

## **Biological Information**

### ***1. Results of the Key deer abundance indices, including the calculation of the average number of deer seen.***

***For January 1, 2014 to December 31, 2014***

Average count for full year = 66.8

The Key deer road-count index value is the average count from multiple road count surveys throughout the year on Big Pine Key and No Name Key. It has also been referred to as the Key deer “census”, road count, and count index; these labels are often used interchangeably. The road counts are conducted on the USFWS Survey Route, monthly in most years. The 2014 road-count index value was derived from 6 standardized count surveys (one each from February, April, May, June, November, and December; in 2013, 5 standardized surveys were conducted, January, April, June, November, and December). For the period January through December, 2014, the value (mean of those 6 counts) was 67. The 2013, 2012, 2011, 2010 and 2009 values were 68, 59, 61, 57, and 64, respectively. The 13-year average was 62.5 as of 2014. The record high count index value for any year since 1975 (when the counts were started) occurred in 2006 (71.5). The second highest was 69.5 in 2005.

The other index of Key deer abundance is the mortality index (human-caused deer deaths documented on Big Pine and No Name Keys [core]). The human-caused mortality index was at least 131 in 2014 (this value was 116, 161, 145, 112, and 121 in 2013, 2012, 2011, 2010, and 2009, respectively). The 2012 count (161 human-caused) was the highest on record since the mortality counts were started in 1966. The 2011, 2014, and 2009 counts were the second, third, and fourth highest counts, respectively. Prior to the years 2009 – 2014, the highest mortality index occurred in 2005 (104 human-caused). The values first surpassed 100 in 2003 (103 human-caused).

In 2014, the total mortality count (all known mortalities from all causes) on Big Pine Key and No Name Key was 148; this value was 151, 197, 175, 140, and 150 in 2013, 2012, 2011, 2010, and 2009, respectively). Prior to the years 2009 – 2012, the highest count of all known mortalities (all causes) on Big Pine Key and No Name Key (133) occurred in 2003. The values first surpassed 100 in 1997 (119 human-caused).

Over the long-term, the Big Pine Key-No Name Key mortality index (count of human-caused deaths documented over the year) and the road count index illustrated a direct correlation, with an overall positive trend in each. The higher mortality indices in recent years are largely related to an increase in the absolute number of deer and road-kills (DVCs). There has also been an increase in the absolute number of disease-related deaths, although of a far smaller magnitude in terms of absolute numbers.

2. *A summary of Key deer mortality information, including the calculation of the number of human-related deaths.*

	Combat	Disease	Dog	Drowning	Entanglement	Poached	Deer-vehicle collision (DVC)	Miscellaneous (human causes)	Undetermined	Total	DVC as % Total
2007	1	6	<b>0</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>83</b>	<b>1</b>	15	112	74%
2008	0	2	<b>0</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>89</b>	<b>1</b>	23	120	74%
2009	0	4	<b>0</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>112</b>	<b>1</b>	25	150	75%
2010	1	7	<b>0</b>	<b>7</b>	<b>1</b>	<b>0</b>	<b>102</b>	<b>2</b>	20	140	73%
2011	2	12	<b>6</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>131</b>	<b>2</b>	16	175	75%
2012	4	17	<b>2</b>	<b>3</b>	<b>5</b>	<b>0</b>	<b>150</b>	<b>1</b>	15	197	76%
2013	0	8	<b>0</b>	<b>5</b>	<b>2</b>	<b>0</b>	<b>109</b>	<b>0</b>	27	151	72%
2014	0	4	<b>3</b>	<b>5</b>	<b>1</b>	<b>0</b>	<b>121</b>	<b>0</b>	13	148	82%

Mortalities in the core of the range (HCP area; Big Pine and No Name Keys), 2007 to 2014. Human-caused mortalities are shown in **bold**. Note that human factors also contribute to Disease and a portion of Undetermined causes (e.g., some of those are likely DVC related). Some of the deaths for which the cause was “undetermined”, and likely some disease deaths, include some cases that may actually be attributable to human causes, particularly DVCs. An unknown number of both natural and human-caused deaths go entirely undetected.

All human causes include Dog, Drowning, Entanglement, Poached, and Miscellaneous human causes in addition to DVCs. The portion of all known Big Pine and No Name Key deaths attributed to all anthropogenic causes was 89% in 2014, the highest proportion since 1983 (92%). From 1966 – 1978 (13 years), the mean was 91%. From 1979 – 1991 (13 years), the mean was 84%. From 1992 – 2004 (13 years), the mean was 75%. Over the last 13 years (2002 – 2014), the mean rose to 82%. It was still declining, and at a low range throughout the 1990s, then rose to 84% in 2002 and remained consistently about 81% through 2013. Accordingly, the 13 year running average declined until 2001 (73%), and has been on the rise subsequently (82% as of 2014). The long-term proportion of deaths attributed to all human causes, encompassing 1966-2014 (grand average), is approximately 83 percent.

