclude:** It is necessary to study those aspects of the ecology of desert tortoises at Yucca Mountain needed to fulfill program goal



**RANGE OF THE DESERT TORTOISE.**

# **PROGRAM OBJECTIVES**

- 1. Evaluate impacts of site characterization activities on tortoises**
- 2. Mitigate impacts of site characterization activities to the maximum extent possible in order to minimize incidental take**
- 3. Develop and test the efficacy of mitigation techniques**
- 4. Obtain site-specific information on desert tortoise biology needed to achieve these other objectives**

# **STUDIES**

## **Studies/Procedures Addressing Direct and Immediate Effects**

- **Preactivity Surveys**
- **Impact Mitigation**
- **Relocation and Displacement**
- **Road Monitoring**
- **Ground Motion Effects**

## **Studies Addressing Cumulative and Indirect Effects**

- **Reproduction**
- **Survival**
- **Behavior and Movements**
- **Health**
- **Diet**
- **Raven**

# **PREACTIVITY SURVEYS**

## **OBJECTIVE**

- **Identify and Mitigate Direct Impacts**

## **METHOD**

- **Survey Area Prior to Activity**

## **MITIGATION**

- **Mitigation of Direct Impacts**
- **Flagging and Avoidance of Burrows**
  - **Relocation of the Activity**
  - **Redesign of the Activity**
  - **Monitoring Tortoises Near Construction**
  - **Relocation of Tortoise**
- **Evaluate Effectiveness after each Activity and during Post-Activity Surveys**

# **IMPACT MITIGATION STUDY**

## **OBJECTIVE**

- **Obtain information necessary to mitigate impacts on tortoises in areas that will have large, long-term disturbances**

## **METHOD**

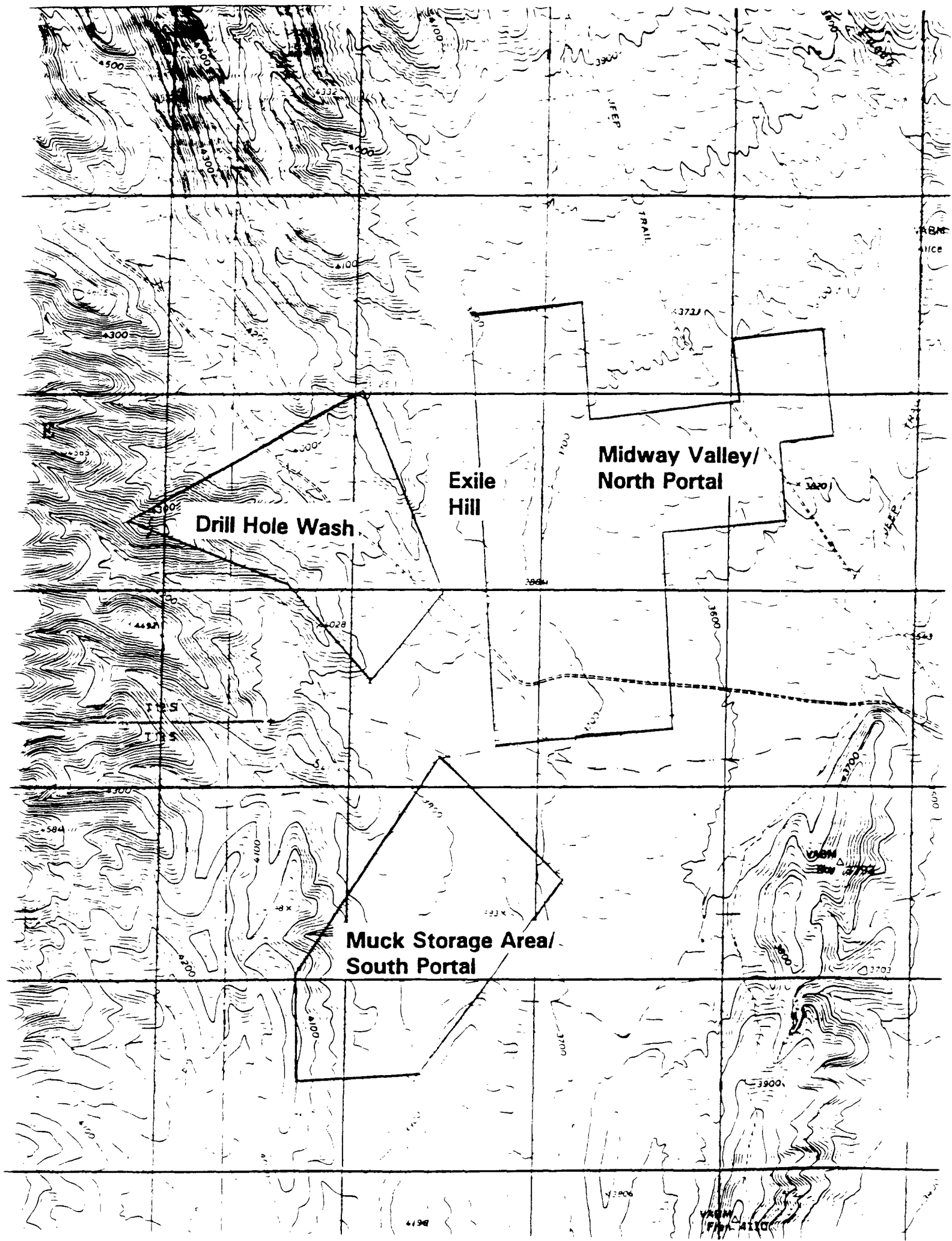
- **Tortoises in proposed high-impact areas are radiomarked and monitored up to one year prior to start of activity**

## **RESULTS**

- **Three Impact Mitigation Study sites have been established**

## **MITIGATION**

- **Identification of best techniques for protecting specific tortoises**



**Drill Hole Wash**

**Exile Hill**

**Midway Valley/  
North Portal**

**Muck Storage Area/  
South Portal**

# **RELOCATION AND DISPLACEMENT STUDY**

## **OBJECTIVE**

- **Develop, implement, and test methods for moving tortoises out of areas that will be disturbed**

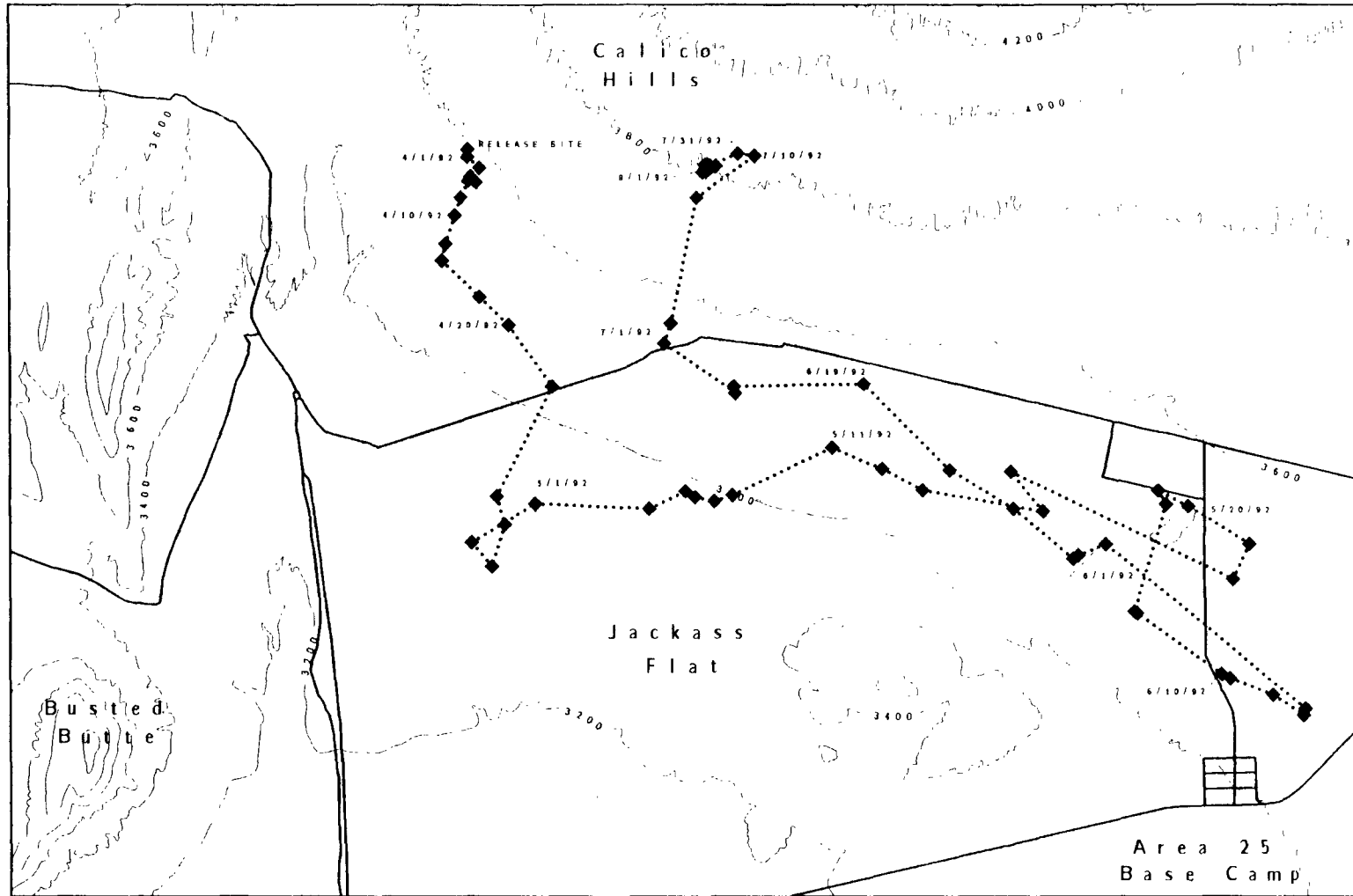
## **METHOD**

- **Originally planned on moving tortoises out of the Yucca Mountain area if >25% of home range was to be destroyed**

## **RESULTS**

- **First tortoise that was relocated moved >30 km**





YMP-93-044 0

# **RELOCATION AND DISPLACEMENT STUDY**

## **REVISED METHOD**

- **Tortoises will be moved within their home range when possible**
- **If a large portion of their home range will be disturbed, tortoises will be moved to a safe area within Yucca Mountain area**
- **Tortoises will be removed from Yucca Mountain only if they continue to return to construction sites**