The proportion of all known Big Pine and No Name Key deaths that were due to DVCs in 2014 (approximately 82 percent) was the highest since 1982 (86%). From 1966 – 1978 (13 years), the mean was 86%. From 1979 – 1991 (13 years), the mean was 76%. From 1992 – 2004 (13 years), the mean was 68%. Over the last 13 years (2002 – 2014), the mean rose to 75%. It was still declining, and at a low range throughout the 1990s, then rose to 73% in 2002 and remained

consistently about 74% through 2013. Accordingly, the 13 year running average declined until 2002 (67%), and has been on the rise subsequently (75% as of 2014). The long-term proportion of deaths attributed to DVCs, encompassing 1966-2014 (grand average), is approximately 77 percent.

Of all known DVCs within the core, approximately 39 percent were females in 2014. Of all road mortalities within the core since 1966 (grand average), approximately 39% were females (58% males and 3% unknown). The 13-year average has ranged from approximately 36-42 percent females since 1978 (the first year a 13-year average was available). The 13-year average as of 2014 was approximately 40 percent females.

Of the DVCs within the core in which sex was determined, approximately 42 percent were females in 2014. Of the road mortalities within the core in which sex was determined since 1966, approximately 40% were females (grand mean; 60% males). The 13-year average has ranged from approximately 37-43 percent females since 1978 (the first year a 13-year average was available). The 13-year average as of 2014 was approximately 42 percent females. It remained below 40% from 1978 to 2007. Thereafter, it has been above 40%. The 13-year average reached its minima in 1997 (37%), and has subsequently grown (to 42%). The annual mean from 1966 to 2007 was 39%; from 2008 to 2014 it was 43%. The difference between means for the first half of the period of record (1966-1990, 37.7%) and the second half (1991-2014, 40.7%) may be biologically significant ( $P(T \leq t)$  one-tail = 0.058). The female contribution to DVCs, as a proportion of all DVCs, has been growing (though the rate is not high).

Of the total DVC mortalities documented since 1966 on Big Pine and No Name keys combined, approximately 53 percent were on U.S.1. From 1966 – 1978 (13 years), the mean was 48%. From 1979 – 1991 (13 years), the mean was 52%. From 1992 – 2004 (13 years), the mean was 53%. Over the last 13 years (2002 – 2014), the mean was 52%.

Of the road mortalities documented on Big Pine Key since 1966, approximately 56 percent were on U.S.1. From 1966 – 1978 (13 years), the mean was 51%. From 1979 – 1991 (13 years), the mean was 58%. From 1992 – 2004 (13 years), the mean was 55%. Over the last 13 years (2002 – 2014), the mean was 54%.

DVCs on U.S.1 comprised approximately 68 percent of all DVCs on Big Pine Key during 2014. The proportions in 2013, 2012 and 2011 were approximately 64, 69 and 61%, respectively, which were the highest values since 1996 (70%). The mean since 2006 (last 9 years) was 58%. The mean since 2011 (last 4 years) was 65%. Similarly, in 2014, DVCs on U.S.1 comprised approximately 66 percent of all DVC mortalities on Big Pine Key and No Name Key combined (63, 69, and 60% in 2013, 2012, and 2011, respectively). The mean since 2006 (last 9 years) was 57%. The mean since 2011 (last 4 years) was 64%. Thus, U.S.1 accounts for roughly half of all DVCs in the core over the long term, but a higher proportion in recent years. However, this finding may indicate that US1 traffic results in DVC numbers commensurate with population size.

Of the total mortalities documented throughout the core since 1966, approximately 74 percent were from DVCs. The 13-year average, 2002-2014, was approximately 75%. Of the mortalities where the cause was determined throughout the core since 1966, approximately 87 percent were from DVCs.

Of the total DVCs documented rangewide since 1966, approximately 90% occurred on BPK and 5% occurred on NNK. Of all rangewide DVCs documented in 2014, the proportion that occurred on Big Pine Key was approximately 87 percent. The proportion of known DVCs that were attributed to No Name Key was approximately 2 percent.

Of all mortalities rangewide, the proportion that occurred on Big Pine Key was approximately 87 percent in 2014 (long term annual mean, 89% since 1966). Mortalities in the core (Big Pine and No Name keys combined), comprised approximately 90 percent of all documented mortalities rangewide in 2014 (annual mean 94% since 1966).

The long-term proportion of all Big Pine and No Name Key deaths attributed to disease (1966—2014) was approximately 4 percent. The annual proportion is greater in recent periods (5%, 13-year annual mean 2002 – 2014) compared to earlier decades (less than 1%, 1966-1990). The proportion of all Big Pine and No Name Key deaths attributed to disease in 2014 was approximately 3 percent.