## **RESULTS**

- **15 tortoises were moved in 1993**
  - **2 tortoises moved outside of home range**
  - **13 tortoises moved within home range**

## **MITIGATION**

- **Evaluate success of each relocation and modify mitigation recommendations if necessary**

# **ROAD MONITORING STUDY**

## **OBJECTIVE**

- **Minimize mortalities of tortoises on roads**

## **METHOD**

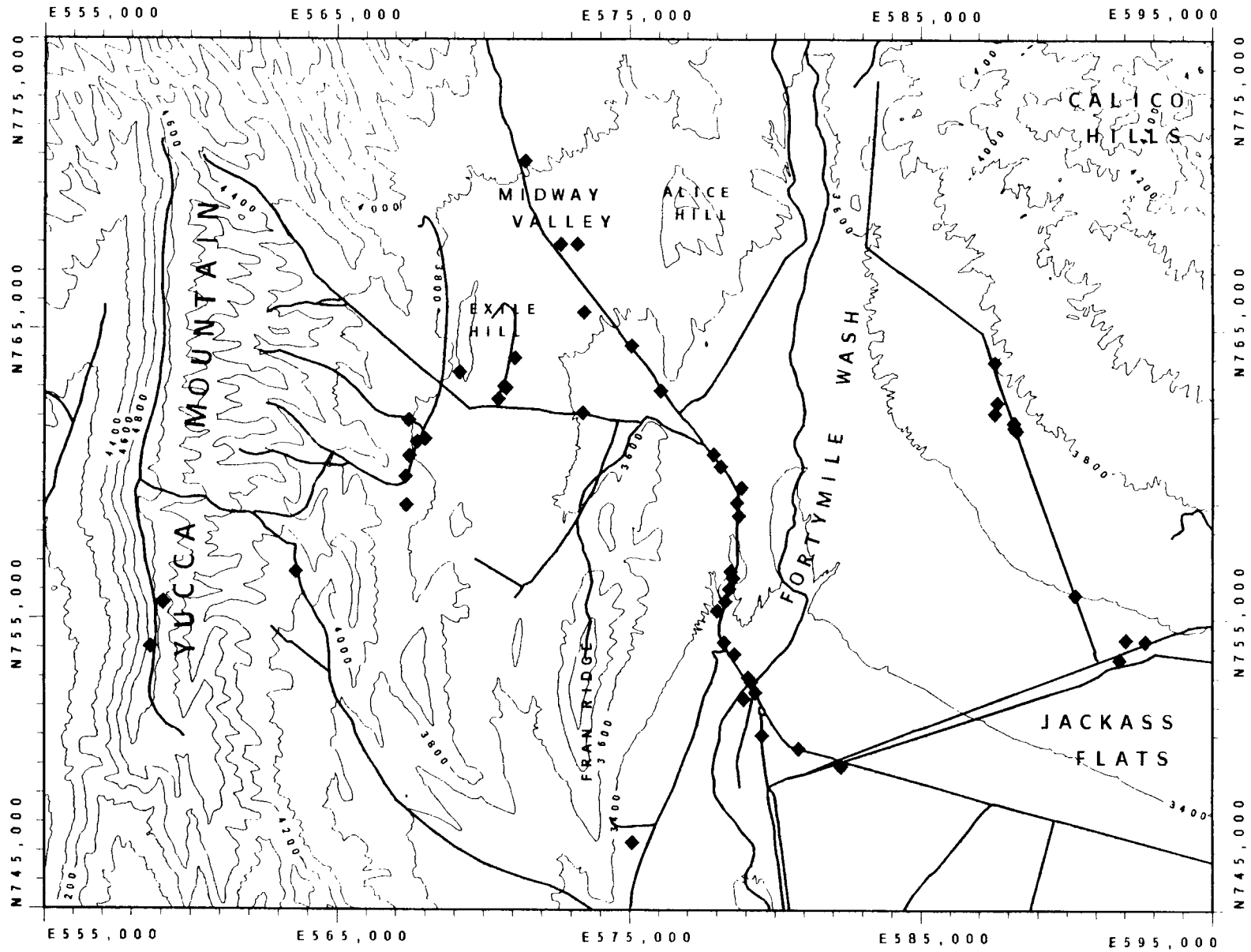
- **Monitor sightings and mortalities of tortoises along roads**
- **Assess information annually to determine if mitigation is required to reduce mortalities along roads**
- **If necessary, develop and test mitigation techniques**

## **RESULTS**

- **155 sightings of tortoises on roads since 1989**
- **4 tortoises killed on roads since 1989 (1 Incidental Take)**

## **MITIGATION**

- **Warning signs placed in areas of highest tortoise activity, but further mitigation not warranted at present**



Grid ticks based on Nevada State Plane coordinate system, central zone.

# **GROUND MOTION EFFECTS STUDY**

## **OBJECTIVES**

- **Determine if ground motion caused by site characterization activities collapses tortoise burrows or causes tortoises to alter their behavior**

## **METHODS**

- **Monitor behavior of tortoises during and after ground motion**
- **Measure burrows near seismic shot holes before and after ground motion**

## **RESULTS**

- **One set of seismic studies monitored. No changes were noted one week after the event.**
- **Burrows and tortoises at North Portal not affected**

## **MITIGATION**

- **None to date**

# CUMULATIVE IMPACTS

- **The combined effects of all types of activities will be evaluated**
- **Because effects may be subtle, sampling is being done over a long period and on many parameters important to tortoise populations**

# PARAMETERS BEING MEASURED

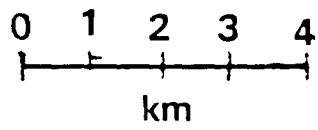
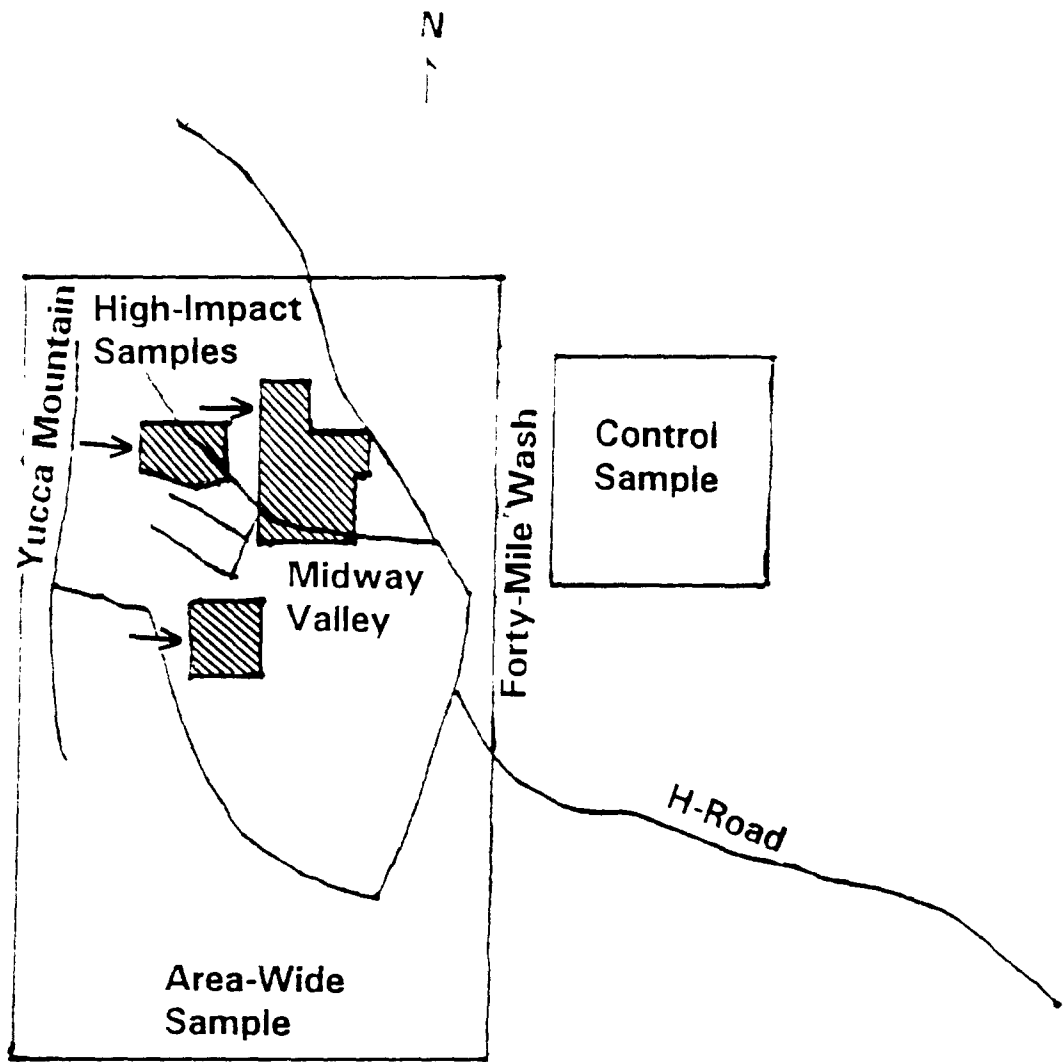
- **Reproduction Study**
  - Eggs Produced per Female
- **Survival Study**
  - Nest Survival
  - Hatchling Survival
  - Adult Tortoise Survival
- **Behavior/Habitat Use Study**
  - Home Range Size
  - Shift in Home Range
  - Percent of Time Active
  - Length of Hibernation
  - Number of Burrows/Number of new Burrows
- **Health Study**
  - Growth
  - Condition Index
  - *Mycoplasma agassizii* Antibody Test
  - Blood Profiles
- **Diet Study**
  - Species Composition
- **Raven Study**
  - Abundance

# DESIGN

- **Sampling radiomarked tortoises at three levels of impact**
  1. **High Impact**
  2. **Area Wide**
  3. **No Impact - Control**
- **Number of Radiomarked Tortoises Monitored**

	<u>1991</u>	<u>1992</u>	<u>1993</u>
<b>High Impact</b>	<b>37</b>	<b>41</b>	<b>43</b>
<b>Area Wide</b>	<b>23</b>	<b>26</b>	<b>22</b>
<b>Control</b>	<b>25</b>	<b>23</b>	<b>24</b>





# OBJECTIVES

- **Evaluate Cumulative Impacts on Tortoises**
- **Obtain Site-Specific Information on Desert Tortoise Biology to Aid in Conserving Tortoises at Yucca Mountain**