**5. *An assessment of whether the ratio of the number of human-related deaths to average deer seen remains below 1.53.***

***For January 2014 through December 2014***

$$\text{Ratio} = \frac{\text{human-related deaths}}{\text{average deer seen}} = \frac{131}{67} = 2.0$$

***For January 2013 through December 2013***

$$\text{Ratio} = \frac{\text{human-related deaths}}{\text{average deer seen}} = \frac{117}{68} = 1.7$$

***For January 2012 through December 2012***

$$\text{Ratio} = \frac{\text{human-related deaths}}{\text{average deer seen}} = \frac{161}{59.0} = 2.7$$

***For January 2011 through December 2011***

$$\text{Ratio} = \frac{\text{human-related deaths}}{\text{average deer seen}} = \frac{145}{61.3} = 2.4$$

***For January 2010 through December 2010***

$$\text{Ratio} = \frac{\text{human-related deaths}}{\text{average deer seen}} = \frac{113}{57.1} = 2.0$$

***For January 2009 through December 2009***

$$\text{Ratio} = \frac{\text{human-related deaths}}{\text{average deer seen}} = \frac{121}{63.9} = 1.9$$

In 2014, the ratio of human-related deaths (mortality index, 131) to average number of deer seen (count index, 67) was 1.96, which is greater than the upper boundary of the 95% confidence interval (1.53) defined in the HCP. The 2012 mortality index (2.7) was at the highest level since 1986. The 13-year average from 1976 – 1988 was 2.2. That declined to about 1.4 during 1989 through 2001, and subsequently rose to 1.8 (13-year average, 2002—2014). The long-term average (39 years, 1975 to 2012) was 1.8.

### 3. *A discussion and interpretation of mortality data.*

In 2014, there were 148 mortalities of all causes recorded in the core; there were 151 recorded in 2013. Total mortalities in the core had jumped to at least 175 and 197 in 2011 and 2012, respectively, from a previous record high of at least 150 in 2009. Total DVC mortalities in the core jumped to at least 131 and 150 in 2011 and 2012, respectively, from a previous record high of at least 112 in 2009. There were at least 121 in 2014.

DVC mortalities on U.S.1 (BPK) had jumped to at least 78 and 103 in 2011 and 2012, respectively, from a previous record high of 53 in 2009. The value was approximately 80 in 2014, the second highest index value to date. The proportion of all known Big Pine and No Name Key deaths that were due to DVCs in 2014 (approximately 82 percent) was the highest since 1982 (86%). Of the total mortalities documented throughout the core since 1966, approximately 74 percent were from DVCs. The 13-year average, 2002-2014, was approximately 75%.

Overall in 2014 (and recent years), the proportion of mortalities from DVCs and the proportion attributed to U.S.1 were relatively high. Higher DVC values on U.S.1 indicate that deer abundance has increased, movement has increased (resulting in more deer intersecting U.S.1 and thus, colliding with vehicles), or that U.S.1 has become more lethal (per capita) to deer that intersect it. The increase in absolute road mortalities in recent years would result from increased abundance and or a higher mortality rate. Higher population levels could result in commensurately more DVCs. Alternatively, mortalities may be occurring at a higher per capita rate than in previous years. Finally, an increase in (per capita) annual productivity could result in the patterns observed (a larger excess both produced, and removed by DVCs, annually in recent years). Available information indicates that the proportion of mortalities that are adults is relatively stable or in recent years, growing slightly. Accordingly, the latter result is unlikely and if it is a factor, it represents a lagged response. US1 may be acting to limit numbers around a certain threshold.

The count index depicts a general lack of growth in recent years (all values 2007—2014, remain below the highest [71.5, 2006] and the second highest [69.5, 2005] mean annual counts). Regarding recent years in the context of the long term record of the count index, the data may indicate a possible decrease in the long-term trajectory of population growth. Key deer have attained or exceeded carrying capacity within the core of the Key deer's range. Accordingly, in

the absence of new and substantial threats or major changes in habitat that result in major changes in food availability and or survival, the Key deer population within the core may fluctuate around carrying capacity (the actual value of which cannot be directly calculated). Numerical fluctuations will result from source-driven and random variation in factors including environmental influences, annual productivity of the landscape, mortality rates, and annual variation in female productivity.

**8.     *A summary of reported Lower Keys marsh rabbit road mortality.***

In both 2006 and 2007, the occurrence of at least one road kill on Big Pine Key was verbally reported by local naturalists, but not otherwise substantiated. In 2008, at least two mortalities were detected and the carcasses retrieved. One was killed by a vehicle on Wilder Road, along a stretch where a rabbit had previously been seen by USFWS personnel fleeing from a cat. In 2009, one was taken from Big Pine Key to a veterinarian, where it died. It reportedly involved a vehicle strike, but no other details were conveyed. A necropsy conducted on that mortality suggested that a predation attempt was likely, but that subsequently, a vehicle strike may have occurred as well. These observations indicate, as per the literature on Lower Keys marsh rabbits, that cats continue to suppress rabbit populations and that vehicle strikes are an additional threat. In 2010, no road mortalities were detected on Big Pine, No Name, or other areas outside of Naval Air Station Key West. In late February, 2011, one LKMR road mortality occurred on and was retrieved on Key Deer Blvd., Big Pine Key. In 2012 (February), one LKMR road mortality occurred on (and retrieved from) Key Deer Blvd., Big Pine Key. No Lower Keys marsh rabbit road mortalities were documented from the HCP area in 2013 or 2014.