# REPRODUCTION

## PARAMETER MEASURED

- Eggs Produced per Female

## METHODS

- 1992 - found nests and counted eggs
- 1993 - x ray

## RESULTS

	$\bar{x}$ Number of Eggs/Female	
	1992	1993
High Impact	13.0 (n=2)	8.2 (n=5)
Control Area	8.0 (n=1)	8.3 (n=4)

# REPRODUCTION

## ADDITIONAL RESULTS

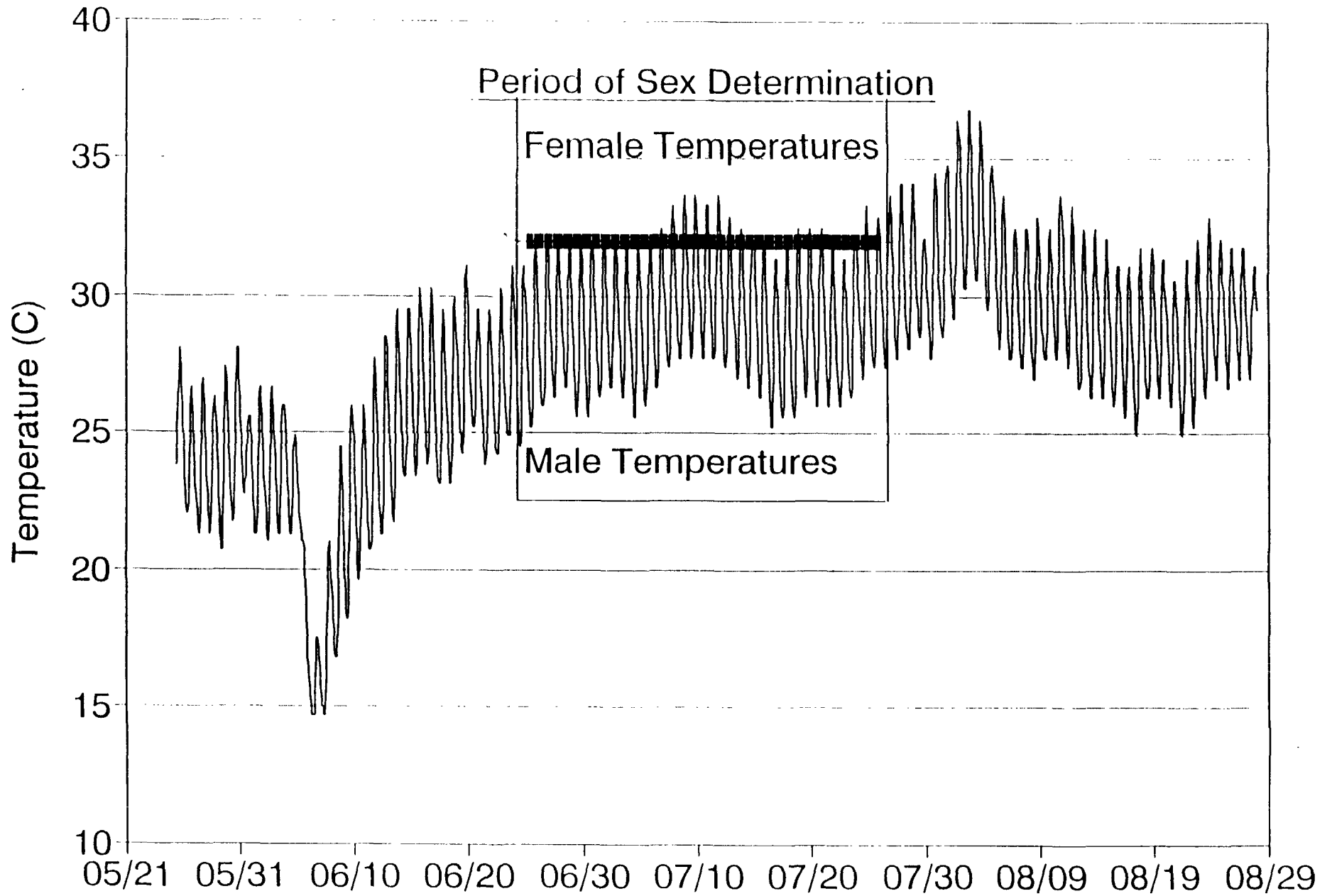
**Eggs laid: 16 May - 4 July**

**Incubation: 79 to 112 days**

**Incubation duration is negatively correlated  
with nest temperature**

**Hatching date: 21 August - 11 October**

# NEST TEMPERATURES OF TORTOISE 718'S FIRST CLUTCH



# **SURVIVAL**

## **PARAMETERS MEASURED**

- **Survival rates of adults, hatchlings, and nests**

## **METHODS**

- **Monitor radiomarked tortoises and nests**

## **RESULTS**

- **Monitored 20 adult tortoises in each of the three treatments**

	<b>Adult Annual Survival</b>	
	<b>1992</b>	<b>1993</b>
<b>High Impact</b>	<b>100%</b>	<b>100%</b>
<b>Area Wide</b>	<b>95%</b>	<b>95%</b>
<b>Control</b>	<b>100%</b>	<b>00%</b>

# SURVIVAL

(Continued)

## RESULTS (Continued)

- Hatchling data inadequate for treatment comparisons, but native fire ants appear to be a significant predator
- Monitored all nests found; only the high-impact and control levels were represented

	Nest Survival	
	1992	1993
High Impact	100% (n=8)	100% (n=10)
Control	100% (n=3)	89% (n=9)

# BEHAVIOR / HABITAT USE

## PARAMETERS MEASURED

- Home Range Size
- Shift in Home Range
- Percent of Time Active
- Length of Hibernation

## METHODS

- Locate radiomarked tortoises twice per week during activity period
- Record information on location, use of cover sites, behavior

## RESULTS

- Assumptions of usual home range calculations violated; other estimators are being evaluated
- Length of hibernation ( $P=0.60$ ) and percent of time active ( $P=0.47$ ) did not differ among the 3 treatment levels during 1992-1993

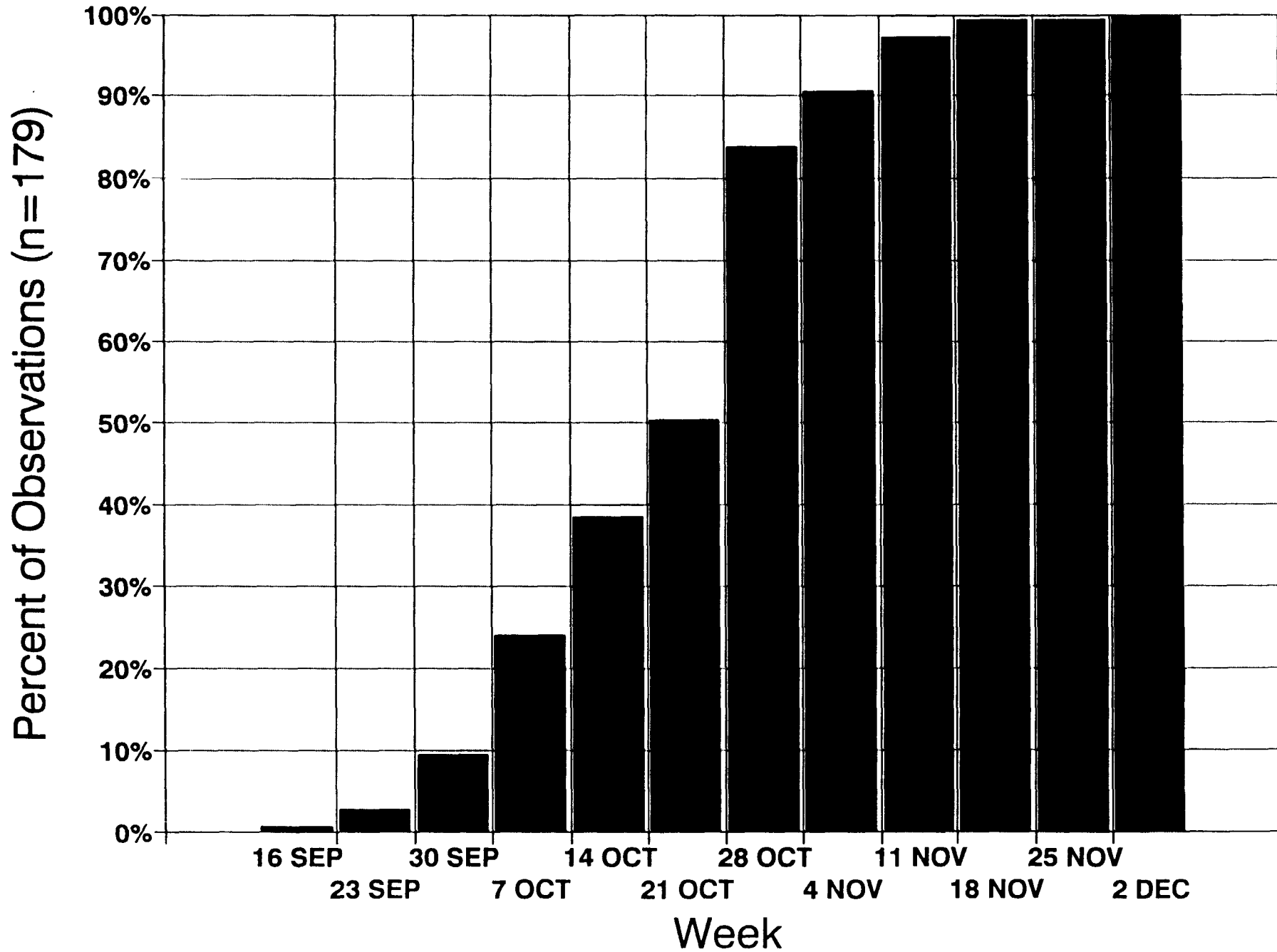


# BEHAVIOR / HABITAT USE

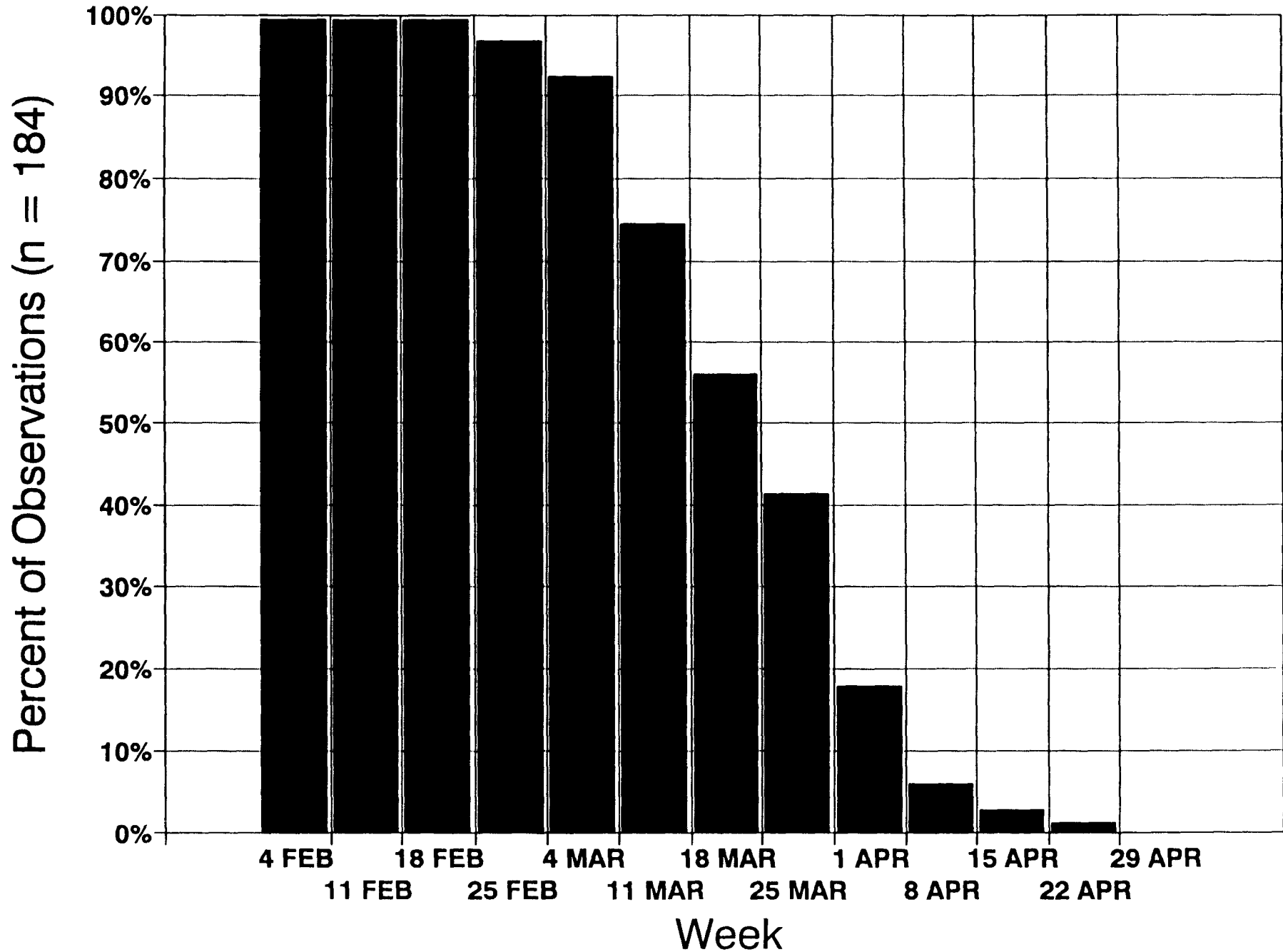
## ADDITIONAL RESULTS

- **97% of radiomarked tortoises started hibernation before 15 November (n=179)**
- **97% of radiomarked tortoises did not exit hibernation until after 1 March (n=184)**
- **Resurveys and construction monitoring are not needed from 1 December through 1 March**

# Percent of Tortoises Hibernating, 1989-92



# Percent of Tortoises Hibernating, 1990-93



# HEALTH

## PARAMETERS MEASURED

- Growth
- Condition Index
- *Mycoplasma agassizii* antibody test
- Blood Profiles

## METHODS

- Measure growth and calculate condition index annually in the fall
- Collect blood to measure antibody response and health profiles

## RESULTS

- Condition index did not differ among groups over three years ( $P=0.56$ )
- Growth data has not been analyzed
- Blood profile data was just received from the lab
- Antibody response did not differ among groups ( $P=0.30$ )

	<u>Number Positive in 1993</u>	
High Impact	4	(n = 18)
Area Wide	2	(n = 14)
Control	1	(n = 14)

# DIET

## PARAMETER MEASURED

- **Species Composition**

## METHODS

- **Count number of bites per forage species during forage observations**
- **Collect scat from desert tortoises at Yucca Mountain and control area**

## RESULTS

- **Composition analysis of 1992 and 1993 samples has not been completed by lab**

# DIET

## ADDITIONAL RESULTS

### 10 Most Commonly Eaten Species

#### Common Name

Red Brome  
Fluffgrass  
Desert Globemallow  
Lupine  
Foothill Deervetch  
Cactus  
Bristly Fiddleneck  
Storksbill  
Saltbushes  
Galleta

#### Scientific Name

*Bromus rubens*  
*Erioneuron pulchellum*  
*Sphaeralcea ambigua*  
*Lupinus* spp.  
*Lotus humistratus*  
Cactaceae  
*Amsinkia tessellata*  
*Erodium cicutarium*  
*Atriplex* spp.  
*Hilaria jamesii*

Based on 1990-1991 scat samples and 1992-1993 feeding observations

# **RAVEN MONITORING**

## **OBJECTIVES**

- **Determine if site characterization activities cause an increase in raven abundance**
- **Monitor use of site characterization activities facilities by ravens and identify where ravens congregate**
- **Recommend how to discourage ravens from using site characterization activities facilities**

## **METHODS**

- **Count ravens along routes at Yucca Mountain and Crater Flat/Bare Mountain (control route) five times every other month**
- **Record use of facilities by ravens seen during counts**

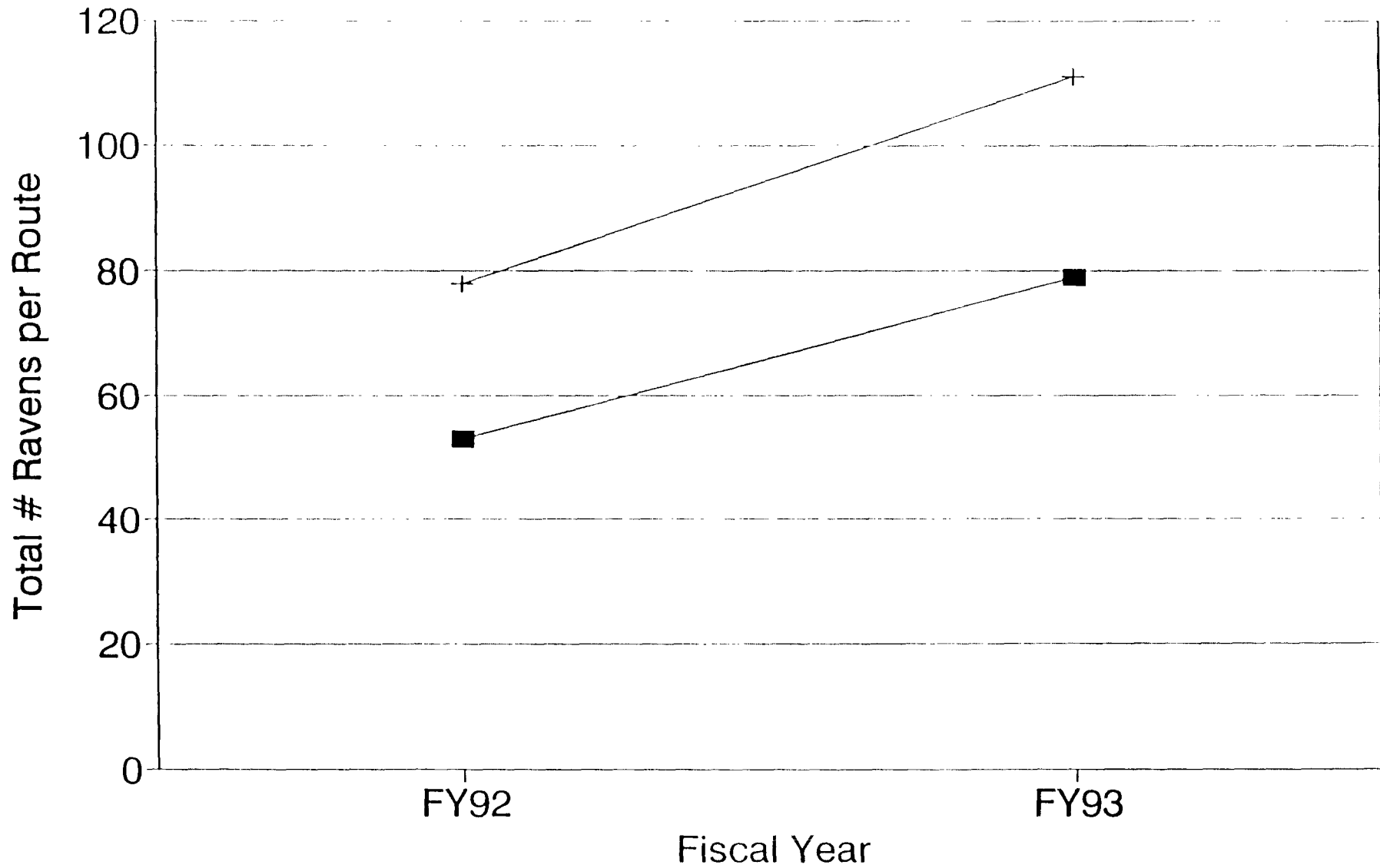
# RAVEN MONITORING

## RESULTS

- **More ravens were observed at Yucca Mountain than on the Control Route ( $P=0.0234$ )**
- **More ravens were observed in FY93 than in FY92 ( $P=0.0371$ ), but this trend was not the same for all months (Month  $\times$  Fiscal Year interaction significant,  $P=0.0186$ )**
- **Since treatment by time interaction was not significant ( $P=0.7306$ ) for FY92 and FY93, conclude that site characterization activities did not cause an increase in raven abundance at Yucca Mountain during FY93**



# Sum of Raven Sightings by Fiscal Year



# **IDENTIFICATION AND MITIGATION OF CUMULATIVE IMPACTS**

- **Identification of Cumulative Impacts**
- **Results Reviewed Annually to Identify Mitigation Methods**